Agricultural bilateral trade agreements between South Africa and the European Union: implications for the South African fresh orange industry

By

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I certify that the work reported in this thesis is my own original and unaided work except where specific acknowledgement is made.

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Abstract

During October 1999 South Africa and the European Union (EU) signed the "Agreement on Trade, Development and Co-operation". This agreement includes a Free Trade Agreement (FTA) which will lead to a free trade area between both partners. The framework for a FTA is set by the World Trade Organization (WTO). This study focuses on the effects of the FTA on the South African fresh orange industry. Fresh oranges account for approximately ten percent of South African agricultural exports. On the other hand, South Africa is the second largest external supplier to the EU and dominates the EU off-season. Fresh oranges are only included in the FTA from June until September and tariffs are reduced by approximately three percent in this time which is the peak South African export season.

A trade simulation model was developed using the programme STELLA to analyse the effects of the FTA on the South African fresh orange industry. The trade simulation model consists of seven sub-models for production according to region and cultivar; a local market model, an export market model and an exchange rate model. The production models run on an annual basis whereas the other sub-models run on a monthly basis to capture the seasonality in fresh orange trade. The simulation period lasts from 1997 until 2011, hence fifteen years.

The production models use gross margins according to the age of the orchard. The annual production is divided into monthly production on the basis of industry information. The South African demand function in the local market model uses the consumption per person, the export price and trend as independent variables. A trend variable is included to cater for the change in consumer preferences, especially, the move from oranges towards easy-peelers.

On the EU market, prices are seen as external variables, except for the months July until October when the South African market share exceeds 50 percent. During these months an import demand flexibility is derived on the basis of the South African market share. The exchange rate model derives from the purchasing power parity between the South African Rand and the Euro.

Simulation model results indicate that the FTA is beneficial for South African producers while South African consumers may also benefit. Further producers are expected to benefit from a slight increase in real free-on-board prices and a slight increase in total production. South African consumers are expected to benefit from a simulated decrease in real local prices due to the predicted increase in production. The effects on the EU market are simulated to be even smaller. A slight increase in EU prices is simulated during South Africa's peak export season which is the EU off-season. Results for regional production areas in South Africa show that during the simulation period the area under Valencias increases strongly whereas the area under Navels decreases.

A comparison with a scenario without any EU tariffs was carried out to estimate the total distortion effect of EU protection on the South African market. Both South African consumers and producers benefit in the scenario without EU tariffs. The results of the simulation indicate that the total effect of EU tariffs is relatively small. Predicted total South African orange production increases by 14.8 percent over the simulation period compared to 9.1 percent in the scenario without any preferential treatment. The difference in other results is even smaller. The FTA reverts only parts of the distortion effect of EU protection. There are still some further possibilities to reduce the effects of EU protection on the South African fresh orange industry.

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Introduction

On the 11 October 1999 South Africa and the European Union (EU) signed the "Agreement on Trade, Development and Co-operation". This agreement forms part of a set of agreements between both partners to enhance their relationship. One of the main parts of the "Agreement on Trade, Development and Co-operation" is a Free Trade Agreement (FTA). The FTA leads towards the formation of a free trade area between South Africa and the EU. This agreement cannot be seen separately from other trade agreements by either partner. Both are members of the World Trade Organization (WTO) which was formed during the Uruguay Round of the General Agreement on Tariffs and Trade (GATT). The WTO sets the rules for international trade and trade preferences. This includes guidelines for the formation of free trade areas. In addition, the most-favoured-nation (MFN) tariff is set by commitments towards the WTO, and it sets the maximum level for tariffs charged on products originating in another WTO member country. Basically, for the formation of a free trade area, 'substantially all trade' between both partners has to be undertaken duty free.

As South Africa is a member of the Southern African Customs Union (SACU), this sets limits on the FTA because there is no internal tariff between members of SACU and all goods entering South Africa can easily enter the other member countries. The other members of SACU - Botswana, Lesotho, Namibia and Swaziland - are the most affected by the FTA between South Africa and the EU. Another Southern African agreement of importance is the Southern African Development Community (SADC) which is in the process of becoming a free trade area on its own. As South Africa is the most advanced member of SADC, the other members are expecting it to open its market first to the SADC and then to the EU. As the negotiations within SADC are still continuing, the analysis on interaction between both

agreements can only be carried out on preliminary results.

On the EU side, the "Europe Agreement" with Central and Eastern European Countries and bilateral agreements with Mediterranean countries limit somehow the negotiation margin but no major impact of these agreements on the FTA between South Africa and the EU is expected. Of greater importance is the Lomé Convention. South Africa became a qualified member in 1997 but is excluded from the trade benefits other members enjoy. The Lomé Convention provides 70 developing countries non-reciprocal access to the EU market. Due to a collision with WTO rules the long-term future of the Lomé Convention is uncertain. The formation of free trade areas between the EU and developing countries might be one possible future scenario. In relation to this, the FTA between South Africa and the EU might set a precedent.

The negotiation for the FTA between South Africa and the EU lasted for over four years and culminated in the signing of the final agreement on 11 October 1999. The implementation period is scheduled to start on 1 January 2000. South Africa will open its market for 86 percent of EU imports over a 12 year period. Exclusions occur in both the industrial and the agricultural sectors. The EU will liberalise the access for 95 percent of South African exports over a ten year period. Almost all excluded products are agricultural products. Therefore, the major concern in relation to the FTA within South Africa originates in the agricultural sector. In the final offer the EU includes some tariff quotas for excluded products. This has increased the share of included agricultural exports from 61 percent to 74 percent. Another major field of concern is the labelling in the wine and spirit industry of South Africa, especially port and sherry. The EU claims that these names refer to physical origin and wants to protect them. South Africa claims that they refer to the production

procedure and not to the physical origin of the product. A specific agreement in this field is still under negotiation. This could delay the implementation of the FTA and especially the sections concerning wine and spirits.

This study focuses on South African exports of oranges to the EU. South Africa is the second largest outside supplier of oranges to the EU. South Africa dominates the EU summer market with a market share of more than 60 percent, as this is the EU off-season. The EU is the destination of more than half of all oranges exported from South Africa. The South African orange industry is export orientated and almost all fruit which fulfil the minimum export requirements are exported. The South African local market absorbs the second class produce. Orange export accounts for approximately ten percent of South African agricultural exports.

The EU is self-sufficient in oranges, but due to consumer preference relating to quality, variety and seasonality, the EU is the largest importer of oranges in the world. The EU tariff system for oranges is set in this regard. The tariffs in the EU on-season are high, whereas the off-season tariffs are relatively low to balance demand and supply. In the on-season, the entry price system ensures, in addition, that a minimum price for local producers is maintained by charging a tariff equivalent if the entry price falls under a set threshold price. South Africa benefits in this regards from its location in the Southern hemisphere and the subsequently altered production seasons. Sanitary and phyto-sanitary requirements influence the trade in oranges. Some South African exporters see these as smaller problems as the local requirements for exports are almost identical with the EU import requirements.

A trade simulation model has been developed to analyse the effects of the FTA between South Africa and the EU on the South African fresh orange industry. This model uses the

programme STELLA. There are two steps in the design of the model. In the first step the linkages between variables are set on a graphical interface. The second step involves the quantification of these relationships. In the second step, observed historical relationships, regressions and known or assumed distributions are included. Data mainly from the 1990s is used in this process. The trade simulation model consists of seven production models, and models for the local market, the EU market and the exchange rate. The production models run on an annual basis, whereas the trade models run on a monthly basis to cater for the seasonality of the orange trade.

South African orange production occurs mainly in four regions: Olifants River of the Western Cape, Sundays River of the Eastern Cape, the North-West Province and the Lowveld of the Northern Province and Mpumalanga. In all regions except the Lowveld (no Navels) both Navels and Valencias are grown. This results in seven production models according to region and cultivar. Region and cultivar have influence on production costs, yields and production season. The local market model simulates the reaction of the local market to the varying supply. The EU market model includes the tariffs of the EU, where the differences in the compared scenarios are introduced. The exchange rate model predicts the development in the Rand / Euro exchange rate during the simulation period.

The simulation period lasts from 1997 until 2011. The final year is the last year of the proposed implementation period of the FTA between South Africa and the EU. Three scenarios are compared to evaluate the effect of the FTA on the South African fresh orange industry. One scenario uses the WTO commitment of the EU, the next considers the outcome of the FTA and in the last scenario the EU allows duty free entry for all oranges. Each scenario is run 100 times. The results are then summarised by mean and standard deviation

for the discussion.

The study is organised in six chapters. The first chapter focuses on literature relating to supply and demand of fruit and to trade models and it introduces the theoretical background. The second chapter evaluates the FTA and related agreements. This is followed by a description of the trade in oranges between South Africa and the EU. Chapter four outlines the development of the trade simulation model. The fifth chapter presents the results and detailed discussion of the results. A conclusion with policy implication closes this study.

CHAPTER 1. Related Literature and Theoretical Background

Related literature could be grouped into two main groups: literature focussing on the supply and demand of fruits, especially oranges, and literature focussing on models to evaluate the influence of trade policies on the agricultural sector with studies pertaining to trade agreements. Many of the studies presented have also been used in the development of the trade simulation model. The study of Behr (1990) is the only one to show simulated effects of agricultural policies on the horticultural sector.

The theory of trade, free trade areas and exchange rates is shown later in this chapter. This emphasizes the theoretical background of the developed trade simulation model.

1.1. Literature on supply and demand of fruits

Several studies have focussed on the demand and supply of fruits. Several elasticities are derived in the discussed studies but a comparison between these is difficult as they relate to different destinations and origins. The first studies presented focus on the demand and supply of South African fruit. Thereafter, international studies relating to supply and demand of fruit are presented. Finally, two studies concerned with consumer behaviour are referred to.

Local demand and supply studies

Hayward-Butt and Ortmann (1994) analysed the local demand for oranges in South Africa. Despite the export-orientation of the industry, the largest percentage of production is

absorbed by local consumers as the fresh produce markets are important outlets for oranges. Two logarithmic demand functions were derived using the ordinary least squares technique, one using orange price as dependent variable and another using orange consumption as dependent variable. In the first model, independent variables include per capita consumption of oranges, apples, lemons, grapefruit and naartjies, and in the second model, the prices thereof. In addition, both functions include real disposable income and a dummy variable for type of marketing as independent variables. An own-price elasticity of demand for oranges of -1.55 was derived from the first model and a price flexibility coefficient for oranges of -0.695 was derived from the second model. The price flexibility coefficient is seen to be more appropriate because the price of fresh oranges seems to be seasonally dependent on availability.

Khuele and Darroch (1997) indicate the importance of the European Union (EU) market for the South African orange industry. They then focus on the demand and supply for fresh orange exports to the United Kingdom. An export demand model and an export supply model were developed. The demand model uses the price for South African oranges in the United Kingdom, the price of oranges from the main competitor (Israel), South African exports of the previous year, national disposable income and population of the United Kingdom as variables. The export supply model uses the price relationship between export and local prices in South Africa, the price relationship between the United Kingdom and French prices for South African oranges, exports of the previous year and a supply shock as variables. There is no correlation between the independent variables in the export demand equation, but a high correlation between variables in the export supply equation. The main problem with this research is the use of annual data because the main competitor (Israel) supplies the United

Kingdom market at a different time of the year. Nevertheless, the information gained in the research could be used to model the export demand on a monthly basis.

Cleasby *et al.* (1991) use annual data to study the demand for and the supply of South African deciduous fruit exports. The study derives four equations for domestic demand, export demand, export supply and the exchange rate. The results show that South Africa is a price taker on the international market. The export supply is price inelastic in the short run. The study shows the importance of the Rand exchange rate for the export orientated deciduous fruit industry.

Ferreira and van Zyl (1997a) analyse gross margins for the citrus industry in South Africa. They differentiated between cultivars and producing areas and developed annual budgets for several citrus cultivars from establishment to peak production. These budgets provide an overview of the cost involved in the production of citrus in South Africa. For two regions (Letaba and Citrusdal), farm models are developed on the basis of local information using a typical farm size and a typical set of cultivars (Ferreira and van Zyl, 1997b; van Zyl and Ferreira, 1997). The detailed information about citrus production in these articles will be used to derive a supply model for South African sweet oranges.

All local studies of fruit demand and supply are using annual data. This can be seen as a major drawback as the main advantage of South Africa on the world fruit market is the alternate production season in comparison with most other main suppliers. No study has attempt to include local supply and local as well as overseas demand in one analysis.

International demand and supply studies

Alston *et al.* (1980) model the supply response in the Australian orange industry. Removals of trees is assumed to be dependent on the number of bearing trees. This results in an annual removal of 4.15 percent of bearing trees. Plantings are dependent on the five year average revenue per bearing tree and numbers of non-bearing, bearing and removed trees. Projections for the industry using different price levels were undertaken for 25 years.

Gunawardana *et al.* (1995) use quarterly data to estimate the export supply response of the Australian citrus industry. The major markets for Australian citrus are eastern Asia, the United States of America and the United Kingdom. Australia accounts for less than one percent of world citrus exports and is therefore a price taker in the international market. The results show that the export supply reaction is inelastic in regard to the price.

Sckokai and Moro (1996) derive elasticities by analysing the direct separability in multi-output technologies. The results estimate an own-price supply elasticity for perennial crops in Italy of 0.128. The cross-price elasticities for perennial crops in relation to other agricultural products are estimated to be below 0.1. The assumption of direct weak separability increases the number of degrees of freedom. The results show that this assumption could not be rejected. It is therefore a useful method to calculate larger equation systems in the case of limited data.

French and Bressler (1962) develop a model to predict the future development of the Californian lemon industry. The supply reaction results from new plantings which are dependent on the five-year average net return. Withdrawal is calculated at 4.5 percent of bearing trees. An on-tree demand function is derived using price as dependent variable and

per capita sales and time as explanatory variables. The results show that the future development of the industry will not result in a constant, but rather in a cyclic development.

French and Matthews (1971) develop a general supply model to include the special requirements of perennial crops. It is necessary to include the time horizon in the development of a supply response model. Planting and removal of plants should be explained. The model compares the future economic expectations for the monitored crop with the economic expectations for other crops. The general model needs a large amount of data and it should be modified according to the availability of data. Rational behaviour by the single farmer is implied. They illustrate it with an application to asparagus.

Muñoz Torres (1996) calculates an "Almost Ideal Demand System" for citrus fruit in Germany. The base years for the calculation were 1974 to 1990. The model is applied in two stages. In the first stage spending is allocated to a product, in this case tangerines, clementines, summer oranges (1 April until 15 October) and winter oranges (16 October until 31 March). In the second stage a differentiation between the origins of the product is achieved. This work is interesting in terms of looking at different seasons for oranges, because it recognises the seasonality of orange consumption in the EU. The short-run price elasticities for summer and winter oranges are -1.13 and -0.99 respectively. The demand for summer oranges is more elastic, which is important for the South African citrus industry because summer is the main period of orange exports to the EU. The second stage results are only given for Spain and its main competitor. In the case of summer oranges, this is South Africa. The demand elasticity calculated with the ordinary least squares method for South Africa is -0.77 compared to -1.11 for Spain.

Ward (1982) uses time varying parameters to estimate a demand function for oranges in the EU and compares the results with an ordinary least square estimation. The results indicate that time varying parameters are better to analyse historic data. The influences of price and income on the demand for oranges differ over time, but towards the end of the period 1959 to 1978 the variation between years becomes less important. Because actual data are needed to estimate the time varying parameters for the following period, it would not be very advantageous to apply this method for future projections.

Tiffin and Aguiar (1995) develop an "Almost Ideal Demand System" for fresh fruit in Portugal. Using data from 1976 until 1991 price elasticities of demand for pears, apples, oranges, peaches, cherries and plums are calculated. Within this period Portugal became a member of the EU (1986). The estimated own-price elasticity for oranges is -0.77. The expenditure elasticity for oranges is 0.89.

Honma (1993) develops an "Almost Ideal Demand System" for the Japanese horticultural market to observe the opportunities for developing countries therein. In the first stage a portion of the spending is allocated to a horticultural product. In the second stage this is attributed to a supplying country. The observed own-price demand elasticities are high in comparison with those of other agricultural crops. The variation between different origins is sometimes large. In the case of bamboo shoots the own-price elasticity for imports from Thailand is -0.074 and the one for Chinese products is -2.113. This indicates that the origin is an important attribute of horticultural products.

Sparks (1992) uses an import allocation model to investigate import demand of major importing countries for United States fresh oranges. The United States, as a major producer

with a production of 8 million tons of oranges per year, exported 367 000 tons in 1988/1989 (thus five percent of its production), mainly to Canada and Japan. In comparison, South Africa exported over 50 percent of its production in the same year. The Rotterdam model is used to analyse the demand for oranges from different origins for major importers. It is found that the income elasticity of demand for oranges in the EU is insignificant. The own-price elasticities for oranges in different markets are calculated, based on annual data from 1963 to 1987. For South African oranges in the EU, the estimated elasticity is -1.31.

Fuller *et al.* (1992) model the import demand for United States of America grapefruit in Canada, Japan, France and the Netherlands, the major trading partners. Quarterly data from 1969 to 1988 are used. The observed quarterly own-price elasticities are similar within one market, but differ between countries. The own-price import demand elasticity is the highest in Canada with -2.1 and the lowest in the Netherlands with -0.1. It is observed that the exchange rate has a high influence on the demand for United States grapefruit in all markets.

Lee *et al.* (1992) use 1960 to 1987 consumption data in Canada to estimate demand elasticities for fresh fruits and fruit juices. The per capita consumption of fruit in Canada in 1987 was found to be 20 percent higher than in the United States of America, at 60 kg per person per year. The Rotterdam model, the CBS model and a general model are used to derive the elasticities. The test statistics for the Rotterdam model and the general model, which combined the two others, are similar. This indicates the superiority of the Rotterdam model for this application. The own price elasticities calculated with the Rotterdam model for fresh fruits are -0.27 for oranges and bananas, -0.28 for apples and -0.50 for grapefruit. The cross-price elasticities indicate that these products are substitutes for each other.

In most international studies the fruit market is generally analysed on an annual basis with the exemption of Muñoz Torres (1996), who uses semi-annual data to capture seasonality. As does Fuller *et al.* (1992) with quarterly data for United States grapefruit. Demand elasticities are derived by different statistical methods. They will be used to compare own estimates. Other results of international studies are also used in the construction of the trade simulation model.

Studies of consumer behaviour

Hörmann and Lips (1996) analyse the buying behaviour of German consumers in relation to fruit and vegetables. A special emphasis is given to the perception of different production methods. Generally, biological production methods have a positive perception. They mention also that price and quality are still the most important determinants in the buying decision. Supermarkets and farmers' markets are the main places of purchase.

Sikka and Azad (1991) collected data from 210 households in Dehli (India) pertaining to fruit consumption. The total consumption was 30 kg of fruit per person per year. Bananas account for one third of the consumption. Calculated income elasticities range from 1.31 for mangoes to 0.11 for sapota.

Studies of consumer behaviour fuel information for the construction of the local and EU demand model within the trade simulation model.

1.2. Literature on trade and policy models for agricultural products

There is a large amount of literature on trade and policy models. Therefore, the focus is on relevant literature for the fruit sector and models which could be useful in the development of the trade simulation model. All known trade models are using annual data, which is seen to be inadequate for the purpose of this study because seasonality is one of the major advantages that South Africa has on the EU fresh produce market.

Trade and policy models for the fruit sector

Behr (1990) evaluates the effects of alternative EU market policies for fruit and vegetables. The EU policy for fruit and vegetable is described and a simulation model is developed. Elasticities of supply and demand from different sources and for different purposes are assumed, with reference to relevant literature. An *ex post* model is run and it results in satisfactory goodness of fit for all simulated time series (plantings, prices, processing, withdrawals, fresh consumption, exports and imports). The model is applied to the apple and peach industry in the EU. Different agricultural policy scenarios are then compared with a welfare measurement derived from the simulation model.

Fernandez-Cavada (1979) uses a quadratic programming model to quantitatively evaluate economic effects on the international orange and tangerine markets. One major focus is on the incorporation of Spain and Greece into the EU. Spanish dominance over the EU market was correctly predicted. Another finding in this study is that an increase of transportation cost would have only limited effects on the orange trade. Even if the EU were to double the tariffs on oranges, this would only have a limited effect on world orange trade. Considerable market

effects will only occur if orange production in major exporting countries changes dramatically.

Brenes (1992) develops a multiple-region equilibrium trade model for fresh oranges. The world is divided into eleven regions. Export supply is mainly influenced by fresh production and only to a lesser extent by the free-on-board (f.o.b.) price. Major importers are more sensitive to changes in average market price than importers with their own production. The model distinguishes between oranges from different origins.

Goddard (1994) estimates the impact of the North American Free Trade Area (NAFTA) on the Canadian fruit and vegetable sector. No clear impact of increased imports from other NAFTA members (Mexico and the United States of America) was observed. A recent reduction in the capital stock within the Canadian horticultural industry is observed, but this observation seems not to be sufficient to predict a decline in investment.

All know trade and policy models in the fruit sector are using operator induced sensitivity analysis. In contrast, the developed trade simulation model is using randomly derived external conditions to account for the volatility of the markets and their influential factors. In addition, the necessity of an equilibrium condition is not required in the derived model. The market is only moving in the direction of the market equilibrium, but it will not necessarily reach it.

Studies on trade agreements and trade liberalisation

Maasdorp (1997) looks at the impact of regional integration on Southern African agriculture. The paper focuses on the development within the Southern African Development Community

(SADC). Agriculture is an important sector of the economy in almost all members of SADC. The main products traded are meat, grain, sugar, tea, tobacco, cotton, rice and fruit. Effective rates of protection are calculated to observe sensitive products. In the case of South Africa those are tobacco, sugar and dairy products.

De Rosa (1996) quantifies the effects of the Uruguay Round on Sub-Saharan Africa. Without exchange rate adjustments, South Africa agricultural exports are predicted to increase by 4.8 percent due to the Uruguay Round agreement. Agricultural imports are predicted to rise by 2.2 percent. Exchange rate adjustments will change these results only marginally.

Yamazaki (1996) estimates the value of trade preferences and the effects of the Uruguay Round. The total value of agricultural trade preferences given by the EU, United States of America and Japan in 1992 amounts to US$ 1.9 billion. This will be reduced to US$ 1.2 billion due to the Uruguay Round agreement. Africa receives approximately one third of the world-wide benefits of preferential trade which originates to over 99 percent in the EU, mainly as part of the Lomé Convention. The reduction due to the Uruguay Round is approximately a quarter of the historical value. All these values are average values and differ largely for single countries and commodities.

Parikh *et al.* (1997) use an applied general equilibrium model to analyse the effect of trade liberalisation in India. The results show that poor people especially will benefit from trade liberalisation in agricultural products while the rural rich will lose the most. A specific reference is given to the rice sector. Rice is the staple food in India and the country is a major exporter of rice. From a social welfare point of view, a restriction of rice exports is desirable in order to secure the availability of rice for the poor.

Hayes *et al.* (1992) analyse domestic price variability during the phase-in period of trade liberalisation. A specific reference is given to the tariffication process required under the Uruguay Round agreement. *Ad valorem* tariffs increase the domestic price variability in relation to free trade. Other protection policies are aimed at reducing this variability. The problem which arises, is how to facilitate a smooth transition to *ad valorem* tariffs. The Swiss formula and modifications are discussed to show how tariff reductions could be instituted.

Meilke *et al.* (1996) evaluate challenges for quantitative analysis of trade agreements. An overview of the influence of the economist on trade negotiations is given, with specific reference to studies relating to the Uruguay Round. For the future, an improvement in existing models should be desirable for the analysis. This is especially needed in the case of interdependence between different support measures. A knowledge of the importance of regional agreements in relation to multinational agreements would be beneficial for quantitative models during the next round of multinational trade negotiations. The presentation of results should be outward-looking so as to improve the general understanding of trade liberalisation.

Levy (1997) conducts a political economic analysis of free trade agreements. The major concern is that bilateral agreements could reduce the support for multinational agreements, especially if bilateral agreements result in disproportional large gains. Under Heckscher-Ohlin settings a bilateral free trade agreement cannot replace multilateral agreements, but the support for the latter could be reduced. Also, political popularity reduces the political support for multinational agreements. A restriction on bilateral agreements would be beneficial for

multinational agreements. This is especially important with regards to major role-players, the EU and the United States of America.

As the Free Trade Agreement (FTA) between South Africa and the European Union is the starting point of the analysis of the impact on the South African fresh orange industry a reflection of other literature in this field is useful. Most other studies evaluate a range of products. This study specifically looks at only one product in the quantitative analysis to incorporate the interrelationships between demand and supply on all levels. One chapter of this thesis will concentrate on the interdependence of the FTA and other agreements as well as the effects of the FTA on the agricultural sector.

Study on fruit transport

Xyttas (1994) describes the advantages and disadvantages of different modes for transporting fruits from the eastern Mediterranean to the European market. This information is also useful in the South African context. Of the four possibilities, vessel, truck, container and aircraft, truck could be excluded for the South African case. He emphasises that future research should improve the transportability of fruit. This is of even higher importance for South Africa, because of the longer distance to the European market.

1.3. Economic theory of trade

Globalisation is one of the major facets of today's economic life, while for more than two centuries international trade has been an integral part of economic theory. Ricardo introduced the concept of comparative advantage in the early nineteenth century. This describes that not

an absolute cost advantage in the production of a product makes trade favourable but also only a relative cost advantage of one good against another. Trade theory as applied in this chapter uses the model of a two factor and two goods economy if nothing else is stated.

The basis of modern trade theory is the Heckscher-Ohlin theorem (Woll, 1990, p. 606). It shows that under free trade conditions, the price relation between production factors will equalise within the world. This does not mean that factors will cost the same at every place on the earth. The Stolper-Samuelson theorem, the Rybczynski theorem and the Leontief paradox describe further research into the Heckscher-Ohlin theorem.

The Stolper-Samuelson theorem shows that a factor benefits from a tariff imposed on a imported good in which it is used most intensively (Tweeten, 1992, S.38). If for example labour is used most intensively in agricultural production, labour would benefit from an import tariff on agricultural goods as this tariff would rise the relative price of agricultural goods in comparison with other goods. This would distort the factor price relation in favour of labour.

The Rybczynski theorem describes the situation in the case of an exogenous increase in one of the production factors (Siebert, 1994, pp. 70-71). In this case the production of the good which uses this factor more intensively will increase. In the same way the production of the good which uses this factor less intensively will decrease. This theorem assumes constant prices and factor price relations.

The Leontief paradox emerged from an empirical study by Leontief in which the Heckscher-Ohlin theorem was tested (Tweeten, 1992, pp. 37-38). He found that countries with a high

labour-capital ratio were exporting labour-intensive products. This highlights that the definition of labour and capital in the original Heckscher-Ohlin theorem was not satisfactory as investments in human capital were not seen as capital but rather as labour.

1.4. Theory of free trade areas

Due to the membership in the World Trade Organization (WTO) South Africa and the EU are generally bound to the Most Favoured Nations (MFN) tariff. Exceptions therof are mainly regulated in Article XXIV of the General Agreement on Tariffs and Trade (GATT). This include custom unions and free trade areas. Customs unions as the EU itself and the Southern African Customs Union (SACU) charge no tariffs on trade between member countries and the external tariff is the same throughout the customs union. Hence, there is no problem with rules of origin. Another form of preferential trade is the formation of a free trade area, which is intended with the Agreement on Trade, Development and Co-operation (TDCA) between South Africa and the EU. The tariffs between members are eliminated on 'substantially all trade' but members charge different external tariffs. It is, therefore, necessary that rules of origin exist to limit trade deflection (Robson, 1993, p. 23). This means that external parties use the lower tariff in one country to enter the other market.

The two main effects of a free trade area are trade creation and trade diversion (Robson, 1993, pp. 23-30). Trade diversion describes the move from trade flows between other countries and a member of the free trade area to trade flows between partners within the free trade area. Trade creation occurs if new trade flows arose because of the tariff elimination between member countries. Analysing firstly the later aspect, new trade flows are created because the tariff in the receiving countries was prohibitive. In this case the more efficient

production in the other partner can compete with the previously protected local industry. This will be beneficial for the now exporting country as the efficient industry has a larger market for its product. In the importing country consumers will benefit as they are now able to purchase the same product for a lower price. The protected industry has to adjust to the new competition. This may result in a more efficient use of the available resources but it also could mean the closure of this industry if it is not able to adjust. In the receiving country the net welfare effects could, therefore, be either positive or negative, as they are entirely positive in the exporting country. This is the main reason for the exclusion of specific products from a free trade agreement. Also the newly agreed free trade agreement between South Africa and the EU has a list of excluded products. In the case of the EU this occurs almost entirely in the field of agricultural products. South Africa has excluded products from all sectors.

The other main aspect, trade diversion involves also the trade relationship with non-participating countries. That means that previously more competitive trade flows will be replaced by trade between members of the free trade area. Products from member countries will be more competitive as they will enter the other country tariff free or at least at a reduced tariff rate. Consumers in the receiving country will benefit as they will be able to pay a lower price for the same good. Industries in the exporting country will also benefit as they can sell their product to a wider consumer basis. The loser will be the previous outside supplier. They cannot compete against the now preferential trade conditions between the members of the free trade area. This is one of the main reasons for the strict regulations of the WTO for the creation of free trade areas. As, South Africa and the EU have other preferential agreements, the effects of the FTA between both on other countries are of major importance. For example the EU permitted South Africa to exclude products if they are of high importance to other members of the Southern African Customs Union (SACU). The EU involved the member

countries of the Lomé Convention in the negotiation process of the FTA. This resulted in the exclusion of cut flowers from the FTA as Kenya and Zimbabwe have developed a large cut flower industry which relies on preferential access to the EU market under the Lomé Convention.

Focussing on the trade with oranges, the effects of trade diversion and trade creation have to be seen seasonally. In the main EU production season, oranges are excluded from the FTA as the EU wants to protect its own orange producers. This was done to eliminate the negative effect of trade creation on the EU producers. In the EU off-season oranges are included. South African orange producers can now benefit from the preferential access, but the previous EU tariffs during the off-season were low. Trade diversion may only occur to a small extent as South Africa has been historically the dominant supplier in the EU off-season. On the other hand, the South African focus on the EU market as export market could be strengthened.

1.5. Theory of exchange rates

As exchange rates form an important factor in international trade, an analysis of the aspects of exchange rates has to form an integral part of a trade model. The major boost in the development of exchange rate models occurred in the early 1970s. This coincided with the collapse of the Bretton Woods system (Siebert, 1997, p.65). One group of exchange rate models is representing monetary models. Another group consists of equilibrium models and liquidity models. In addition a portfolio balance model exists (Taylor, 1995).

The basis of monetary models forms the assumption of purchasing power parity and supply and demand for money within an economy. In the flexible price model, money demand is determined by real income, price level and nominal interest rate (Taylor, 1995). For each country this equation is solved for the price level. Because of the assumption of purchasing power parity a constant relationship between both price level is expected. In spite of strict assumptions of the purchasing power of parity approach in the long run this approch is seen as logical (Siebert, 1997, pp. 56-58). Therefore, a model was developed which allowed short term overshooting of exchange rates. The sticky price model included interest rates as so called 'jump variables' to allow for short term overshooting of the exchange rate (Taylor, 1995). Frankel (1976) applied monetary models to the hyperinflation in Germany in the 1920s and found a good fit. Some good fits were found for exchange rate analysis for the 1970s, but later the monetary approach resulted in less satisfying outcomes (Taylor, 1995).

Equilibrium and liquidity models were developed in the early 1980s (Taylor, 1995). The demand for money to purchase foreign goods determines the exchange rate. Liquidity models are extensions of equilibrium models, which include not only the exchange of goods but also the purchase of assets. The implications of equilibrium and liquidity models in comparison to monetary models are similar, an example would be a rise in money supply (Taylor, 1995). Empirical evidence rejects simple equilibrium models but a conclusion for the empirical validity of the whole group of equilibrium and liquidity models cannot be drawn.

A portfolio balance model allows for imperfect substitutability between domestic and foreign assets (Taylor, 1995). Domestic wealth can only be held in three forms: money, domestic bonds and foreign bonds. If the money supply increases, the local interest rate will fall and foreign bonds will become more competitive thus the demand for foreign money will increase

and the local currency will be depreciated. In consequence the demand for foreign goods will decline as those are comparatively more expensive. Therefore, the demand for foreign money will also decline and the local currency will be appreciated. Problems with portfolio balance models occur mostly in the search for adequate data. As imperfect substitutability of domestic and foreign assets is assumed within the portfolio balance model this leads to the assumption of risk premia in the foreign exchange markets. Recent studies have found preliminary evidence of such a phenomenon (Dominguez and Frankel, 1993).

As monetary models are the only ones, which are not based on a general equilibrium, they are the most suited for trade simulation. The results of monetary models are also comparable with those of equilibrium and liquidity models. The usage of a portfolio balance model is due to lack of satisfying data on the asset situation within the EU and South Africa impossible.

CHAPTER 2. The Free Trade Agreement between South Africa and the European Union and other Trade Agreements

South Africa is involved in several international trade agreements and recently signed the "Agreement on Trade, Development and Co-operation" (TDCA) with the European Union (EU)[1]. One of the main parts of the TDCA is a Free Trade Agreement (FTA). This agreement cannot be seen to be separate to other trade agreements, because they are interlinked. The most important of these agreements is the General Agreement on Tariffs and Trade (GATT) and the subsequent World Trade Organization (WTO). They set the international rules for trading and trade relations. The Southern African Customs Union (SACU) and the Southern African Development Community (SADC) are interlinked with international trade involving South Africa. Trade agreements by the EU include the Lomé Convention and several other trade agreements; bilateral agreements with Mediterranean countries and with countries in transition. The importance of these agreements in relation to the FTA will be highlighted. The FTA between South Africa and the EU will then be described, with an emphasis on agricultural products.

2.1. General Agreement On Tariffs and Trade and the World Trade Organization

The General Agreement on Tariffs and Trade (GATT) is a multinational trade negotiation. The eighth round (Uruguay Round) of GATT was concluded in 1994. The GATT and the

[1]The EU referred to in this paper comprises 15 countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom).

World Trade Organization (WTO), established in the Uruguay Round, form the multinational framework for all further trade-related policies and agreements. South Africa and the EU are members of the WTO. Therefore, the rules are binding for both. Agriculture was partially included in earlier negotiation rounds, but it was only brought into line with general GATT rules by the Agreement on Agriculture during the Uruguay Round.

Members of the WTO are bound to the Most Favoured Nation (MFN) tariffs, set according to a commitment to the final agreement of the Uruguay Round in 1994. For this purpose all non-tariff barriers had to be changed into tariffs. Swart *et al.* (1995) described this process of tariffication for South African agriculture. The obtained tariffs form the basis for the agreed tariff reduction within the GATT agreement. Tangermann (1996) showed how the Uruguay Round Agreement on Agriculture was implemented. He recognised that, due to the agreed rules, it is possible to maintain the level of protection despite the Uruguay Round Agreement. This possibility will be eroded by the end of the six year implementation period. An exclusion of the MFN tariff is regulated in the safeguard clause of the Agreement on Agriculture. The importance of this for the agreement between South Africa and the EU will not be considered in this study. The applied MFN tariffs by South Africa and the EU form the basis for the negotiation of the FTA.

Another aspect of the Agreement on Agriculture is the treatment of export subsidies. Only notified export subsidies are allowed and they have to be reduced by 36 percent over six years. The notification was included in the final commitment to the Agreement on Agriculture. The EU uses export subsidies for several agricultural goods including cereals, meat, milk and milk products, fruits, sugars and others (Table2.1). The South African General Export Incentive Scheme (GEIS) was abolished in July 1997.

Table 2.1: Export and 'food aid' refunds by the EU in ECU million

Products	**1993**	**1994**	**1995**	**1996**
Cereals	2878.8	1571.6	1129.3	320.2
Rice	75.4	23.6	65.1	42.6
Sugars	1.0	0.7	1.9	1.6
Olive oil	68.8	52.8	38.2	59.3
Fruits and vegetable	187.5	216.7	239.4	98.4
Wine	100.2	80.4	36.7	40.8
Tobacco	36.2	49.9	35.1	2.4
Dairy products	2340.8	1949.2	2290.2	1615.8
Bovine meat	1711.2	1708.4	1761.0	1559.4
Pigmeat	193.5	259.1	118.2	101.4
Eggs and poultry	290.9	239.6	200.5	139.2
Products of the agri-foodstuffs industries	743.5	631.4	574.3	493.9
Fishery products	0.1			
Total expenditure	**8627.9**	**6783.4**	**6489.9**	**4475.0**

Source: World Trade Organization (1998b)

According to Table 2.1 export subsidies by the EU have been reduced substantially in recent years. This is mainly due to a sharp reduction in export refunds in the cereals sector. This has been caused by the change from price support towards acreage payments, which resulted in lower internal EU prices for cereals. On the other hand, export refunds for bovine meat and dairy products remained relatively constant.

The WTO monitors the development of national trade policies in Trade Policy Reviews on a

regular basis. For the EU this is every two years and for South Africa every four years. The Trade Policy Review of the EU in November 1997 indicates that the implementation of the WTO rules and the completion of the single market has led to greater liberalisation within the EU (Trade Policy Review Body, 1997). The average level of agricultural tariffs was reduced to 20.8 per cent in 1997 from 25 per cent in 1995. Tariff peaks in the agricultural sector are in cereals, meat, dairy, poultry, sugar and tobacco. Import arrangements for meat, dairy products, rice, fruit and vegetables are still a matter of concern. Financial transfers to agriculture continue to grow, but they are increasingly taking the form of direct payments. The recent Agenda 2000 of the European Commission proposes further limitations on farm subsidies.

The last trade policy review of South Africa took place in April 1998 (Trade Policy Review Body, 1998). This was a joint review of all members of the Southern African Customs Union (SACU). According to this review, the common external tariff averaged 15 per cent. The applied average rate for agricultural products is 5.6 per cent. The reduction in the number of control boards within the South African market is seen as a step towards further deregulation of agricultural trade. The restructuring of regional trade agreements is welcomed.

Future development of the international trade regulations will be in the context of the WTO. In November and December 1999 the third ministerial meeting of the WTO took place in Seattle, and the expected launch of a new round of multinational trade negotiations was stalled. It has now to be seen when a new round of multinational trade negotiation will be initialised. The outcome of that round is expected to result in further improvement towards free trade. There are expectations for either the same pace of liberalisation or even an increase (de Zeeuw, 1997). Pressure for total elimination of subsidies will rise, especially in the case

of export subsidies. Income support could become even more decoupled after future negotiation rounds. A maximum tariff level per product of 50 percent was discussed in the Uruguay Round and it will be on the negotiation agenda again.

South Africa has been a member of the Cairns Group since the meeting of this group in April 1998 (World Trade Organization, 1998a). The Cairns Group was founded at the beginning of the Uruguay Round as an interest group to promote free trade in agricultural goods. The members[2] of this group are mainly agricultural exporters, from both developed and developing countries. Membership in the Cairns Group indicates South Africa's willingness to promote free trade in agricultural products.

Josling and Tangermann (1999) evaluate the implementation of the Uruguay Round agreement. With respect to domestic support the major countries had no difficulties in implementing the Uruguay Round agreement. This is mostly due to transformation of support into categories which fall outside the reduction commitments. Export support commitments are binding for the EU and the United States of America. In the field of market access, almost all restrictions are converted into tariffs and subsequently reduced as agreed upon. In the next round of negotiations a further reduction of tariff protection is expected. More controversial in the field of market access is the field of tariff quotas. A guideline for administering these should be set within the next round. Export support will be reduced, but a total elimination within the next round seems unlikely. With regards to domestic support, a clarification of allowed measures has to be obtained. The positions of major role players are presented. Other

[2]Members of the Cairns Group: Argentina, Australia, Brazil, Canada, Chile, Colombia, Fiji, Indonesia, Malaysia, New Zealand, Paraguay, the Philippines, South Africa, Thailand, and Uruguay

related fields such as sanitary and phyto-sanitary restrictions and technical barriers of trade will play an increasing role in the next round of multilateral trade negotiations.

Conformity of the Free Trade Agreement with World Trade Organization rules

The regulations for concessions to other members through a bilateral Free Trade Area can be found in article XXIV of the GATT 1994. Paragraph 8(b) of this article describes a Free Trade Area in the context of the WTO. In a Free Trade Area the duties between the involved partners should be eliminated on 'substantially all trade'. In the negotiation of the FTA, conformity with WTO rules has been seen as a necessity. The question which arises is whether this was successful or not. The major problem is the intentionally vague WTO rules concerning the establishment of a Free Trade Area. In addition, until now, no formal notification of a Free Trade Area under WTO rules has been requested. Such a request set precedents for other agreements (Stevens, 1999).

Firstly, what is 'substantially all trade'? It is clearly understood that all sectors should be included in a FTA. This has not been problematic in relation to the South African EU agreement. An amount of 90 percent of all trade has been seen as the cut-off for 'substantially all trade', but should this apply to the historic trade between both partners or to tariff lines. Both South Africa and the EU opted for the former. South Africa offered to liberalise 86 percent and the EU 96 percent of imports. On average this is higher than 90 percent of the total trade, but do WTO rules allow for this asymmetry. The disparity becomes even more complicated if sectors and not total trade are assessed (Ng'ong'ola, 1999). Looking at tariff lines, the result would be that much less than 90 percent of trade is liberalised, because tarrification policy normally results in a higher number of tariff lines for sensitive products.

This is done to optimise protection for these products but could lead to problems in the formal acceptance procedure of the FTA (Stevens, 1999).

Another problem lies in the length of the implementation period of the FTA. World Trade Organization rules generally allow for an implementation period of 10 years which has been extended to 12 years in the case of the South African offer. The EU and South Africa argue that this concession to South Africa improves the developmental character of the FTA. The question is whether this is acceptable in an agreement between two developed partners, as South Africa is classified as a developed country by the WTO.

A clarification of the conformity of the FTA with WTO rules will only be obtained if the FTA is challenged by a WTO member. This will start a dispute settlement process in which clear definitions for the establishment of Free Trade Areas will arise. The United States of America has indicated that they will not challenge the FTA, but any WTO member could (Stevens, 1999). Lack of clarity of WTO rules makes it impossible to establish a Free Trade Area with full concordance to these rules. So, although effort has been made to follow these rules, there are still open questions.

2.2. Southern African Customs Union and Southern African Development Community

South Africa is member of the Southern African Customs Union (SACU) and the Southern African Development Community (SADC). Both agreements include regulations concerning interregional trade. These regulations have an impact on all outside relationships. This section highlights the trade part of both agreements and evaluates the interrelation with the FTA

between South Africa and the EU.

Southern African Customs Union (SACU)

SACU was founded in 1910 and renegotiated in 1969 (Blumberg, 1994: 1-7). The members are South Africa, Botswana, Lesotho, Namibia and Swaziland. The latter four are named the BLNS countries in connection with SACU. Within SACU no member can sign a trade treaty with outside parties without formal agreement of the other members. The objectives of the SACU are to maintain free interchange of goods between members, to apply the same tariffs to goods from outside the common customs area and to promote economic development. There should be no duties or quantitative restrictions on trade between members. Exceptions to this are regulated in the agreement. One such measure is to temporarily protect an industry in an exceptional situation. This was used by Namibia and Swaziland in the case of different kinds of flour and by South Africa for cars imported from Botswana in recent years (Otto, 1998). The BLNS countries should apply the same tariffs and trade restrictions as those set by South Africa. There are some exemptions to this general rule, but they are not important in the context of this thesis. All received duties are paid quarterly into the Consolidated Revenue Fund of South Africa. They are redistributed by an agreed formula to the members of SACU. The BLNS countries are largely dependent on the custom earnings (Keet, 1996). The GATT/WTO was never informed of the SACU agreement, but through the joint Trade Policy Review in April 1998 the WTO seems to have recognised SACU. SACU is currently being restructured.

The BLNS countries are the countries most affected by the FTA between South Africa and the EU (IDS & BIDPA, 1998). The study by IDS and BIDPA (1998) evaluated the following

main potential effects:

- greater competition for BLNS exports to the EU from South African products;
- greater competition for BLNS products in the SACU market from EU products;
- a loss of customs revenue;
- indirect effects arising from changes to the South African economy;
- indirect effects on the flow of investments to the BLNS.

Different kinds of analyses were carried out to evaluate all of these effects. A trade and tariff analysis resulted in a list of products of importance for BLNS countries and South Africa with regards to export to the EU: preserved fish, grapefruit, grapes, processed pineapples, and clothing. A commodity flow model indicates that direct effects of the FTA on the BLNS countries are small with the exception of the loss in tariff revenue. Another study estimated the revenue shortfall for Swaziland at five to fifteen percent (Directorate General VIII, 1997). A survey of firms in BLNS countries indicates that only a minority of firms would be affected. A computerised general equilibrium (CGE) model confirms the findings of the commodity flow model.

The study by IDS and BIDPA (1998) concludes with some recommendations. In relation to the negotiation, which was still under way at that stage, a co-operation with South Africa with regards to exclusions was proposed. Article 24.3. allows the BLNS countries to request South Africa to take surveillance or safeguard measures on their behalf. A problem could arise now if South Africa has a different opinion about the necessity of taking safeguard measures. Thus some parties would prefer the BLNS countries to have the right to take safeguards on their own. Kirk (1999) argues that it would be very unusual to grant non-signatories such rights. A clarification of the rules of origin was requested, which was subsequently included in the FTA. The governments of the BLNS countries were strongly advised to review their taxation

system. The EU offered a support package to cater for possible transitional difficulties in fiscal restructuring in the BLNS countries (European Commision, 1999). Gaolathe (1999) describes options for a fiscal restructuring in the BLNS countries. He emphasises the necessity of an efficient tax administration. The introduction of Value Added Tax (VAT) is seen as one possibility to broaden the tax base.

Southern African Development Community (SADC)

In 1994 South Africa became a member of SADC. The SADC includes 14 Southern and Eastern African Countries[3], and was redesigned by the SADC Trade Protocol, which was signed in Maseru in 1996. SADC intends to become a Free Trade Area in Southern Africa. The deadline for submission of detailed trade offers has been extended to the end of 1999. Therefore, it seems likely that the intended start of the implementation period intended to be at the beginning of the year 2000 will be postponed. Within this agreement, members should not allow another country or group of countries (non SADC members) to enter the local market on more favourable terms than other SADC members. This means that all concessions given to the EU through the FTA should also be applied to SADC.

South Africa, as the largest and most economically powerful member of the SADC, has to open its markets faster than the other members. The countries of SADC which are not members of the SACU are not directly affected by the FTA, but there are substantial spillovers (Directorate General VIII, 1997). Most members are highly dependent on the possibility of exporting to South Africa. Therefore, an improved access by another country to

[3]Current Members are Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, the Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

South Africa can diminish the export possibilities of the other SADC members. South Africa and the EU have agreed that South Africa should open its market first to SADC and then to the EU. This is called the 'SADC first' principle. Within the SADC there will be an asymmetric opening of markets. South Africa will open its markets faster than the other members of SADC.

2.3. Lomé Convention and other agreements by the European Union

Another important agreement is the Lomé Convention between the EU and 71 countries in Africa, the Carribian and the Pacific (ACP). This agreement includes non-reciprocal trade concessions by the EU and a framework for aid to the ACP countries. The current fourth Lomé Convention will expire in 2000. South Africa requested to join the Lomé Convention in 1994 (Directorate General VIII, 1998a). The EU offered South Africa a qualified membership to the Convention. This includes: technical, cultural and social co-operation, regional co-operation, eligibility for tenders for the 8th European Development Fund (but excluding the preferential ACP treatment), industrial development, investment promotion and protection, and participation in the institutions of the Convention. It came into force after the approval of the ACP/EU Council, which happened in April 1997, and after the ratification of the Lomé IV-bis in May 1998 (Directorate General VIII, 1998a). Cumulation of ACP exports with South African inputs were regulated on an *ad-hoc* basis within the qualified membership in the Lomé Convention. The TDCA between South Africa and the EU now allows full cumulation in this regard.

The Free Trade Agreement between South Africa and the EU will clearly have an impact on the ACP countries. Therefore, the EU began a process of regular consultations with the ACP

group of Ambassadors (Directorate General VIII, 1997). It has been observed that only a limited number of products could be affected by a total liberalisation between South Africa and the EU. Some suppliers could lose market share if a South African supplier were to gain the same access as they enjoy under Lomé. One example are cut flowers from Kenya. There is also expected to be a positive growth effect of encouraged trade between South Africa and the EU, which could spill over into other countries in the region. The positive and the negative effects need further investigation (Directorate General VIII, 1997).

The future of the Lomé Convention after the year 2000 is unclear. The current Lomé IV was examined by a GATT working group in 1994 (Davenport *et al.*, 1995: 65). They concluded that the Convention does not conform with the rules of GATT. The two main problems are that it is non-reciprocal and that it is discriminatory among developing countries. The EU and the ACP countries sought a waiver, which was granted until the year 2000. An option is the creation of a network of Free Trade Areas. Another waiver until 2005 is very likely (Stevens, 1999). A further extension seems unlikely because the United States of America will have replaced their non-reciprocal trade agreement and the EU would be the only WTO member to maintain such a scheme. At the moment a threefold replacement is in discussion. The first is the replacement of the Lomé Convention by a set of regional economic partnership agreements (REPAs) (Stevens, 1999).

These agreements will be over different periods of time and they will be biased in the pace of implementation. A problem might occur if the FTA between South Africa and the EU is challenged under WTO rules which might exclude this possible future solution. The second option might be an improved Generalised System of Preferences (GSP) for least developed countries which would also be open for non Lomé members. Finally, if no solution could be

found by 2005, the normal GSP will be in place for all Lomé members. The EU GSP is far reaching in the case of industrial products, but agricultural products are excluded to a large extent. These are in general the most interesting export products for the least developed countries. In the long run the benefits of preferential market access will be eroded because of low Most Favoured Nation (MFN) tariffs.

Other important agreements of the EU are the 'Europe Agreement' with the countries in transformation and the agreements with the Mediterranean countries. All these agreements include trade. Some of them also rule that there should be no other agreement which grants another country more favourable access to the EU market. This limits the negotiation margin for the EU within the FTA.

2.4. Agreement on Trade, Development and Co-operation between South Africa and the European Union

After denying South Africa full membership in the Lomé Convention, the EU offered a set of agreements. One of these is the "Agreement on Trade, Development and Co-operation" (TDCA) which includes a Free Trade Agreement (FTA). The formal negotiation towards the FTA started in June 1995. Initially, a fast track negotiation was expected. The detailed proposals were presented in March 1996. Subsequently, the negotiation started and detailed line-by-line trade offers were presented by South Africa in November 1997 and by the EU in January 1998. The final agreement was accepted at the Berlin European Council (1999) in March 1999 and signed in Pretoria on 11 October 1999. This agreement has no predecessor, which is one reason for the long negotiation period (Directorate General VIII, 1997). It is the first FTA by the EU that includes agriculture to a large extent. Normally, agriculture is

included in a positive list, which comprises only included products. This FTA includes a negative list, which shows the excluded products. The implementation period is set to start on 1 January 2000 (National Department of Agriculture, 1999).

As the FTA is only part of a set of agreements between South Africa and the EU, a short overview of the other parts will be given here. The qualified membership in the Lomé Convention is another part. This is described in section 2.3. Economic co-operation will be promoted under the TDCA. This will focus on sustainable development, regional economic co-operation, small and medium-sized enterprises and the environment (European Commission, 1999). A co-operation agreement for science and technology was signed in December 1996 and it has already been implemented. A regular political dialogue between South Africa and the EU on ministerial level, with specific focus on the development in Southern Africa, was established. Another major part of the co-operation between the EU and South Africa is the "European Programme for Reconstruction and Development in South Africa". With an annual budget of Euro 127.5 million this programme is the largest implemented by the EU throughout the world (European Commission, 1999).

The specific agreements for wine and spirits, and fishery are still under negotiation. This will include specific regulations for the phasing out of the use of the names port and sherry for South African fortified wines. The general rules are set by an annex to the TDCA.

2.5. Line-by-line trade offers of South Africa and the European Union

The line-by-line trade offers regarding the treatment of products in relation to inclusion in the FTA are divided into separate lists. At the end of the implementation period 86 percent of EU exports will enter South Africa duty free, whereas 95 percent of South African exports are

exempt from EU tariffs. Focussing on agriculture, 83 percent of EU exports are included whereas only 61 percent of South African exports are fully included. An exclusion from the FTA does not mean that trade is not allowed, but that those products will be treated in terms of the Most Favoured Nations (MFN) tariff, set through the commitments to GATT/WTO. Another 13 percent is covered by tariff quotas, hence resulting in a total of 74 percent of fully and partial liberalised access for South African agricultural products to the EU (National Department of Agriculture, 1999).

European Union offer for agricultural products

The EU offer for agricultural products consists of eight lists within appendix IV of the TDCA (Department of Trade and Industry, 1999). All agricultural products not covered by these lists will enter the EU duty free at the start of the implementation period. The majority of these products are already entering the EU without tariffs. Lists one to four include all products which will be included fully by the end of the ten year implementation period. Table 2.2 indicates the tariff reduction.

Table 2.2: Tariff level with regard to the basic duty for lists 1 to 4 of the European Union agricultural offer

Years of implementation	0	1	2	3	4	5	6	7	8	9	10
List 1	75%	50%	25%	0%							
List 2	91%	82%	73%	64%	55%	45%	36%	27%	18%	9%	0%
List 3				87%	75%	62%	50%	37%	25%	12%	0%
List 4						83%	67%	50%	33%	17%	0%

Source: Department of Trade and Industry, 1999.

These lists include the majority of agricultural products. Normally, a product belongs to a higher list if the applied tariff in the base period is high. Lists five to eight consist of all products which will not be fully included in the FTA. List five indicates the duty rates applicable for specific processed agricultural products. Future reduction or inclusion will be decided by the co-operation council, established by the TDCA.

Tariff quotas offered by the EU are included in list six (Table 2.3). Products included in transitional tariff quotas will be liberalised at the end of the implementation period and the tariff quota will then be obsolete. Those products belong to either list three or four. Reciprocal quotas have a counterpart in the South African offer. The governing of these quotas is done by the National Department of Agriculture in South Africa.

Table 2.3: Tariff quotas in agricultural products offered by the European Union

Products	Size	Tariff rate	Type
Global cheese and curd	5 000 t	0 %	transitional; reciprocal
Global flowers	1 500 t	50 % mfn 80 % gsp	
Flowers	2 600 t	50 % mfn 80 % gsp	
Flowers	3 500 t	25 % mfn	
Proteas	900 t	0 %	transitional
Strawberries	250 t	50 % mfn	
Global prepared fruit	40 000 t	50 % mfn	
Global mixed prepared fruit	18 000 t	50 % mfn	
Tropic prepared fruit	2 000 t	50 % mfn	
Frozen orange juices	700 t	50 % mfn	
Global fruit juices	5 000 t	50 % mfn	
Global wine	32 mill. l	0 %	reciprocal
Global sparkling wine	450 000 l	0 %	transitional; reciprocal

Notes: mfn = most favoured nation; gsp = generalised system of preferences

Source: Department of Trade and Industry, 1999

List eight includes products which are covered by protected EU denominations. These are products which are classified according to origin: Specific cheeses, champagne, specific wines, port, sherry and several spirits. Excluded agricultural products form list seven and will be reviewed periodically. The following description of excluded products is general, for specific information the actual agreement should be used (Department of Trade and Industry, 1999). Exclusions occur in bovine meat and offal, dairy products, cut flowers, sweet corn, bananas, most oranges, lemons, apples, pears, maize, rice, sorghum, flours and starches, sugars, preserved tomatoes, preserved fruits and fruit juices, some wines, vermouth, and some spirits.

Table 2.4 indicates the treatment of the main agricultural exports of South Africa in the FTA.

Table 2.4: Major South African exports to the European Union on the 8-digit CN code level and treatment in the Free Trade Agreement

CN code	Description (time of entry)	Volume traded in '000 ECU average 1994-1996	List in FTA
08044090	Avocados (01.06-30.11.)	26 446	2
08051038	Fresh Navels, Valencias etc. (01.06.-30.09.)	61 593	4
08051044	Fresh Navels, Valencias etc. (01.10.-15.10.)	15 654	7
08052021	Clementines (01.03.-31.10.)	10 159	3 or 4
08054090	Grapefruit (01.05.-21.10.)	27 852	0
08061029	Fresh table grapes (01.01.-14.07.)	83 811	2 or 4
08081061	Fresh Golden Delicious (01.04-30.06.)	32 609	7
08081063	Fresh Granny Smith (01.04.-30.06.)	29 936	7
08081069	Fresh other apples (01.04.-30.06.)	14 391	7
08081071	Fresh Golden Delicious (01.07.-31.07.)	11 918	7
08081073	Fresh Granny Smith (01.07.-31.07.)	21 135	7
08082031	Fresh pears (01.01.-31.03.)	10 993	7
08082037	Fresh pears (01.04.-30.04.)	16 908	7
08082041	Fresh pears (01.05.-30.06.)	18 355	7
08094010	Fresh plums (01.01.-10.06.)	16 663	1
12022000	Shelled ground-nuts	10 851	0
20089274	Mixtures of fruit, preserved, containing sugar in packings =< 1kg	10 459	6
22042179	White wine in containers =< 2l	22 424	6
22042180	Other wine in containers =< 2l	22 787	6
41022100	Raw hides and skins of sheep and lamb	33 078	0
51011100	Greasy shorn wool	41 155	0
51021050	Hair of Angora, Tibetan, Kashmir, and similar goats	11 380	0

Source: Directorate General VIII (1998b) and Department of Trade and Industry (1999)

The main products are mostly fruits and products thereof, and animal products for the textiles industry. For most fruits the tariffs in the South African export season are low because it is the EU off-season and a year round supply of fresh fruit is demanded by the EU consumer. Apples and pears are in list seven and thus excluded from the FTA. Other important products,

such as animal products for the textiles industry, are in list zero and are allowed to enter the EU duty free from the start of the implementation period.

The EU offer for fresh oranges classifies all fresh sweet oranges entering the EU from 15 October until 31 May in list seven. In addition, fresh Navels, Valencias etc. are in list seven for the period from 1 October to 15 October. All other fresh oranges are in list four. Fresh Navels and Valencias, which enter the EU between 1 June and 30 September, will be liberalised at a later stage of the implementation period.

South African offer for agricultural products

The lists for agricultural products entering South Africa from the EU form appendix VI of the TDCA (Department of Trade and Industry, 1999). Products not included in these lists will enter South Africa duty free at the start of the implementation period on 1 January 2000. Products in list one will be liberalised in four steps, starting at the beginning of the implementation period and ending three years later. Tariffs on products in list two will be phased out in three steps between the third and fifth year of the implementation period. The liberalisation of products in list three will operate in eight steps between the fifth and twelfth year of the implementation period. South Africa has to offer tariff quotas for some products where reciprocal quotas were agreed upon (Table 2.5). These quotas are mostly transitional until the affected product is fully included in the FTA.

Table 2.5: Tariff quotas in agricultural products offered by South Africa

Products	Size	Tariff rate	Type
Global cheese and curd	5 000 t	50 % mfn	reciprocal
Global wine	1 mill. l	0 %	transitional; reciprocal
Global sparkling wine	260 000 l	0 %	transitional; reciprocal

Notes: mfn = most favoured nation

Source: Department of Trade and Industry, 1999

List four comprises products which will be excluded from the FTA. The possibility of inclusion should be periodically reviewed. The products in this list are: bovine meat, swine meat, meat of sheep and goats, some dairy products, wheat, barley, maize and products thereof, sugars, ice creams, flax, and true hemp. For some cheeses a tariff quota is provided (Table 2.5).

Table 2.6 indicates the treatment of the main EU agricultural exports in the FTA. The major exports of the EU to South Africa are meats, grains and processed agricultural goods. Whereas bovine meats and grains are excluded from the FTA, processed agricultural products are included. The single most important product, whiskies, is included in list three and will be liberalised in the later stage of the twelve year implementation period. Meat offal, sausage casings and malt will enter South Africa duty free at entry into force of the FTA, thus they belong to list zero.

Table 2.6: Major European Union exports to South Africa on the 8-digit HS code level and treatment in the Free Trade Agreement

HS code	Description	Total volume traded in R '000 1994-1996	List in FTA
02022000	Meat of bovine animals, other frozen cuts with bone	99 913	4
02023000	Meat of bovine animals, frozen boneless	298 741	4
02032910	Meat of swine, frozen ribs	89 389	0
02074200	Turkey cuts and offal, frozen	124 375	0
05040010	Sausage casings	250 212	0
10019000	Wheat and meslin, other	256 311	4
11071020	Barley malt	338 283	0
15149090	Rape, colza and mustard oil, other	67 837	1
15179090	Margarine, other	64 431	1
21069050	Mixtures of chemicals and foodstuffs	95 811	2
21069090	Other food preparations	132 994	3
22071000	Undenatured ethyl alcohol	53 316	3
22083000	Whiskies	841 167	3
23099020	Fodder supplements for stock feeding	55 086	0

Source: Department of Trade and Industry (1997 and 1999)

General effects on the South African agricultural sector

The two main effects of the FTA on the South African agricultural sector are: Firstly, competition from EU products, because of easier access to the South African market. Specific reference is given to internal support and export subsidies by the EU. Secondly, improved market access to the main export market could be beneficial for the South African agricultural sector.

Concerning EU exports to South Africa, several studies focussed on the beef industry (Nieuwoudt, 1997; Baldurally Adam, 1998; Koester and Loy, 1998). Nieuwoudt (1997) calculated that South African beef prices are depressed by ten percent due to EU export subsidies. Badurally Adam (1998) estimated a reduced price effect of seven percent due to EU export subsidies in the South African market in 1996. The forward and backward linkages between the beef industry and other industries are emphasised. In addition the contrary effects of the EU beef policy regarding other members of SACU is pointed out. Those countries benefit from market access concessions under the Lomé Convention, but the regional market is depressed due to EU export subsidies. Different FTA scenarios were simulated and results show that the retail price would increase if EU export subsidies and South African tariffs were eliminated. Koester and Loy (1998) conclude that the direct impact of EU export subsidies for beef is limited on the South African market. This is mainly due to the market presence of Argentinean beef. It is assumed that Argentina would increase their market share if the EU would stop exporting to South Africa. They report the effect on world prices for beef caused by EU domestic support and export subsidies at around ten percent. The final FTA excludes beef on both sides. There will thus be no change in the trade regulations concerning beef. South African tariffs are still applicable, as EU export subsidies will still be paid.

Viljoen (1999) concluded that the South African poultry industry will benefit from exporting to the EU under the FTA. A comparison between costs and income of a broiler unit producing for the local or EU market has been undertaken. The exporting unit becomes more profitable as the elimination of tariffs on poultry meat comes into effect in the EU. Before the inclusion of poultry in the FTA the local unit is more profitable. It is mentioned that producers have to

be compliant with EU sanitary requirements.

Nieuwoudt (1995), Penzhorn and Kirsten (1999) and Gay and Nieuwoudt (1999) have focussed on the general effects of the FTA on the South African agricultural sector. Nieuwoudt (1995) points out that the South African horticultural sector paid over R 250 million duties to the EU. An industry by industry overview of threats and opportunities of free trade with the EU has been given. The horticultural sector expects the exclusion of several products because of sensitivity in the EU. The meat sector is particularly concerned about export subsidies by the EU. Penzhorn and Kirsten (1999) used a general equilibrium analysis to estimate impacts of the FTA on the South African agricultural sector. Their results show that both parties will have positive welfare effects due to the FTA. A sharp increase in South African meat and dairy exports is predicted, but it must be kept in mind that the starting point for the products is very low. Gay and Nieuwoudt (1999) looked at effects of changes in tariff for major exports. In most cases these changes are very small. This is caused either by their exclusion, or because the EU *ad valorem* tariff is already below five percent. Only for clementines and table grapes, was a tariff reduction of almost 20 percent observed, the realisation of which will be beneficial for exporters in those industries.

CHAPTER 3. Trade in Oranges between South Africa and the European Union

The EU exports only negligible amounts of oranges to South Africa, whereas South Africa is one of the main external suppliers of oranges to the EU. Table 3.1 shows the main external suppliers of oranges to the EU from 1991 until 1996. The EU is the destination for more than half of all South African orange exports (AgriReview, 1999).

Table 3.1: External imports of oranges into the European Union in metric tons

	1991	**1992**	**1993**	**1994**	**1995**	**1996**
Morocco	349 947	289 287	254 739	248 181	172 684	315 971
South Africa*	**161 510**	**175 405**	**135 007**	**178 552**	**167 283**	**228 365**
Israel	95 076	98 093	72 746	53 887	93 402	115 247
Brazil	72 454	62 107	67 269	90 743	81 063	69 880
Argentina	71 891	63 997	52 987	66 961	65 423	68 043
Uruguay	32 406	44 694	57 062	52 389	49 740	34 819
Turkey	10 896	6 469	5 185	8 630	24 268	30 911
Cuba	17 200	17 266	22 845	22 166	21 027	22 705
Cyprus	43 764	59 170	38 374	42 177	36 410	20 781
Tunisia	20 927	19 190	20 097	20 356	22 620	20 162
Zimbabwe	6 643	5 626	3 019	6 325	5 799	13 067
Extra-EU	**922 925**	**885 543**	**798 112**	**846 627**	**869 659**	**967 499**

Note: * Differences to Table 3.4 are due to revisions in the original dataset

Source: Eurostat, various issues.

The number of oranges imported from external sources by the EU fluctuates at around 900 000 metric tons. Approximately half of this originates in two countries, Morocco and South Africa. Due to the location of South Africa in the southern hemisphere, the production season differs from that of the EU. This is of major importance in the analysis of trade between both partners. In addition, the EU tariffs alter during the seasons of the year.

3.1. South African production and domestic consumption

The production of oranges in South Africa rose from 0.4 million tons in 1961 to 0.95 million tons in 1997 (Figure 3.1).

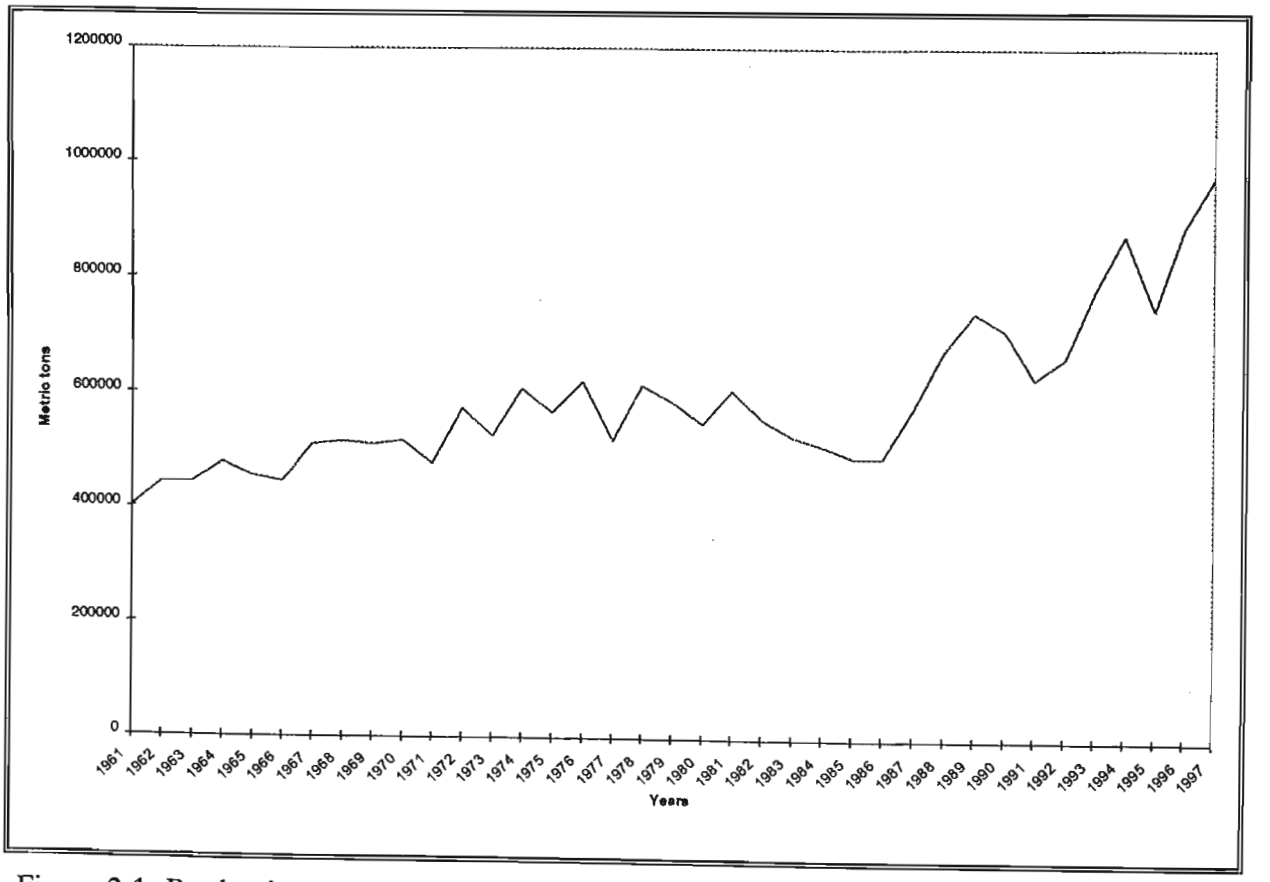

Figure 3.1: Production of oranges in South Africa (1961 - 1997)
Source: FAO, 1999.

The major rise in production occurred during the last decade. In the early 1980s, the production was around 0.5 million tons per annum. The FAO data on average yields of the past ten years shows an increase from 18 tons per hectare to 24 tons per hectare. During this period, the harvested area increased by one-third to 40 000 hectares. Planting information may yield more information about future development of the harvested area.

Table 3.2 indicates the dominance of the two main cultivars, Navels and Valencias, in the South African orange industry. The production of Navels is limited to the cooler climates within South Africa, whereas Valencias can be grown throughout the country. The major production occurs in regions which are far away from the nearest harbour.

Table 3.2: Regional and cultivar distribution of area planted with oranges in 1992

	Lowveld	North-West	Sundays River	Olifants River	Other	**Total**
Navels	3.49 %	7.36 %	9.39 %	5.21 %	0.90 %	**26.36 %**
Valencias	44.16%	9.43 %	7.23 %	5.32 %	4.54 %	**70.67 %**
Other	2.70 %	0.19 %	0.00 %	0.05 %	0.03 %	**2.97 %**
Total	**50.35 %**	**16.98 %**	**16.62 %**	**10.58 %**	**5.47 %**	**100.00 %**

Source: Capespan (1999)

As an estimate of the local consumption, the data collected at the fresh produce markets in South Africa is used. It excludes direct sales from producers to consumers and is, therefore slightly lower than the actual figure. The per capita consumption derived from the fresh produce market data is 2.5 kg. The variation between years is large, but in the long run the consumption is stable. The use of monthly data from the fresh produce markets makes it possible to derive a seasonal figure for the price of oranges at the local market in South

Africa. Total monthly figures are not published for all South African fresh produce markets. However, the main four markets, namely, Johannesburg, Pretoria, Cape Town and Durban, are taken to derive a seasonal figure for price movement (Table 3.3).

Table 3.3: Monthly real South African fresh produce market prices for fresh oranges R (1995) per metric ton and total amount traded in tons.

	1990	1991	1992	1993	1994	1995	1996	1997
January	1601.64	965.88	1253.98	1272.48	795.82	866.87	1343.18	826.37
February	1531.97	1111.88	1325.37	1316.11	807.80	1066.68	1306.17	912.69
March	1050.23	1009.74	1022.40	900.87	826.82	1006.23	908.60	756.04
April	1059.64	961.16	1025.07	823.42	740.85	824.20	731.52	674.10
May	760.03	769.97	655.00	568.96	591.03	586.30	612.74	577.43
June	738.90	652.96	606.03	623.78	524.14	652.52	593.94	465.30
July	805.28	700.53	687.79	579.39	611.26	771.95	611.48	471.01
August	775.55	673.59	690.74	519.01	633.78	746.01	631.25	499.27
September	814.14	803.87	757.55	640.66	628.29	814.98	658.85	487.37
October	980.95	904.08	915.06	702.81	729.47	1031.56	754.41	579.99
November	983.03	1016.98	1035.42	735.24	770.78	1072.72	790.36	608.04
December	980.53	1154.84	1159.78	803.12	810.91	1214.00	747.83	679.49
Average*	**894.26**	**821.48**	**803.55**	**666.75**	**663.54**	**793.98**	**685.44**	**558.78**
Amount traded annually	**96 019**	**105 018**	**113 109**	**134 346**	**125 208**	**99 937**	**108 414**	**136 421**

Note: * weighted average by amount traded

Source: Directorate Agricultural Statistics and Management Information, various issues.

These markets also represent the main areas of consumption in South Africa. According to the data from the fresh produce markets, there is no differentiation between different orange

cultivars. The seasonal price variation differs between years, because the availability of oranges for the local market is dependent on weather conditions. Off-season prices (December to February) are almost twice as high as the peak-season price. The real local fresh orange price has declined over the years. As real local prices have declined producers may have tried to increase the export percentage but this has stayed almost constant during the last thirty years (Figure 3.2).

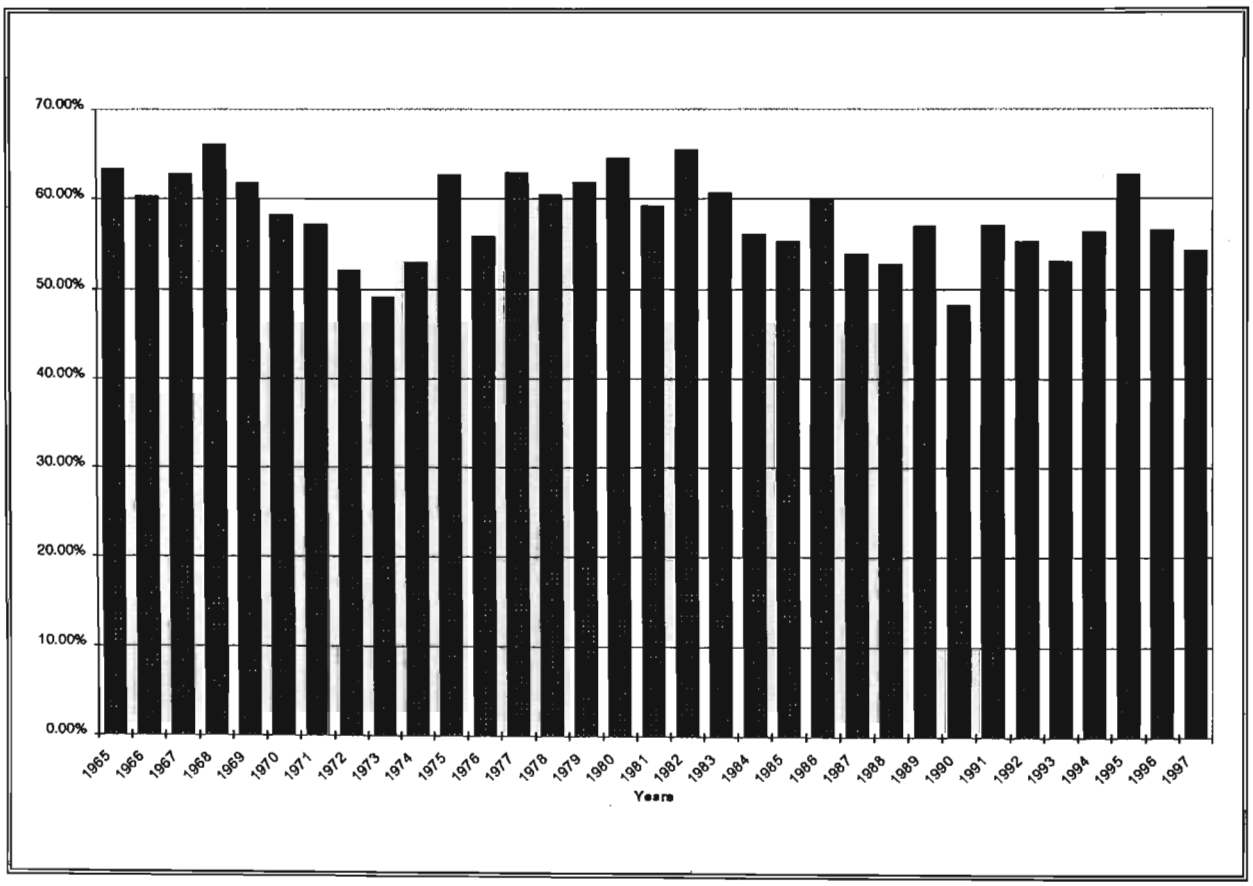

Figure 3.2: Export percentage for the South African orange industry from 1965 until 1997

Source: Directorate Agricultural Statistics and Management Information (1999).

The export percentage is expected to stay the same in the future, while product quality and EU import standards are expected to rise (Bower, 1999). A change in the export percentage is, therefore, unlikely. A fluctuation in export percentage is mainly caused by the quality

variation in the annual crop. Among other reasons, damage, deformation and miscolouration normally excludes oranges from being exported.

3.2. European Union production and consumption of oranges

The main changes in production of oranges within the EU emerged from the inclusion of Spain and Portugal in 1986. For the further analysis of the EU orange sector, it is assumed that the EU consists of its current 15 member countries throughout the whole period. Figure 3.3 depicts the production and consumption of oranges within the EU.

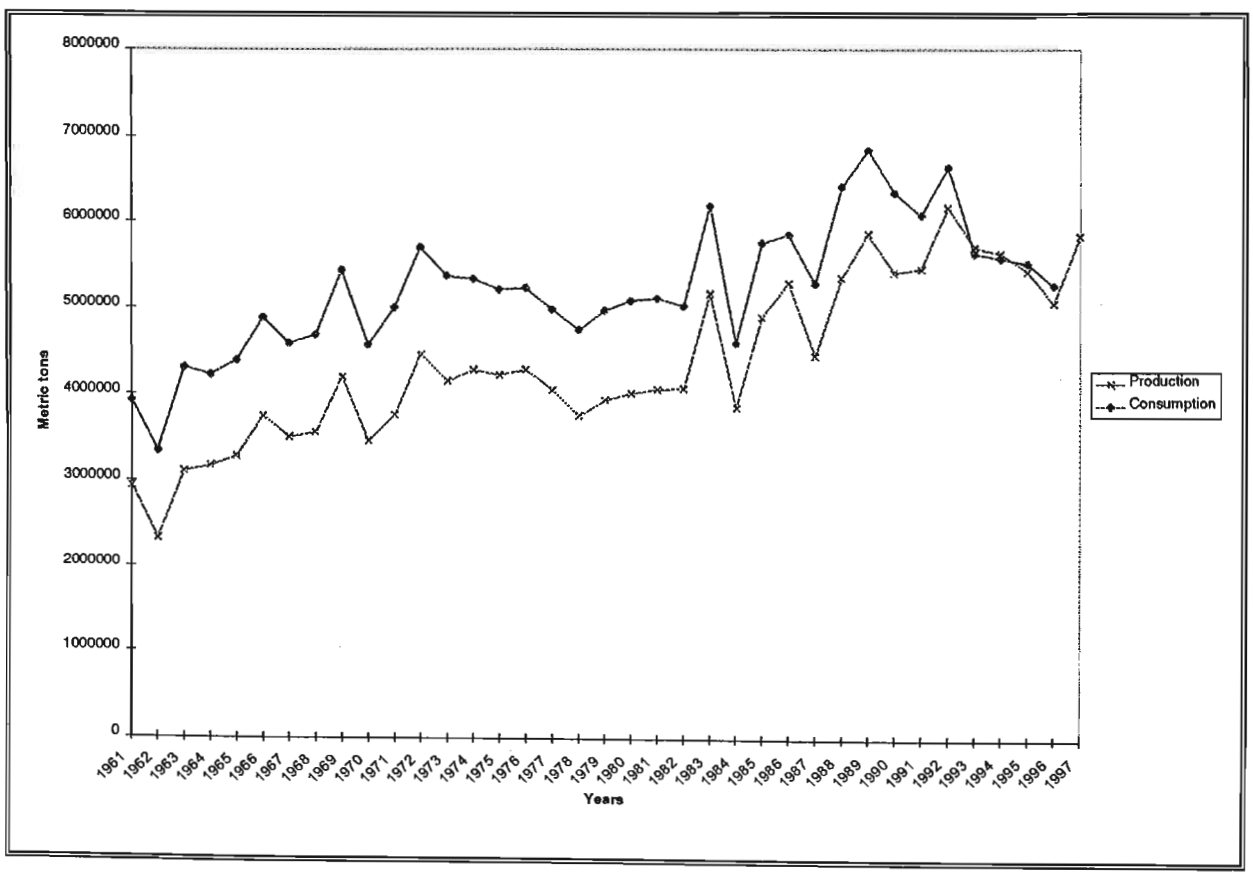

Figure 3.3: Production and consumption of oranges in the 15 member countries of the European Union from 1961 until 1997

Source: FAO (1999)

Orange production in the EU doubled from 1961 to 1997, but the variation in production between years was sometimes large. Production occurs almost entirely in Spain, Italy, Greece and Portugal, while other member countries of the EU are major importers of oranges. For the evaluation of orange consumption, a division of the EU in these two groups is helpful. Annual orange consumption throughout the rest of the EU has declined from 10 kg per person to seven kg per person from the early 1960s to the present date. This refers only to fresh oranges, because in the FAOSTAT trade data there is a differentiation between fresh and processed oranges.

The decline in demand for oranges is partly due to the shift of consumer preference to smaller citrus, as observed in France (Loeillet, 1992). The consumption in Spain, Italy, Greece and Portugal is around 25 to 30 kg per person (including the processing of domestic oranges), although actual consumption in any given year is very dependent on the amount harvested and thus the price. Overall, the EU has become self-sufficient in recent years. A large demand for fresh orange imports exists because orange production in the EU does not fulfil consumer preferences in terms of quality, variety and seasonality.

Prices for oranges on the EU market differ substantially between different levels of distribution. Figure 3.4 indicates the prices of oranges in Germany and shows that there is a strong seasonality in the retail prices but not in the other prices. Retail prices are very often prices like DM 1.99 or DM 2.99 per kg as observed for apples in Germany (ZMP, 1997, p.161). This could be assumed for oranges and also within other EU member countries. The reason lies in the price setting of retailers. They tend to market products just below the next full currency unit. The fluctuation of wholesale and entry price follows the same pattern

which implies a direct link. This includes the import margin and the transport from the point of entry to the fresh produce market.

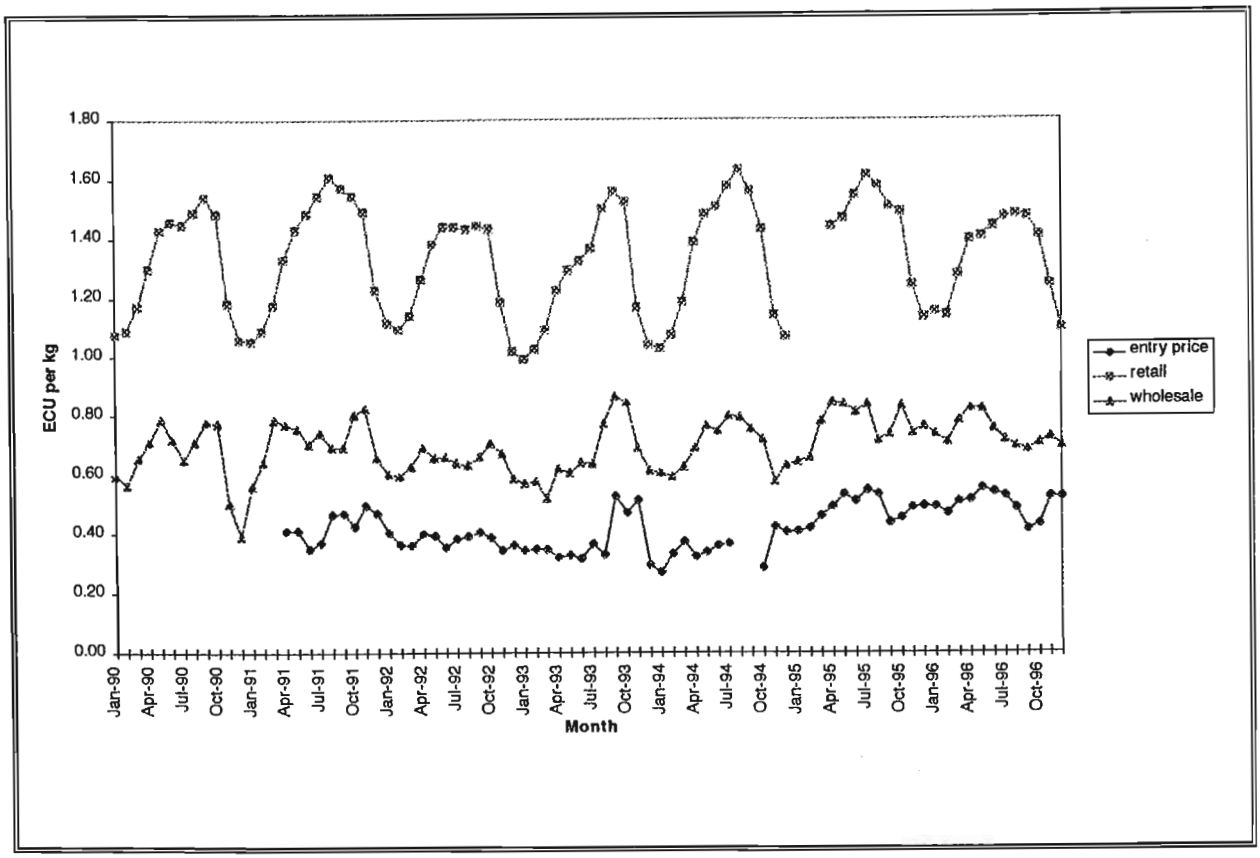

Figure 3.4: Monthly nominal prices of oranges in Germany from 1990 until 1996 in ECU per kg

Source: Eurostat (various issues) and ZMP (various issues)

The retail margin is larger and is adjusted to the season to arrive at the prices shown above. Highest prices in retail outlets are obtained in the European summer. This is the EU off-season. Overall, the prices at all market levels are almost constant over the 1990s in nominal terms. However, a slight increase could be observed in the case of nominal entry prices. Due to the low inflation rate of approximately one percent, a constant real entry price could be assumed.

3.3. Trade in fresh oranges between South Africa and the European Union

There are almost no imports of EU oranges into South Africa. However, as shown in table 2.1 above South Africa is the second largest external supplier of oranges to the EU after Morocco. South Africa dominates the EU summer in which it is the principal market supplier. Not only is South Africa an important supplier to the EU market, but the EU is also the major destination of South African oranges. Table 3.4 shows the monthly exports of fresh oranges to the EU in metric tons.

Table 3.4: South African monthly fresh orange exports to the European Union in Metric Tons, 1991 - 1996.

	1991	1992	1993	1994	1995	1996
January	21	384	46	4	0	56
February	0	227	0	24	0	0
March	0	297	39	0	0	0
April	13	31	0	0	0	2
May	2 428	3 113	3 666	1 899	1 452	4 199
June	12 875	18 116	13 214	15 995	23 691	23 852
July	29 248	31 665	25 467	26 623	30 054	38 691
August	41 965	44 112	34 090	34 717	32 593	49 373
September	38 387	43 295	29 356	47 533	43 541	49 285
October	33 625	28 760	25 968	36 375	26 266	52 894
November	2 235	5 190	2 080	11 688	9 196	10 471
December	874	151	1 080	3 693	61	1 088
Total	161 671	175 341	135 006	178 551	166 854	229 911

Source: Eurostat, various issues.

More than half of South African orange exports are shipped to the EU. Other important markets are the Middle East, Eastern Europe, Eastern Asia, Japan and Canada. With regards to Eastern Europe, the anticipated ascension of several countries to the EU will again increase the importance of the EU as a destination for South African oranges. Looking at the extensive economic importance of oranges, the export of fresh oranges accounts for approximately ten percent of total agricultural exports in South Africa. Table 3.4 indicates that South Africa exports mainly from June to October. The first four months of the year are unimportant in relation to the rest of the year. As discussed in the next section, the peak-season for South Africa is the time when the entry price system is not in place, which limits market access in the EU from November until May. The products, therefore, only face the *ad valorem* tariff. The amount traded is dependent on the harvest and the quality thereof.

Organisational framework for fresh orange trade between South Africa and the European Union

The Citrus Board in South Africa, responsible for the marketing of South African citrus, was terminated at the end of the 1997/98 marketing year (Citrus Board, 1998). Outspan International Ltd was its marketing agent and also the sole exporter of South African oranges until March 1998. Since then, competitors have been able to enter the market and export fresh oranges. In the first two seasons of deregulation, the market share of Outspan International Ltd has dropped to approximately two thirds of the market. Other companies like Cape Citrus, Del Monte, Oceanic, and Safe entered the market. The large overhead costs seem to have resulted in larger exporting costs for Outspan International Ltd (Wulff, 1998). Outspan International Ltd does more quality checks at the point of arrival than most competitors in addition it still has a larger workforce due to the previous operations as secretary of the citrus

industry in South Africa. It is, therefore, easier for competitors to enter the market due to generally low overhead costs.

The importance of the relationship between producer and exporter has to be emphasised. On the one side, Outspan International Ltd can draw on a long term relationship with producers and on the other hand, smaller companies try to personalise the grower-exporter relationship. Two years ago the South African Citrus Growers' Association (SACGA) was founded to voice and co-ordinate the interests of the growers. The responsibility for research is shifting from Outspan International Ltd, as agent of the Citrus Board, towards SACGA.

Countervailing charges for low import prices of oranges in the EU were handled before 1995 on a country-per-country basis, which favoured sole export agents. They could manage their pricing so that the import price would not fall under the threshold price for countervailing charges. The new entry price system works on a shipment basis, which does not favour any specific export organisation. This shows that the deregulation of South African orange marketing fits the requirements of the EU market regulations.

The Perishable Produce Export Control Board (PPECB) is responsible for the technical organisation of orange exports. It carries out quality controls and subsequently submits exports licences. In addition, the PPECB advises exporters with respect to optimal temperature regimes and other technical aspects relating to the export of oranges. The PPECB is governed by the National Department of Agriculture.

3.4. Tariffs for oranges in the European Union

The applied tariff system changed in 1994/95 from the reference price system to the entry price system (Swinbank and Ritson, 1995). The entry price system is effective for sweet oranges from December until May. This is the marketing season of sweet oranges produced in the EU. During the rest of the year only an *ad valorem* tariff is applied. The entry price system applies a tariff equivalent, if the importing value is lower than the ruling entry price. If the importing price is below 92 percent of the entry price, the maximum tariff equivalent is charged. There are four sub-steps for each two percent between 100 percent and 92 percent. The tariff equivalent is then equal to the difference between the lower limit and the 100 percent entry price (Hauptzollamt Kiel, 1999).

Importers have three options to comply with the entry price (Grethe and Tangermann, 1999).

(1)Standard import value method. Using the calculated EU standard import value.

(2)Customs clearance by invoice. A entry price is calculated on the basis of a free-on-board invoice. If this price exceeds the standard import value by more than 8 per cent, the final selling price has to be proved otherwise the standard import value method would be used.

(3)Deductive method. The effective selling price is used to calculate possible tariff equivalents.

The latter two options are only used if the standard import value requires the payment of a tariff equilibrium, but a security payment has to be lodged until final customs clearance. Table 3.5 indicates entry prices and maximum tariff equivalents for sweet oranges from 1995 until 2001. The reduction by 20 percent of the maximum tariff equivalent between 1995 and 2001 forms a part of the EU commitments to the WTO. The entry price system is more

important as an import barrier to the EU than the *ad valorem* tariff. In 1996 the actual tariff for some tariff lines was more than three times the *ad valorem* tariff. Regarding South African exports of oranges to the EU, this is not important, because most oranges arrive in the EU when the entry price system is not in operation.

Table 3.5: European Union entry prices and maximum tariff equivalents for sweet oranges from 1995 until 2001

Dates *	Entry price in Euro per 100 kg	Maximum tariff equivalent in Euro per 100 kg
1. 1.1995 - 31. 5.1995	37.2	8.9
1.12.1995 - 31. 5.1996	36.9	8.6
1.12.1996 - 31. 5.1997	36.6	8.3
1.12.1997 - 31. 5.1998	36.3	8.0
1.12.1998 - 31. 5.1999	36.0	7.7
1.12.1999 - 31. 5.2000	35.7	7.4
1.12.2000 - 31. 5.2001	35.4	7.1
1.12.2001 - 31.12.2001	35.1	6.8

Notes: * There is no entry price and maximum tariff equivalent in the rest of the year.
Euro 1 equals Rand 6.57 in May 1999.

Source: Hauptzollamt Kiel (1999) and own calculations

The *ad valorem* tariffs differed between four and 20 percent in 1994/95 according to the period of the year and will be reduced by 20 percent in 2000/01 due to the GATT commitment of the EU (European Commission, 1995). Table 3.6 indicates the seasonality of Most Favoured Nations (MFN) EU tariffs for fresh sweet oranges. Tariffs are high in the EU season and low in the off-season. The EU FTA offer for sweet oranges will only change the situation for fresh sweet oranges entering the EU during June until September (Department of

Trade and Industry, 1999). Otherwise, the MFN tariff as shown here will be applicable for South African exports.

Table 3.6: European Union Most Favoured Nations (MFN) tariffs for fresh sweet oranges for 1995 and 2001

Period	Tariff 1995 in percent	Tariff 2001 in percent	Entry price
1 January to 31 March	20.0	16.0	Yes
1 to 30 April	13.0	10.4	Yes
1 to 15 May	6.0	4.8	Yes
16 to 31 May	4.0	3.2	Yes
1 June to 30 September	4.0	3.2	No
1 to 15 October	3.9	3.1	No
16 October to 30 November	19.3	15.3	No
1 to 31 December	19.3	15.3	Yes

Source: Hauptzollamt Kiel (1999) and own calculations

Generally an import license is necessary, but this is not required if the oranges fulfil the required EU standards and a valid control document can be presented. The Perishable Produce Export Control Board (PPECB) issues such documents for South African oranges. Therefore, this rule implies no restriction on the trade between South Africa and the EU.

3.5. Non-Tariff Barriers

Non-tariff barriers are divided into sanitary and phytosanitary (SPS) regulations and technical barriers to trade (TBT). Multinational rules apply for both kinds of barriers in the framework of GATT / WTO. TBTs could be classified by policy instrument into three major groups:

import bans, technical specifications and information remedies (Roberts, 1999). Import bans are, for example, used to protect endangered species. Technical specifications relate to standards in relation to the process, the product or the packaging. Information remedies include labeling requirements and controls on voluntary claims. For example, oranges require a certificate of conformity with EU quality standard (Hauptzollamt Kiel, 1999). These seem to be of lesser importance with regards to trade between South Africa and the EU, because the South African quality standards for fresh produce export are equivalent to EU import requirements (Beghin, 1999).

The question of SPS restrictions was brought into GATT / WTO rules during the Uruguay Round. Swinbank (1999) indicates how the SPS Agreement influences the setting of SPS restrictions. Article 4 allows for the negotiation of bilateral equivalency agreements on SPS measures. South Africa wanted to negotiate an equivalency agreement on sanitary and phytosanitary requirements within the framework of the FTA (National Department of Agriculture, 1999). This was denied by the EU because several countries were asking for similar agreements. However, the EU committed itself to negotiating such an agreement with South Africa as soon as possible. According to Bower (1999), it is expected that the sanitary and phytosanitary restrictions of the EU will become stricter and therefore the export percentage is likely to decrease a little. But this will not have a major impact on the general trade in fresh oranges with the EU. The application of plant health requirements in the South African citrus industry has been evaluated by the European Commission (1998). The major problems occur in relation to fruit flies and *Scirtothrips aurantii.*

CHAPTER 4. Trade Simulation Model

The trade simulation model is developed on a graphical interface using the programme STELLA to indicate linkages between different variables (High Performance Systems, 1997). There are four different types of building blocks on the graphical interface: stocks, flows, converters and connectors (Figure 4.1).

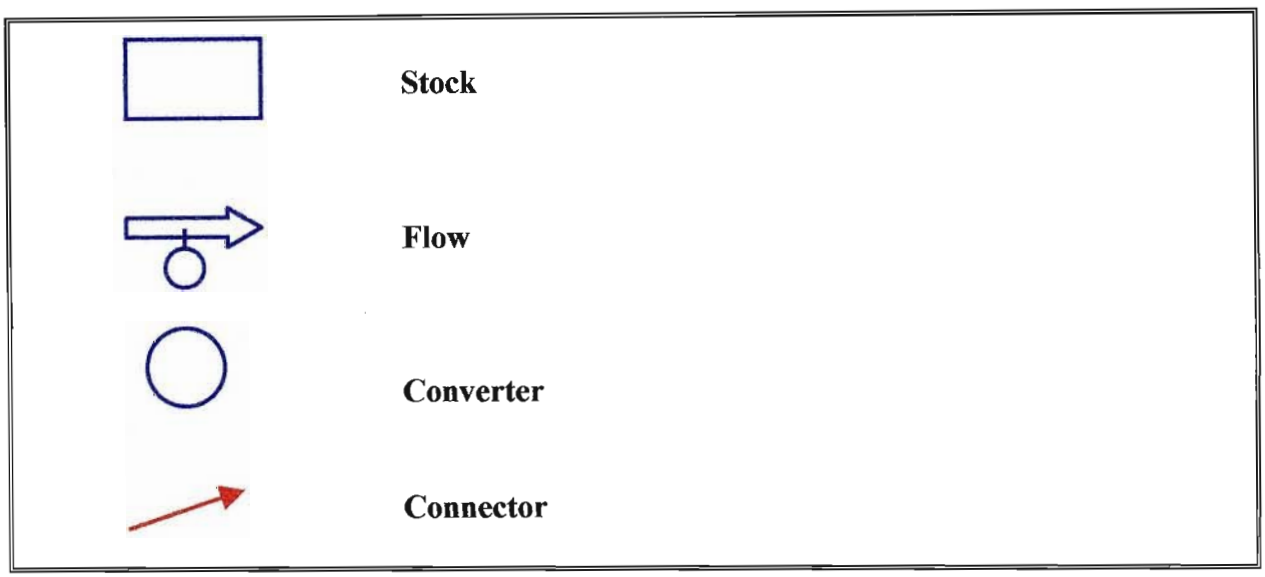

Figure 4.1: Building blocks on the graphical interface of STELLA

Stocks are accumulating inflows and discharging outflows. They carry over the final amount from one period to another. Lower and upper limits of the amount in a stock can be set. In this model only non-negative stocks are used. Flows indicate filling and draining of stocks. A flow terminating in a cloud means that the origin or destination of the flow is not catered for in the model. Flows can work either in both directions or in one direction only. In the one direction option, calculated negative values are seen as zero. Converters hold constants, define external inputs and calculate algebraic relationships. They are the most flexible building blocks within a STELLA model. Connectors indicate the linkages between other building blocks. They

indicate which inputs are used within the calculation of flows and converters. Another tool is a ghost. Ghosts are not building blocks but they are used to improve the lucidity of the model. Ghosts allow the copying of building blocks to another part of the model. These building blocks can then be used as described before at more than one place. This is helpful if a building block is calculated at one place of the model and it is thereafter used at other parts as an input. Ghosts are lighter in colour and have the same name as the parent building blocks. Figure 4.2 shows all linkages within the model, a detailed description will follow in the subchapters.

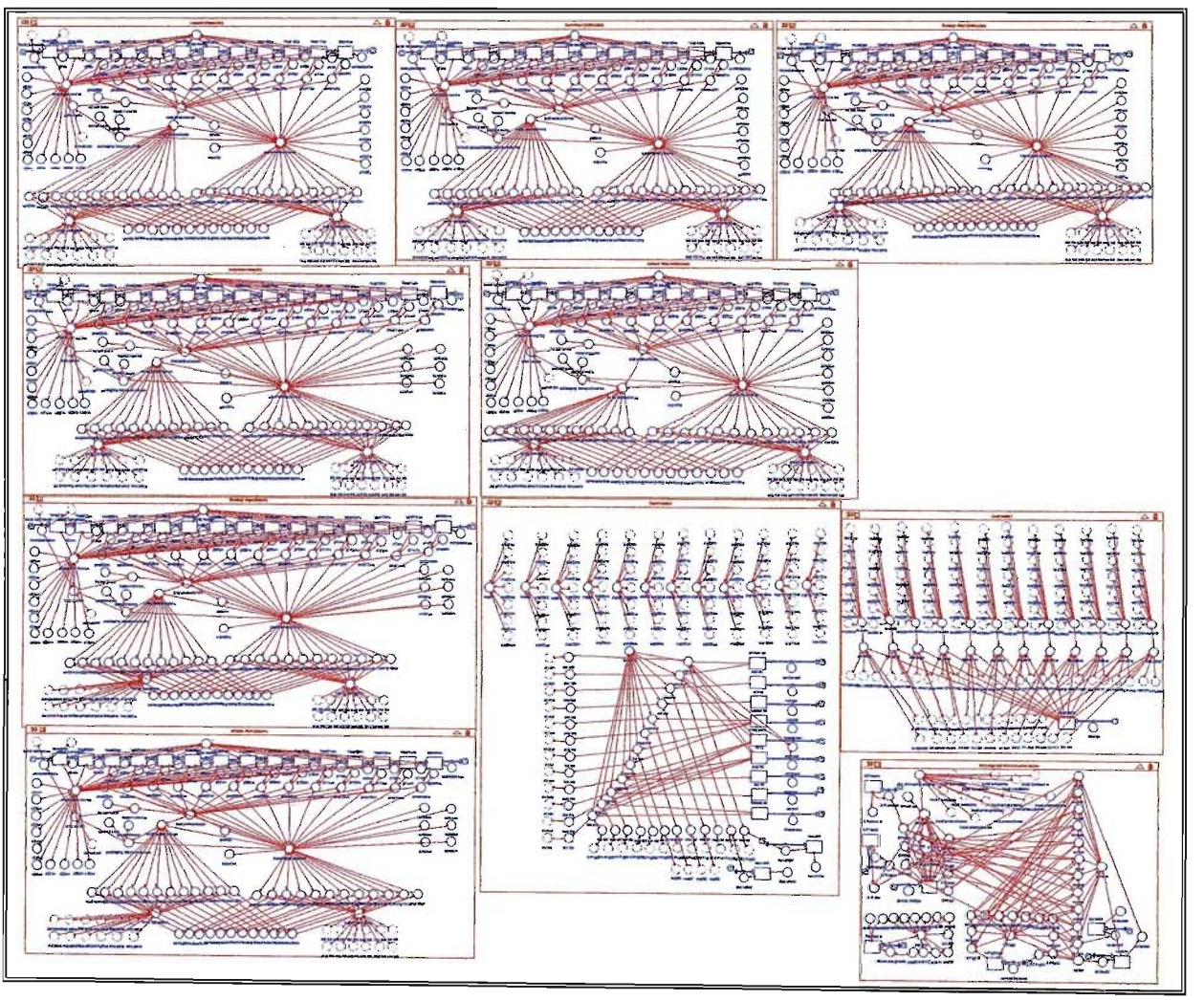

Figure 4.2: Graphical linkages of the trade simulation model: an overview

As Figure 4.2 indicates, the trade simulation model consists of several linked sub-models. There are seven production models, a local market model, an exchange rate model and a model for the European demand. The second step in the design of the trade simulation model under STELLA is the quantification of the relationships between building blocks. Stocks have only an initial value attached. Flows and converters have either a constant value assigned or an algebraic function is used. These functions can include a distribution which is done if the distribution is known or can be assumed. Due to the usage of these distributions each simulation run will result in a different outcome. Each scenario is, therefore, run 100 times and the results are then analysed by mean and standard deviation. The calculation order during the simulation is: first stocks are calculated then converters and lastly flows. The order between the same kind of building blocks is determined by the algebraic functions used. The simulation runs on an annual basis from 1997 until 2011 but this is divided into monthly data in the case of the trade models, to cater for the seasonality of trade with oranges.

4.1. Production Models

The production of fresh oranges occurs mainly in the following four regions within South Africa: the Lowveld region of the Northern Province and Mpumalanga, the North-West Province, the Sundays River region of the Eastern Cape, and the Olifants River region in the Western Cape. The two main cultivar groups are Navels and Valencias, each with different ripening seasons. Navels are not planted in the Lowveld region. Therefore, seven production models are designed for each cultivar group and region with the exception of Navels in the Lowveld. Table 4.1 indicates the share each region has in the total production of oranges.

Table 4.1: Share of regions and cultivars in area planted with oranges as included in the trade simulation model (percent)

	Navels	Valencia	**Total**
Lowveld	0	46	**46**
North-West	7	8	**15**
Sundays River	17	7	**24**
Olifants River	10	5	**15**
Total	**34**	**66**	**100**

Note: Regions accounting for less than five percent of total production are excluded.

Source: Capespan (1999) and own calculations.

The outline of each production model is similar. Therefore, figure 4.3 shows the linkages between the building blocks for one production model (North-West (Navels)). The only difference is that Valencias reach maturity earlier than Navels and subsequently three years less are reported in the model. Variable names are explained in the appendix.

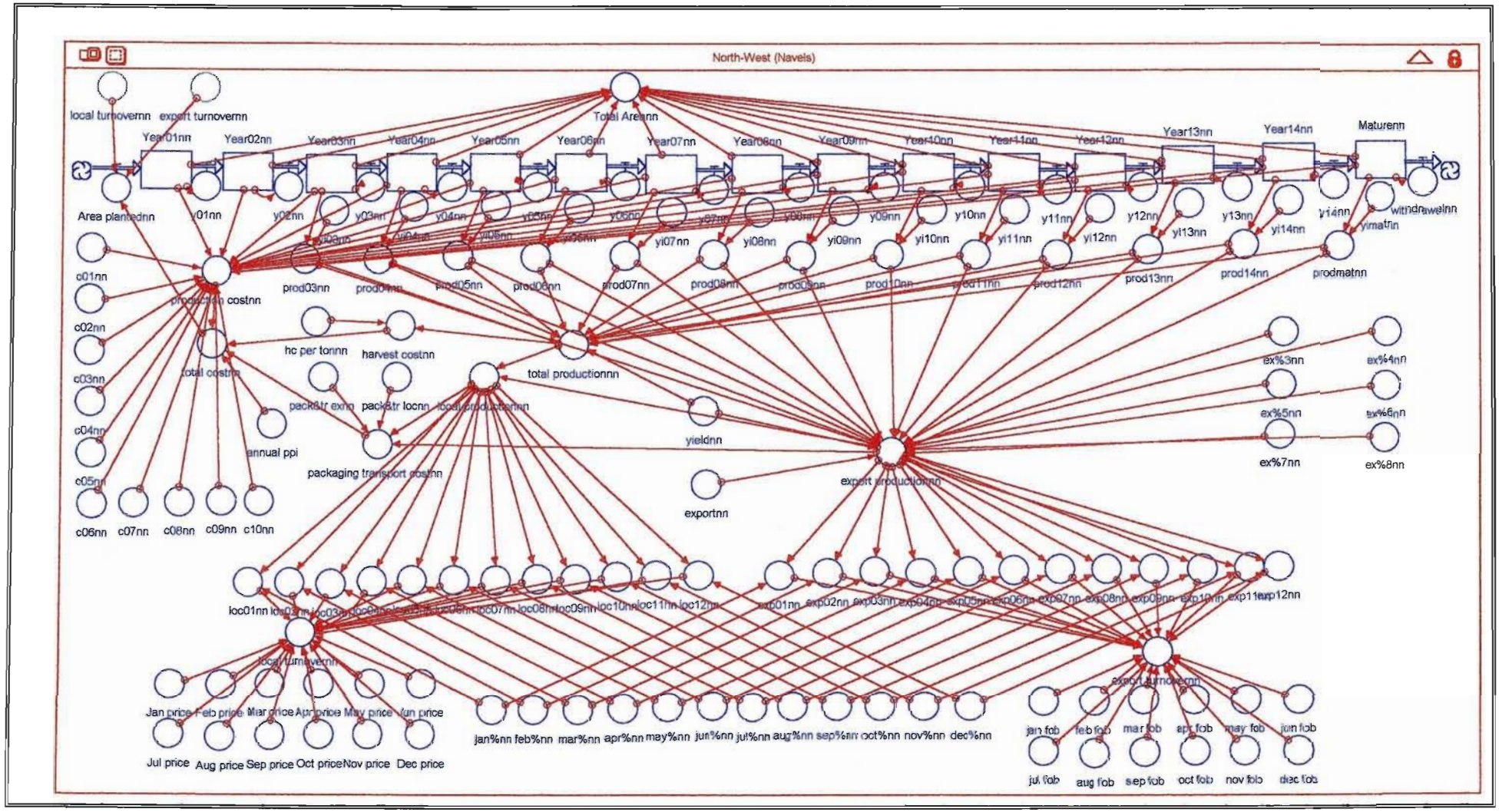

Figure 4.3: Graphical interface of the production model for North-West (Navels)

Models are based on gross margins derived by Ferreira and van Zyl (1997a). These gross margins use the age of the orchard to determine production and costs. The base year for these gross margins is 1995. In the calculations all monetary values are deflated to the year 1990. Table 4.2 indicates the production costs according to region and age of orchard.

Table 4.2: Real variable production costs in 1990 Rands per hectare according to region and age of orchard

Age of	Lowveld	North-West		Sundays River		Olifants River	
Orchard	Valencia	Navel	Valencia	Navel	Valencia	Navel	Valencia
1	10253.83	13654.37	10253.83	17171.41	12894.97	17171.41	12894.97
2	1647.70	1396.57	1647.70	1322.39	1560.18	1322.39	1560.18
3	2328.23	2255.84	2328.23	1840.99	1900.07	1840.99	1900.07
4	2943.84	3126.55	2943.84	2546.32	2397.52	2546.32	2397.52
5	3606.86	3706.82	3606.86	2894.24	2816.19	2894.24	2816.19
6	4306.35	4375.06	4306.35	3343.54	3291.03	3343.54	3291.03
7	4838.07	4945.86	4838.07	3647.70	3568.20	3647.70	3568.20
8	5159.74	4970.36	5159.74	3849.02	3727.21	3849.02	3727.21
9	5393.14	5000.42	5393.14	3928.52	4237.05	3928.52	4237.05
10+	5638.22	5157.97	5638.22	4010.94	4384.39	4010.94	4384.39

Source: Ferreira and van Zyl (1997a) and own calculations.

The real production costs in the first year include costs for preparing and planting of the orchard. Thereafter, input and maintenance costs are shown. Table 4.3 shows the average yield according to age group.

Table 4.3: Average yield per hectare according to region and age of orchard (metric tons)

Age of	Lowveld	North-West		Sundays River		Olifants River	
Orchard	Valencia	Navel	Valencia	Navel	Valencia	Navel	Valencia
3	0.00	0.00	0.00	0.00	3.30	0.00	3.30
4	11.42	4.00	11.42	4.00	12.10	4.00	12.10
5	17.52	7.00	17.52	8.00	20.90	8.00	20.90
6	22.26	11.00	22.26	14.00	28.60	14.00	28.60
7	32.90	16.50	32.90	17.60	35.20	17.60	35.20
8	38.71	20.50	38.71	22.00	41.25	22.00	41.25
9	43.55	25.25	43.55	26.00	45.10	26.00	45.10
10	50.32	29.25	50.32	28.80	49.50	28.80	49.50
11	54.19	32.75	54.19	31.60	52.25	31.60	52.25
12	60.00	35.00	60.00	34.00	55.00	34.00	55.00
13	60.00	37.25	60.00	36.80	55.00	36.80	55.00
14	60.00	40.00	60.00	38.80	55.00	38.80	55.00
15+	60.00	42.00	60.00	40.00	55.00	40.00	55.00

Source: Ferreira and van Zyl (1997a) and own calculations.

The actual yield resulting from within the simulation model is assumed to be normally distributed with a coefficient of variation of ten percent. This simulates the influence of weather conditions and diseases on the annual harvest amount. Export percentages are also expected to vary by ten percent as observed in historic data. Table 4.4 shows the average export percentage. A long term change in the proportion exported is unlikely because technical progress in the production quality and the increase in sanitary and phyto-sanitary requirements are likely to level each other out (Bower, 1999).

Table 4.4: Average proportion exported according to region and age of orchard

Age of	Lowveld	North-West		Sundays River		Olifants River	
Orchard	Valencia	Navel	Valencia	Navel	Valencia	Navel	Valencia
3	0.0000	0.0000	0.0000	0.0000	0.4320	0.0000	0.4320
4	0.4154	0.4800	0.4154	0.5200	0.4464	0.5200	0.4464
5	0.5159	0.5150	0.5159	0.5525	0.5544	0.5525	0.5544
6	0.6164	0.5750	0.6164	0.6175	0.6624	0.6175	0.6624
7	0.6633	0.6000	0.6633	0.6435	0.7128	0.6435	0.7128
8+	0.6700	0.6050	0.6700	0.6500	0.7200	0.6500	0.7200

Source: Ferreira and van Zyl (1997a) and own calculations.

Harvest costs, and transport and packaging costs are calculated on a per metric ton basis (Table 4.5).

Table 4.5: Harvest, and transport and packaging costs in 1990 Rand per metric ton

Region	Cultivar	Harvest costs	Transport and packaging costs	
			Local market	Export market
Lowveld	Valencias	14.92	145.88	386.62
North-West	Navels	14.92	145.88	386.62
	Valencias	14.92	145.88	386.62
Sundays	Navels	22.83	196.94	383.51
River	Valencias	22.83	196.94	383.51
Olifants	Navels	29.60	226.11	396.60
River	Valencias	29.60	226.11	396.60

Source: Ferreira and van Zyl (1997a) and own calculations.

Transport costs accounted for are either transport to the fresh produce market or to the port. Age distribution, regional and cultivar production distribution and total production were used to derive an acreage for each age group in all production models (Van Zyl and Ferreira, 1997; Ferreira and van Zyl, 1997b; Capespan, 1999). Information provided by Bower (1999) was used to derive a seasonal production distribution within each production model (Table 4.6).

Table 4.6: Percentage of monthly production in relation to annual production by region and cultivar

	Lowveld	North-West		Sundays River		Olifants River	
Month	Valencia	Navel	Valencia	Navel	Valencia	Navel	Valencia
January	0	2	0	0	1	0	3
February	0	4	0	1	0	0	0
March	1	8	0	2	0	2	0
April	2	18	1	8	0	4	0
May	8	25	8	20	2	19	0
June	18	20	16	23	8	22	5
July	22	10	24	23	19	23	18
August	25	7	26	12	23	15	21
September	16	3	16	9	25	10	25
October	5	1	6	2	14	4	15
November	2	0	2	0	6	1	8
December	1	0	1	0	2	0	5

Source: Bower (1999) and own calculations

The supply response occurs only through planting new orchards. It is not possible to withdraw orchards before the end of the productive life-span. Equation (4.1) shows the supply response.

$$(4.1) \qquad \ln pl_t^{reg} = \beta_0^{reg} + \varepsilon_s * \ln \frac{to_t^{reg}}{c_t^{reg}}$$

Where:

ln = Natural logarithm

β_0 = Coefficient

pl = Plantings of new orange orchards

ε_s = Elasticity of supply

to = Total orange turnover

c = Variable costs

reg = Production region (cultivar and locality)

t = Year

An own estimate of the supply elasticity could not be derived because of insufficient available data. However, Khuele and Darroch (1997) estimate the export supply elasticity for South African oranges to the United Kingdom at 0.248. This is referring to production rather than area planted with oranges and it excludes the supply to other destinations as well as the local market. A supply elasticity of 0.128 for perennial products in Italy has been obtained by Sckokai and Moro (1996). Approximately five to ten percent of total area is annually replanted or freshly planted. Therefore, a supply elasticity in terms of area planted every year should be ten to 20 times as large, implying a supply elasticity of approximately 2.0 for plantings. A sensitivity analysis to study the impact of supply elasticities on model results will be undertaken in Chapter 5.

In the case of withdrawal of old trees, information derived by Alston *et al.* (1980) is used. They found that in the Australian orange growing industry each year 4.15 percent of bearing

trees are removed. The results of French and Bressler (1962) for the withdrawal of 4.5 percent of bearing Californian lemon trees are also comparable. Using the 4.15 percent for the withdrawal of bearing trees a withdrawal of 5.2 percent could be calculated for mature trees as those comprise approximately 80 percent of bearing trees.

4.2. Local Market

About 40 percent of the South African orange production is either processed or sold locally. This section analyses the proportion sold on the local fresh produce markets. Roughly 100 000 tons of oranges are marketed annually on the local fresh produce markets which handle the bulk of oranges sold locally. Amounts sold for recent years are reported in Chapter 2. This study analyses the influences on the monthly real prices at the four main South African fresh produce markets for oranges. The four main markets - Johannesburg, Pretoria, Durban and Cape Town - account for 70 percent of total turnover on fresh produce markets. They are all close to the main areas of consumption. Therefore, the average prices are slightly higher than at the other fresh produce markets.

An influential variable is the actual amount traded on a specific market in a particular month. It is expected that prices will be higher if the traded volume declines. The price on the main export market is one important factor in the determination of the local price as international prices will influence the local prices. The price difference between export and local market is the highest around the middle of the year and the lowest at the beginning of the year. This is caused by the high supply of northern hemisphere products at the beginning of the year. The EU tariffs also enhanced this situation due to low tariffs at mid-year and high tariffs at the beginning of the year. The quality premium on the overseas markets is normally higher than

on the local market. This implies that the price difference between the overseas and local market rises with quality. Over the period analysed the export of oranges was managed by a single company, Outspan International Ltd. This could also have influenced the quality requirements for export. The future will show whether this influence was significant. Formula (4.2) shows the anticipated relationship between variables.

(4.2) $$\ln \frac{pr_t}{cpi_t} = b_0 + b_1 * \ln \frac{q_t}{pop_t} + b_2 * \ln \frac{pr_{t-1}^{ex} * ex_{t-1}}{cpi_{t-1}} + b_3 * trend_t + e_t$$

Where:

ln = natural logarithm

pr = nominal monthly price for fresh oranges on the fresh produce markets (R/ton)

cpi = consumer price index in South Africa (1990 = 1)

q = total monthly fresh orange quantity traded on the fresh produce markets (tons)

pop = total South African population ('000)

pr^{ex} = entry price for fresh oranges in the European Union (ECU/ton)

ex = exchange rate (R/ECU)

trend = monthly trend variable (January 1990 = 1)

e = error term

t = 1,...,96 months (January 1990 until December 1997)

The use of a logarithmic function results in a constant flexibility of demand. Ordinary least square was used to estimate the demand function (4.3) (t-values in parentheses).

(4.3)
$$\ln \frac{pr_t}{cpi_t} = 4.311 - 0.301 * \ln \frac{q_t}{pop_t} + 0.216 * \ln \frac{pr_{t-1}^{ex} * ex_{t-1}}{cpi_{t-1}} - 0.0036 * trend_t$$
(8.9) (-16.9) (3.1) (-5.0)

F-value = 97.5 adjusted $R^2 = 0.81$ df = 63

Signs of all variables are as expected. There is an inverse relationship between price and quantity while an increase in export prices results in an increase in local prices. This shows the linkage between prices on both markets. The negative effect of the trend variable indicates that real prices of oranges are declining over time. This observation is made for most agricultural products. A trend variable was included in the model to capture the change in consumer preferences over time, especially the change from oranges towards easy-peelers. The adjusted R^2 and t-values show that the model explains the data adequately. The Durbin-Watson test is inappropriate because of missing values and results are not reported.

The price flexibility of demand in the local market is estimated at -0.301 which is lower than the -0.695 obtained by Hayward-Butt and Ortmann (1994). A reason is the use of monthly data in comparison to annual data in the other study. Monthly flexibilities of demand are expected to be lower, because of short term storage possibilities (Shepherd, 1972, pp. 67-68). Another difference lies in the independent variables. This study uses overseas price and a trend. The study by Hayward-Butt and Ortmann (1994) uses consumption of substitutes and real disposable income per capita. The R^2 values are comparable.

A large percentage of oranges are processed locally. In recent years the price of processing oranges has been approximately 80 percent of the fresh market price. This ratio is used to calculate future prices for processing oranges. Approximately one quarter of the total orange production in South Africa is processed. Therefore, the income from local production is multiplied by 0.9 within the trade simulation model. This done to account for the proportion

processed which only achieves a price approximately 20 percent lower than the ruling price on the fresh produce markets.

4.3. Exchange rate between South African Rand and Euro and macro-economic indicators

Exchange rates are important in trade models (Dutton and Grennes, 1988). Depreciation of a currency normally increases the quantity of exports, but it is difficult to distinguish between the price and the exchange rate effect. The South African producers are interested in the Rand price received for their product, whereas the consumer in the EU pays in Euro. The Euro has a fixed exchange rate to eleven European currencies. Those currencies will be totally replaced by the Euro in 2002. The Euro was introduced in January 1999 as a single currency in eleven EU member countries. Non-participants are Denmark, Greece, Sweden and the United Kingdom. The Euro replaced the ECU (European Currency Unit) which was used for transactions between the EU and member countries. The ECU was only used for calculation purposes and it was never an official currency. It was calculated as a currency basket according to size of member economies. The exchange rate between member currencies and Euro was fixed at the exchange rate those currencies had against the ECU on 31 December 1998.

The exchange rate between Rand and ECU from 1990 until 1996 is analysed to obtain a prediction function for the future exchange rate. In this study the EU market is represented by Germany because of a lack of information about the EU monetary market prior to 1999. The German mark represented approximately one third of the ECU currency basket. For the analysis of exchange rates, several different approaches are used (Taylor, 1995). Monetary

models are the most suitable for this study because other models are normally based on a general equilibrium approach. Out of the group of monetary models, a sticky price monetary model is used to analyse the exchange rate (Frankel, 1993, pp. 100-102). This model uses the monetary equilibria in both markets concerned. The sticky price monetary model derives from the flexible price monetary model by relaxing the necessity of short run purchasing power parity. The test with data for the exchange rate between Rand and ECU did not meet *a priori* expectation.

Purchasing power parity is seen as the long run determining factor for exchange rates, but in the short run differences may occur (Siebert, 1997, pp. 56-58). A question arises whether the exchange rate between the South African Rand and ECU / Euro fulfils the assumption of purchasing price parity also in the short run (4.4).

(4.4) $$\ln ex_t = \beta_1 \ln CPI_t^{SA} + \beta_2 \ln CPI_t^{Ger}$$

Where:

ln = natural logarithm

ex = exchange rate (R/ECU)

CPI = Consumer Price Index (1990 = 100)

SA = South Africa

Ger = Germany

t = 1,...,84 month (January 1990 until December 1996)

The regression results in a positive autocorrelated outcome. Therefore the Cochrane-Orcutt two-step procedure was used to derive function (4.5) (t-values in parenthesis).

$$(4.5)\quad \ln ex_t - \rho * \ln ex_{t-1} = \underset{(4.0)}{1.395} * (\ln CPI_t^{SA} - \rho * \ln CPI_{t-1}^{SA}) \underset{(-3.1)}{-1.179} * (\ln CPI_t^{Ger} - \rho * \ln CPI_{t-1}^{Ger})$$

F-value = 411.4 adjusted $R^2 = 0.91$ df = 81 $d = 1.57$

Where:

ρ = 0.961 coefficient of autocorrelation (Cochrane-Orcutt two-step)

The coefficients have the expected signs. If the South African Consumer Price Index (CPI) increases, the Rand depreciates against the Euro. The *a priori* expected absolute values of the coefficients were one. The derived values do not differ from one to a high level of significance. Normally, the Durbin-Watson *d* test is not adequate because no intercept term is included, but Farebrother (1980) derived a table to use the Durbin-Watson *d* test in the absence of an intercept. Using his procedure, the hypothesis of a positive autocorrelation cannot be accepted on a 99 percent level of significance. In the absence of a better model for the prediction of the Rand / Euro exchange rate, the purchasing power parity will be used to predict the future exchange rate.

Macro-economic indicators used in the model are CPI on both sides, and Producer Price Index (PPI) and population only on the South African side. The German CPI is expected to change according to the behaviour over the base period from 1990 until 1996. That means a moderate increase of around one percent per year. The South African CPI is expected to have decreasing rates of increase (Nedcor, 1999 and ABSA, 1999). The rate of increase is expected to decline from around seven percent in 1997 to around four percent in 2011. The South African PPI derives in the model from the South African CPI, based on their historic relationship. The population in South Africa is expected to increase at a decreasing rate. Predictions derived by Nieuwoudt (1998) and Sadie (1993) were used to design a population

growth model for South Africa. Both CPIs and the South African population estimate are exogenous to the trade simulation model.

4.4. European Market

The European Union (EU) is the largest export market for South African fresh oranges. The EU share declined in the early to mid 1990s, but it still accounted for 50 percent of total South African exports (Citrus Board, 1998). Thereafter it increased again to over 60 percent (AgriReview, 1999). Other major export markets are the Middle East, the Far East, Eastern Europe and Canada. This study concentrates on the EU. The EU is self-sufficient in the production of oranges, but a large import demand exists due to consumer preferences in relation to seasonality, quality and cultivar.

South Africa is the major supplier during the EU summer, but Spain is diversifying into that time period through improved storage technologies and cultivar selection. South Africa is generally a price taker on the European market (Wulff, 1998). Only in the months of July until October can South Africa influence EU prices significantly. For the other months the price of fresh oranges in the EU is seen as an exogenous variable. The average real price of the years 1991 until 1996 (base year 1990) is taken as the baseline price and the generated price within the model will fluctuate around this level (Table 4.7).

Table 4.7: Average real entry prices in the EU for oranges 1991 until 1996 (1990 ECU / metric ton)

	January	February	March	April	May	June	November	December
Average price	350.95	347.89	368.90	370.80	373.37	357.10	409.65	372.74
Standard deviation	69.39	43.37	51.49	63.07	69.74	69.40	59.64	73.97

Source: Eurostat, various issues.

The price information will be used to generate the EU entry price for fresh oranges. For the months from July until October, a monthly price flexibility based on the South African supply was calculated. Firstly, an annual price flexibility for oranges in Germany was calculated. Germany was chosen because it is the main EU market. In addition, prices and per capita consumption in Germany are between levels observed in the UK and France, the other two main markets. As independent variables, the income per capita, orange consumption per capita and a dummy variable for German unification were used. The following demand function (4.6) was estimated (t-values in parentheses).

(4.6)
$$\ln\left(\frac{pr_t}{CPI_t}\right) = -2.975 - 0.479 * \ln\left(\frac{q_t}{pop_t}\right) + 0.232 * \ln\left(\frac{GDP_t}{pop_t}\right) + 0.200 * un_t$$

(-7.4) (-3.8) (3.9) (4.3)

F-value = 22.6 adjusted $R^2 = 0.71$ df = 24 $d = 1.45$

Where:

ln = natural logarithm

pr = entry price for oranges in Germany in ECU

CPI = German consumer price index (1990 = 100)

GDP = real German Gross Domestic Product (base year 1990)

q = annual demand for fresh oranges in Germany

pop = German population

un = dummy for German unification (before unification 1 afterwards 0)

t = 1,...,28 years (1970 until 1997)

All variables are highly significant and the signs of the estimated coefficients are in the expected direction. The adjusted R^2 falls within an acceptable range and the Durbin-Watson test indicates that autocorrelation is in the indecisive range. This price flexibility calculated using data for Germany was assumed to be a proxy for that of the EU in the model. Secondly, monthly price flexibilities of the import demand for South African oranges were calculated in (4.7), using a procedure adapted from Johnson (1971).

(4.7) $$\rho_{SA} = \frac{X}{D} * \rho - \frac{X}{S} * \frac{1}{\varepsilon}$$

Where:

ρ_{SA} = import demand flexibility for South African oranges in the EU

ρ = demand flexibility for oranges in the EU

D = total quantity of oranges demanded in the EU (metric tons)

X = South African exports of oranges to the EU (metric tons)

ε = 0.2 (supply elasticity of rest of the world to the EU market)

S = quantity supplied by the rest of the world to the EU market (metric tons)

The supply elasticity of the rest of the world on the EU market is derived by information from Sckokai and Moro (1996) for the Italian market. A slight adjustment has been effected to cater for the more elastic supply towards a single destination. The import demand flexibility for South African oranges decreases with an increase in supply elasticity by the rest

of the world. For the months from July until October a relationship (4.8) between EU prices and South African supply was subsequently quantified.

$$\ln \frac{pr^{EU} * 100}{CPI^{Ger}} = \beta_0 + \beta_1 * \ln q^{SA} \quad (4.8)$$

Where:

ln = Natural logarithm

$prEU$ = Entry price for oranges in the EU (Euro)

CPI^{Ger} = Consumer price index in Germany (1990 = 100)

q^{SA} = Quantity supplied by South Africa to the EU market (metric tons)

β_1 = ρ_{SA} (Monthly demand flexibility for South African oranges in the EU)

The results for the months July until October are presented in Table 4.8.

Table 4.8: Calculated coefficients and standard deviation for July until October

	July	August	September	October
β_0	8.271	10.202	9.031	9.241
$\beta_1 = \rho_{SA}$	-0.228	-0.401	-0.287	-0.324
South African market share	0.4996	0.8484	0.6211	0.6953
Standard deviation	64.212	67.399	30.858	53.006

Source: Eurostat (various issues) and own calculations.

The derived monthly prices for fresh oranges within the EU are then transformed into free-on-board (f.o.b.) prices in South Africa in Euro/ECU. This is done by firstly deducting the tariff. For the months June to November a division by one plus the *ad valorem* tariff is carried

out. For the rest of the year the entry price system is in force within the EU. Therefore, it has to be determined whether the entry price before tariffication is below the threshold. If this is the case a tariff equivalent has to be subtracted as well. If not, the same process is used as for the other months. Over all months, the cost of transport from the South African harbours to the EU point of entry has to be deducted. The transport costs are expected to stay constant in nominal terms at 150 Euro per ton over the time of simulation. The amount of 150 Euro per ton derives from the difference in South African prices in the harbours and the EU between 1991 and 1996. Information from FAO (1994) implies constant nominal transport cost for wheat in United States Dollars which is assumed to be the case for fresh oranges in Euro. To retain the prices in Rand at the South African harbours the Euro value is multiplied by the predicted exchange rate.

Non European Union destinations for South African oranges

As the EU accounts for 60 percent of all South African orange exports, other destinations also have a considerable share. These are, in declining order of importance,: the Middle East, Eastern Europe, Japan, East Asia and Canada (Citrus Board, 1998). During 1997 Outspan International Ltd exported some oranges to the United States of America but the strict phyto-sanitary requirements caused the rejection and subsequent diversion of large volumes of oranges. Table 4.9 indicates the nominal annual import prices for oranges on South Africa's main markets.

The highest annual import price occurs in Japan. It is a high risk market due to import regulations. In the case of South African grapefruit in 1997, a problem arose, because South African exports arrived later in Japan than scheduled (Citrus Board, 1998). This caused a

poor season on the Japanese market for South African citrus products. On the other hand, price premiums were achieved in earlier years.

Table 4.9: Annual nominal import prices for oranges on the main South African markets in US$ per metric ton

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
EU	**443**	**431**	**535**	**506**	**495**	**417**	**445**	**557**	**549**	**532**
Middle East	371	357	336	359	347	380	365	334	359	382
Eastern Europe	421	386	357	315	284	234	230	276	344	326
Japan	1106	1050	997	1640	903	945	977	1030	1026	872
East Asia	734	734	731	849	731	677	706	732	831	714
Canada	519	453	468	738	453	463	461	482	522	521

Source: FAO, 1999.

Most of the other South African export markets for oranges are not price competitive with the EU in annual terms. As the FAOSTAT data only provide average annual prices it is not possible to evaluate the competitiveness of export markets with regards to product quality and seasonality. Such an evaluation is required to develop a decision mechanism with respect to the destination of exports. As most producers use independent export companies to export their product, those companies, and not the producers, decide to which destination oranges are exported.

On the liberated export market in South Africa, smaller export companies might focus on one destination only as the in-depth knowledge of an export market is essential for a successful exporter. Strategic exports to highly regulated markets such as the United States of America and Japan might only be viable for larger companies.

As the model simulates different EU tariff scenarios, EU prices change in a comparable manner to those of other markets. This could imply a change in the market share of different destinations for South African orange exports because some exports might be diverted to the then more profitable EU market. Using the export supply elasticity of 0.248 for South African oranges in the United Kingdom it is expected that the South African supply increases by 0.73 percent due to the EU tariff reduction of approximately three percent in the FTA (Khuele and Darroch, 1997). Within the model, however, it is assumed that no trade diversion will take place due to the change in EU tariffs, hence the EU share of South African orange exports will remain constant.

It would be useful for future research to model a decision mechanism which reflects the choice of export destination by producers and exporters. Due to lack of information regarding the other destinations for South African oranges, this was not possible within this study.

4.5. Future Scenarios

Three future scenarios will be compared using the trade simulation model. These are a base scenario, a FTA scenario and a no-tariff scenario. The difference between these three scenarios occurs with respect to EU tariffs for fresh oranges. Table 4.10 shows the tariffs in the EU and the inclusion in the FTA of fresh oranges in relation to date of entry.

Table 4.10: European Union tariffs for fresh sweet oranges in 1999 and Free Trade Agreement (FTA) treatment

Period	Tariff 1999 in percent	Entry price	FTA treatment
1 January to 31 March	17.3	Yes	excluded
1 to 30 April	11.3	Yes	excluded
1 to 15 May	5.2	Yes	excluded
16 to 31 May	3.5	Yes	excluded
1 June to 30 September	3.5	No	included
1 to 15 October	3.3	No	excluded
16 October to 30 November	16.7	No	excluded
1 to 31 December	16.7	Yes	excluded

Source: Hauptzollamt Kiel (1999) and Department of Trade and Industry (1999)

The entry price system is described by Swinbank and Ritson (1995). An additional tariff equivalent is charged if the entry price before tariffs falls short of a threshold price. Refer to chapter 3 for a detailed description. The inclusion in the FTA only occurs at a later stage of the implementation period, from 2000 until 2011. The included time period accounts for the majority of South African fresh orange exports to the EU. Table 4.11 shows the seasonality of South African fresh orange supply to the EU market.

The tariff for South African fresh sweet oranges during the peak exporting season will be eliminated within the FTA. This could have an impact on the South African fresh orange industry.

Table 4.11: Monthly South African Fresh Orange Exports to the European Union in Percentage, 1991 - 1996.

	1991	1992	1993	1994	1995	1996
January	0.0 %	0.2 %	0.0 %	0.0 %	0.0 %	0.0 %
February	0.0 %	0.1 %	0.0 %	0.0 %	0.0 %	0.0 %
March	0.0 %	0.2 %	0.0 %	0.0 %	0.0 %	0.0 %
April	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
May	1.5 %	1.8 %	2.7 %	1.1 %	0.9 %	1.8 %
June	8.0 %	10.3 %	9.8 %	9.0 %	14.2 %	10.4 %
July	18.1 %	18.1 %	18.9 %	14.9 %	18.0 %	16.8 %
August	25.6 %	25.2 %	25.3 %	19.4 %	19.5 %	21.5 %
September	23.7 %	24.7 %	21.7 %	26.6 %	26.1 %	21.4 %
October	20.8 %	16.4 %	19.2 %	20.4 %	15.7 %	23.0 %
November	1.4 %	3.0 %	1.5 %	6.5 %	5.5 %	4.6 %
December	0.5 %	0.1 %	0.8 %	2.1 %	0.0 %	0.5 %
Total	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

Source: Eurostat

The base scenario will use the current EU tariff structure. It will also include the WTO commitments until 2001. Thereafter, a constant pace of tariff reductions is assumed. The FTA scenario will use the same tariffs, but the tariff for fresh oranges for the months June to September will be eliminated in the year 2000. This is earlier than the actual tariff elimination, but it is done to observe a difference between both scenarios and because producers know about the inclusion from the beginning of 2000.

The no-tariff scenario will eliminate all EU tariffs for fresh oranges from the beginning of the simulation period in 1997. This is done to estimate the effect EU tariffs have on the South

African fresh orange industry and to evaluate to what extent the FTA has captured this margin. The model simulates the time period from 1997 until 2011. This is a fifteen year period which ends at the conclusion of the implementation period of the FTA. A longer period would require additional inputs in relation to the production process, and trade assumptions. Each scenario is run 100 times. The results are then summarised accordingly by mean and standard deviation.

Chapter 5. Results

Each simulation run results in values for all variables and time periods. The trade simulation model is run for fifteen years. There is, therefore, a value for each variable for fifteen years. For several variables, not all years will be reported. The amount of data finally analysed is reduced by a selection of variables. Some variables are only direct conversions of others, others are constant throughout the simulation. All variables are described in the appendix. Each scenario is run 100 times. This results in a large amount of data. Only means and standard deviations are reported in this chapter to reduce the data to two percent of the original amount so that it can be presented in a manageable form (see appendix). The standard deviation indicates the volatility of the results. The simulation does not result in an optimal outcome. There will not be an equilibrium, either at the start or at the end of the simulation period.

5.1. Comparison between model predictions and actual values

As the simulation period starts in 1997, the results of the first three years can be compared with the actual exchange rate (Figure 5.1). In the first part of 1997 the actual exchange rate was below the 95 percent confidence interval, but thereafter the exchange rate stayed within the interval. This even includes the period of rapid depreciation of the Rand in July 1998.

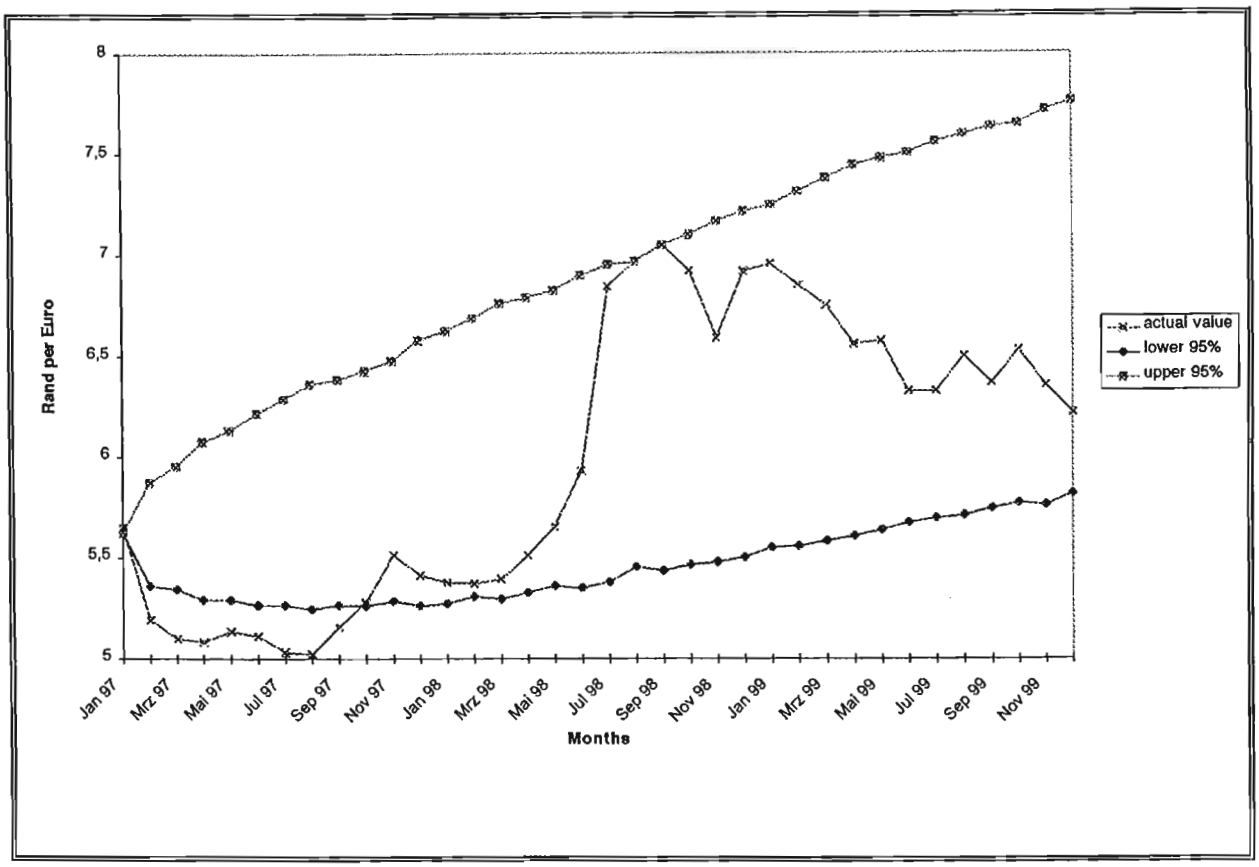

Figure 5.1: Predicted and actual exchange rate between Rand and Euro 1997 until 1999

Source: De Nederlandsche Bank (2000) and own calculations

More important than the exchange rate are orange prices for South African producers. Table 5.1 compares the actual annual prices for 1997 with the predicted prices within the model.

Table 5.1: Predicted and actual nominal South African orange prices in 1997 in Rand per metric ton

	Actual price	Base scenario	FTA scenario	No-tariff scenario
Local price	619	621	612	618
f.o.b. price	1369	1531	1516	1729

Source: Directorate Agricultural Statistics and Management Information, 1999.

In terms of local South African orange prices there is no significant difference between model prediction and the actual value. The lower actual f.o.b. price in South Africa is caused by the difference in predicted and actual exchange rate for 1997. The considerable higher f.o.b. price in the no-tariff scenario is due to the elimination of all tariffs from the first year in this scenario.

5.2. Predicted exchange rate and orange prices

The importance of the exchange rate is outlined in Chapter 4. Because neither direct nor indirect interaction arises between the tariff level and the exchange rate, the prediction for the exchange rate in all three scenarios should be the same. This is not the case because each scenario run includes random factors, but the average of 100 runs per scenario evens these variations almost out. Table 5.2 presents the predicted exchange rate for each scenario and the average of the three scenarios.

Table 5.2: Predicted nominal exchange rate between Rand and Euro 1997 until 2011 in Rand

	1997	**1999**	**2001**	**2003**	**2005**	**2007**	**2009**	**2011**
Base scenario	5.77	6.58	7.49	8.45	9.53	10.40	11.54	12.82
FTA scenario	5.73	6.58	7.50	8.47	9.43	10.60	11.54	12.71
No-tariff scenario	5.77	6.63	7.56	8.43	9.48	10.44	11.61	12.76
Mean	**5.76**	**6.60**	**7.52**	**8.45**	**9.48**	**10.48**	**11.57**	**12.77**
Standard deviation*	0.18	0.43	0.55	0.56	0.61	0.74	0.76	0.83

Note: * reported standard deviation is according to all simulation runs and not relating to variation between scenario means

The comparison of means between the different scenarios indicates that *a priori* expectations are met. The exchange rate model predicts a depreciation of the Rand against the Euro. The rate of depreciation declines with time, due to decreasing South African inflation rates (Table 5.3). The exchange rate is one of the major influences on the f.o.b. prices in South Africa. It is used to convert the EU prices in Euro into prices in South African Rand.

Table 5.3: Predicted consumer price index (CPI) and inflation rate 1997 until 2011 (1997 = 100), South Africa

	1997	**1999**	**2001**	**2003**	**2005**	**2007**	**2009**	**2011**
Base scenario (CPI)	100.00	113.91	127.84	141.76	155.72	169.63	183.59	197.50
FTA scenario (CPI)	100.00	113.89	127.79	141.75	155.68	169.61	183.51	197.43
No-tariff scenario (CPI)	100.00	113.87	127.78	141.70	155.61	169.54	183.49	197.42
Mean (CPI)	**100.00**	**113.89**	**127.80**	**141.74**	**155.67**	**169.59**	**183.53**	**197.45**
Standard deviation*	0.21	0.23	0.20	0.23	0.20	0.23	0.22	0.22
Inflation rate**	**-**	**6.58**	**5.74**	**5.16**	**4.67**	**4.25**	**3.94**	**3.66**

Note: * reported standard deviation is according to all simulation runs and not relating to variation between scenario means

** reported inflation rate is an annual value in percent

The consumer price index (CPI) reported here is used in deflating prices in other results. The low standard deviation indicates the consistency of the CPI prediction throughout the simulation runs. A decreasing inflation rate is in line with observations of recent years.

The South African producer is interested in the prices he receives for his products at comparable places. The price at the fresh produce markets is used to represent the local market price. Export prices are Rand f.o.b. prices in South African harbours. Table 5.4

presents the predicted real prices for fresh oranges on the fresh produce markets in South Africa in 1997.

Table 5.4: Predicted real prices for fresh oranges on the fresh produce markets for 1997 in South Africa in Rand per metric ton (1997 values)

	Base Scenario		FTA Scenario		No-tariff Scenario	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
January	1956	233	1937	217	1948	185
February	1637	184	1677	202	1652	192
March	1148	127	1177	140	1142	118
April	888	95	888	107	869	100
May	677	83	667	71	681	87
June	601	72	602	74	599	83
July	597	77	578	68	583	62
August	591	71	588	81	600	66
September	663	70	646	70	658	84
October	918	102	902	89	911	108
November	1212	160	1205	159	1194	144
December	1590	193	1542	183	1595	187

The predicted mean local prices are similar for all three scenarios. Taking the high standard deviation into account, no statistically significant difference between the scenarios could be observed. The predicted prices are three times as high in January as they are in the peak production season for all scenarios. Table 5.5 illustrates the predicted real prices after the first half of the simulation period. By 2004 the predicted real prices will be reduced by approximately 25 percent, but the structure will remain the same. In addition, there is no

difference between the three scenarios. Table 5.6 presents the real local prices for the final year of the simulation period.

Table 5.5: Predicted real prices for fresh oranges on the fresh produce markets for 2004 in South Africa in Rand per metric ton (1997 values)

	Base Scenario		FTA Scenario		No-tariff Scenario	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
January	1456	173	1460	188	1433	218
February	1229	162	1262	141	1226	147
March	911	117	901	97	891	106
April	703	84	700	82	700	86
May	530	67	538	65	526	63
June	470	53	480	56	477	56
July	443	53	444	57	450	57
August	446	49	457	53	452	57
September	498	62	504	57	496	52
October	687	82	700	77	691	74
November	906	102	921	100	910	113
December	1206	155	1195	125	1183	145

Table 5.6: Predicted real prices for fresh oranges on the fresh produce markets for 2011 in South Africa in Rand per metric ton (1997 values)

	Base Scenario		FTA Scenario		No-tariff Scenario	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
January	1144	160	1141	143	1143	143
February	1015	137	995	129	1010	137
March	732	89	703	74	703	83
April	556	60	538	65	554	60
May	418	54	411	50	413	49
June	371	49	374	45	372	48
July	344	39	348	45	344	41
August	355	46	352	38	350	42
September	390	45	387	46	379	49
October	535	75	540	64	533	60
November	722	98	696	84	690	85
December	934	107	917	105	919	115

In the final year of the simulation period, 2011, real local price will have been reduced to approximately 60 percent of the real prices in 1997. The main reason for this is the production increase during this period. In addition, the change in consumer preferences is also expected to cause the local price to decline. The major reason for this is the increasing preference for soft citrus compared with oranges. The strong seasonality is predicted to remain during the simulation period. All three scenarios are still very similar but a slight difference is observable. This is by no means statistically significant because of the high standard deviation of the simulation results.

The f.o.b. price in the South African port is of greater importance for the local producer because approximately 60 percent of the crop is exported which accounts for approximately 80 percent of gross turnover. Table 5.7 illustrates the predicted real f.o.b. prices in 1997.

Table 5.7: Predicted real free-on-board (f.o.b.) prices for fresh oranges in South African ports for 1997 in Rand per metric ton (1997 values)

	Base Scenario		FTA Scenario		No-tariff Scenario	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
January	881	548	993	610	1774	571
February	779	292	843	284	1544	287
March	1002	408	1029	466	1729	406
April	1271	554	1131	510	1661	438
May	1410	643	1332	711	1666	439
June	1576	446	1590	458	1635	469
July	1447	368	1490	419	1605	402
August	1572	370	1552	414	1738	366
September	1707	214	1727	242	1870	232
October	1425	327	1353	286	1603	335
November	1619	377	1499	364	2027	406
December	1101	635	989	623	1780	569

The results show that there is no significant difference between the base and the FTA scenario. This is expected because the EU tariffs are the same in both scenarios for the first three years of the simulation. The seasonality of the f.o.b. prices in the base and FTA scenarios is inverse to the seasonality of the prices at the fresh produce markets in South Africa, which is mainly caused by high EU tariffs at the beginning and end of the year. This

is also the main reason for the considerable difference of f.o.b. prices in the no-tariff scenario compared to the other two scenarios. In this scenario, all EU tariffs on oranges are eliminated from the start of the simulation. The difference is especially large during the months from January until April and November and December. These are also the months when the entry price system for oranges is in force in the EU. Table 5.8 shows the real f.o.b. prices in 2004.

Table 5.8: Predicted real free-on-board (f.o.b.) prices for fresh oranges in South African ports for 2004 in Rand per metric ton (1997 values)

	Base Scenario		FTA Scenario		No-tariff Scenario	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
January	1535	692	1634	641	1994	574
February	1387	448	1339	458	1780	329
March	1616	415	1603	466	2065	445
April	1782	561	1817	621	2022	509
May	1896	580	1876	619	2030	565
June	1855	512	1815	624	1970	619
July	1747	443	1739	435	1757	450
August	1812	438	1830	491	1803	548
September	1990	247	2038	292	2069	276
October	1555	318	1631	355	1823	398
November	1962	393	2026	437	2340	520
December	1647	640	1636	624	2072	609

Despite the tariff reduction in the FTA scenario for the period from June until September in the year 2000, no difference between the base and the FTA scenario could be observed. This is due to the high variability of the results. Compared to 1997, the seasonality of the f.o.b.

price is emphasised much less. This is because absolute tariff reduction is larger in months with lower prices, and more importantly, usage of the entry price system in the EU declines. The EU also has to reduce the threshold price and the maximum tariff equivalent as part of the WTO commitments to increase the market accessibility. These reasons are also responsible for the reduced difference between the no-tariff scenario and the other two scenarios. Table 5.9 presents the f.o.b. prices in the final year of the simulation.

Table 5.9: Predicted real free-on-board (f.o.b.) prices for fresh oranges in South African ports for 2011 in Rand per metric ton (1997 values)

	Base Scenario		FTA Scenario		No-tariff Scenario	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
January	1990	616	1946	652	2157	757
February	1833	384	1774	388	2008	438
March	2064	479	1906	545	2280	472
April	2120	546	2124	649	2222	508
May	2297	682	2212	591	2266	647
June	2119	627	2084	641	2222	588
July	1923	539	2054	538	2036	493
August	1952	460	1974	460	1946	589
September	2243	323	2251	287	2220	327
October	1949	348	1850	434	1908	416
November	2487	486	2298	482	2683	516
December	2055	683	1973	651	2344	693

The development of the f.o.b. prices in the first half of the simulation is continued in the second half. During the period of low tariffs for oranges in the EU, from May until October,

the f.o.b. prices are similar for all scenarios despite different applied tariffs. Especially in the months from July until October, when South African exports have an impact on the EU prices, the f.o.b. prices in the base scenario benefit from the lower increase in exports.

The comparison of real local prices and real f.o.b. prices in South Africa indicates that the South African local market is price competitive in the South African off-season for the earlier years of the simulation period. By 2004 the real f.o.b. price is higher the whole year round for all scenarios. In the no-tariff scenario the real South African local price is only higher during January for the first two years of simulation. For the other scenarios, the months from January until March, and December have higher real local prices in the first year. These four months account for three percent of the annual production of oranges in South Africa. One reason for the competitiveness of the South African market is the EU entry price system. An additional levy will be charged if the entry price falls under a certain threshold. Due to WTO commitments the threshold price also has to be reduced. Therefore, the additional levy will be charged less often and the average f.o.b. price will increase as time goes by.

The most predominant observation is the increasing difference between local and f.o.b. prices. The real local prices are predicted to decrease by 40 percent over the fifteen year simulation period. This represents an annual rate of decrease of 3.3 percent, a smaller rate than the inflation rate. Therefore, the nominal local price is expected to increase over the simulation period. The real f.o.b. price in Rand is expected to increase on average by 30 percent. The increase in the EU off-season is smaller than during the on-season. This is caused by larger absolute tariff reductions during the on-season than for the off-season.

The observation of an increasing difference between local and f.o.b. prices for fresh oranges in South Africa can also be made for the current decade. This implies that the exports become even more rewarding for South African producers, and leads to the question of whether the export percentage is expected to increase in the future. Bower (1999) expects that the export percentage will not change much in the future because sanitary and phyto-sanitary requirements will become more stringent. He reckons that even biotechnology will not have a major impact on orange quality with regards to fresh produce, although it may influence the processing product quality.

There is no significant difference between the base and the FTA scenario with regards to real local and f.o.b. prices in South Africa. Slightly lower real local prices could be observed in the FTA scenario in later stages of the simulation but the high variability of the results has to be kept in mind. The no-tariff scenario is also not significant different in terms of real local prices but a clear difference in real f.o.b. prices could be observed. Especially during the early years of the simulation, real f.o.b. prices in South Africa are considerably higher due to high EU tariffs on fresh oranges in those months.

5.3. Predicted orange production and area under oranges

The more physical aspects of the results are the change in area planted with oranges and the predicted development of orange production within South Africa. The design of seven production models permits an analysis of the national orange industry and the regional aspects thereof. The results are presented as indices as the area used within this study is derived from other information, namely, total annual production and yields used by Ferreira and van Zyl (1997a) in their gross margin calculations. These gross margins were used in the

design of the production models. The indices are based on the area under oranges in the first year of the simulation period. Therefore, a change in the index means a change in relation to the starting year and not the base scenario.

The area planted with oranges is an indicator for total production. Table 5.10 shows the development of the predicted area under oranges for the first half of the simulation period.

Table 5.10: Predicted index of total area planted with oranges by production region in 2004 (1997 = 100)

		Base scenario		FTA scenario		No-tariff scenario	
Region	Cultivar	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Lowveld	Valencias	103.75	2.59	104.75	2.64	107.38	2.73
North-West	Navels	94.13	1.85	94.65	1.97	96.77	2.02
	Valencias	103.96	2.70	105.01	2.62	107.35	2.62
Sundays	Navels	95.84	1.76	96.39	1.77	97.69	1.72
River	Valencias	104.96	2.93	105.44	2.90	110.60	3.14
Olifants	Navels	95.03	1.64	95.76	1.59	96.87	1.64
River	Valencias	104.42	2.90	104.71	3.01	111.15	3.13
Total		**99.93**	**2.14**	**100.68**	**2.15**	**103.10**	**2.20**

The hypothesis that scenarios result in equal change of total area under oranges can be rejected at a 85 percent level of significance if the base scenario is compared with the no-tariff scenario. In the case of the comparison of the FTA and the no-tariff scenario, the level of significance is 70 percent. The level of significance of rejecting the hypothesis of similarity between the total area under oranges for the FTA and base scenario is 25 percent. This result suggest that no significant difference between these two scenarios could be

observed in the year 2004. On the other hand, the results indicate consistently for all regions that the FTA scenario leads to a larger area under oranges than the base scenario. As the simulation period lasts until 2011, table 5.11 shows the development of the predicted area under oranges until the final year of simulation.

Table 5.11: Predicted index of total area planted with oranges by production region in 2011 (1997 = 100)

		Base scenario		FTA scenario		No-tariff scenario	
Region	Cultivar	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Lowveld	Valencias	110.04	3.88	112.00	4.22	116.15	4.22
North-West	Navels	93.39	2.83	94.54	3.04	98.04	3.42
	Valencias	110.55	4.09	112.57	4.47	116.29	4.63
Sundays	Navels	92.14	2.72	93.32	2.95	95.29	2.77
River	Valencias	115.28	4.50	116.49	4.70	125.32	5.47
Olifants	Navels	90.40	2.43	91.79	2.93	93.62	2.75
River	Valencias	114.56	4.18	115.60	5.21	126.11	5.54
Total		**102.42**	**3.18**	**103.97**	**3.55**	**107.85**	**3.56**

The level of significance for rejecting the hypothesis of equal change in area under oranges between the three scenarios does not change. The differences between the scenarios increase until 2011 but so does the standard deviation of the results. The consistency of the difference between the scenarios in all production regions remains the same for the final year of the simulation period.

The different development of the area under oranges throughout the scenarios is distinct. Generally, regions planted to Navels are on a decrease whereas regions planted to Valencias

are on an increase. Recent observations of the cultivar mix in the South African orange industry confirm this observation (AgriReview, 1999). In the case of Valencias, the area planted with oranges in the cooler regions of the Cape - Sundays River and Olifants River - seems to increase faster than in the warmer regions. With respects to Navels, the decrease in area planted with oranges seems to be prolonged in the cooler regions.

The change in total production is dependent on the total area planted with oranges and on the age of the orchards. Table 5.12 shows the index for total orange production by region in the year 2004.

Table 5.12: Predicted index for total orange production by production region in 2004 (1997 = 100)

		Base scenario		FTA scenario		No-tariff scenario	
Region	Cultivar	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Lowveld	Valencias	117.52	10.30	114.56	12.32	120.21	11.35
North-West	Navels	94.97	9.50	96.00	9.39	96.24	9.10
	Valencias	114.86	12.36	112.62	11.95	115.62	10.94
Sundays River	Navels	104.98	10.86	107.53	11.48	105.06	9.39
	Valencias	110.30	11.79	108.36	10.60	115.38	11.54
Olifants River	Navels	107.30	10.67	105.23	10.30	106.12	11.21
	Valencias	112.40	10.39	111.11	11.06	113.72	9.86
Total		**110.70**	**5.38**	**109.48**	**6.34**	**111.40**	**5.86**

The difference between all three scenarios in year 2004 is small. This is to be expected because freshly planted orchards have their first considerable crop after five years. Therefore, only different amounts of plantings in the first three years of the simulation are captured in

the production of 2004, the eighth year of simulation. This means that no difference in total production would be expected between the base and the FTA scenario because the change in EU tariffs only comes into account in the fourth year of the simulation. A slightly higher total production could be expected in the no-tariff scenario. This can be observed in the results but it lacks significance. Comparing the results of area planted with oranges and of total production, the total production increases by ten percent over the first half of the simulation period, whereas the area under oranges stays almost constant. The reason is that the proportion of mature trees is increasing in relation to immature trees. Table 5.13 shows the total production index for the year 2011.

Table 5.13: Predicted index for total orange production by production region in 2011 (1997 = 100)

		Base scenario		FTA scenario		No-tariff scenario	
Region	Cultivar	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Lowveld	Valencias	118.95	12.08	120.23	12.55	126.08	13.49
North-West	Navels	90.27	10.53	91.87	9.95	92.99	10.00
	Valencias	117.31	11.98	119.30	12.62	125.55	13.54
Sundays River	Navels	95.65	9.67	98.28	9.25	99.08	10.22
	Valencias	117.79	9.96	117.41	12.24	125.55	11.49
Olifants River	Navels	96.91	10.27	95.38	9.71	98.91	9.08
	Valencias	116.72	12.38	118.92	13.39	126.51	12.78
Total		**109.11**	**6.18**	**110.48**	**6.70**	**114.83**	**6.87**

During the second half of the simulation period, the total orange production in the base and FTA scenario does not change. In 2011 the total production in the FTA scenario is slightly higher than for the base scenario but the difference is not statistically significant. In the no-

tariff scenario an increase of total production from 2004 up to 2011 can be observed. During the final year of the simulation period total production is clearly higher than for the other two scenarios but the level of significance is less than 50 percent in relation to the FTA scenario. Due to the time delay between plantings and the first crop, differences in total production are delayed in comparison to differences in total area under oranges. Only a longer term simulation will result in clearer differences between the three scenarios.

Focussing on the regional results, as expected from the predicted area under oranges the total production increases faster in the regions planted with Valencias than those planted with Navels. Table 5.14 indicates the regional distribution of the total production at the end of the simulation for the base scenario. Similar results can be observed for the FTA and the no-tariff scenario.

The share of Valencia production increases while the share of Navel production decreases. In the context of production regions, only the Lowveld increases its share of the total production. The main reason is that only Valencias are grown in the Lowveld. In contrast, in all other regions the share of Navels is larger than that of Valencias, with respect to total production. Even so, Valencias are more preferred by the producers, a total move from Navels to Valencias is not expected. The production season of both cultivars differs. It is, therefore, advantageous to produce both types in order to extend the production season. This improves the utilisation of the production resources, for example harvest labourers, and packhouses. In terms of marketing, a longer production period is desirable because of improved market presence. This is especially important if the product is branded. With regards to South Africa, the brand name "Outspan" is of importance in the overseas market.

Table 5.14: Share of regions and cultivars in total production for the base scenario by 2011 (values for 1997 in parenthesis) (percent)

	Navels	Valencia	**Total**
Lowveld	-	46.8 (42.9)	**46.8 (42.9)**
North-West	10.8 (13.1)	8.1 (7.5)	**18.9 (20.6)**
Sundays River	14.0 (16.0)	7.1 (6.5)	**21.1 (22.5)**
Olifants River	8.3 (9.3)	4.9 (4.7)	**13.2 (14.0)**
Total	**33.1 (38.4)**	**66.9 (61.6)**	**100 (100)**

5.4. Predicted gross margins and consumer surplus

This model uses gross margins to determine the welfare effect on South African producers. As the model uses regional sub-models it is difficult to estimate fixed costs for orange production. Fixed costs would be necessary to calculate profit margins at the farm level. To estimate the change in profit margins a design of a farm model would be necessary as profits can only be measured on the farm level. The derived gross margins within this simulation model can be used to aid the development of farm models. It is recognised that relative changes in gross margins are normally smaller than changes in profit margins. Figure 5.2 illustrates the development of the national real gross margin in the South African orange industry.

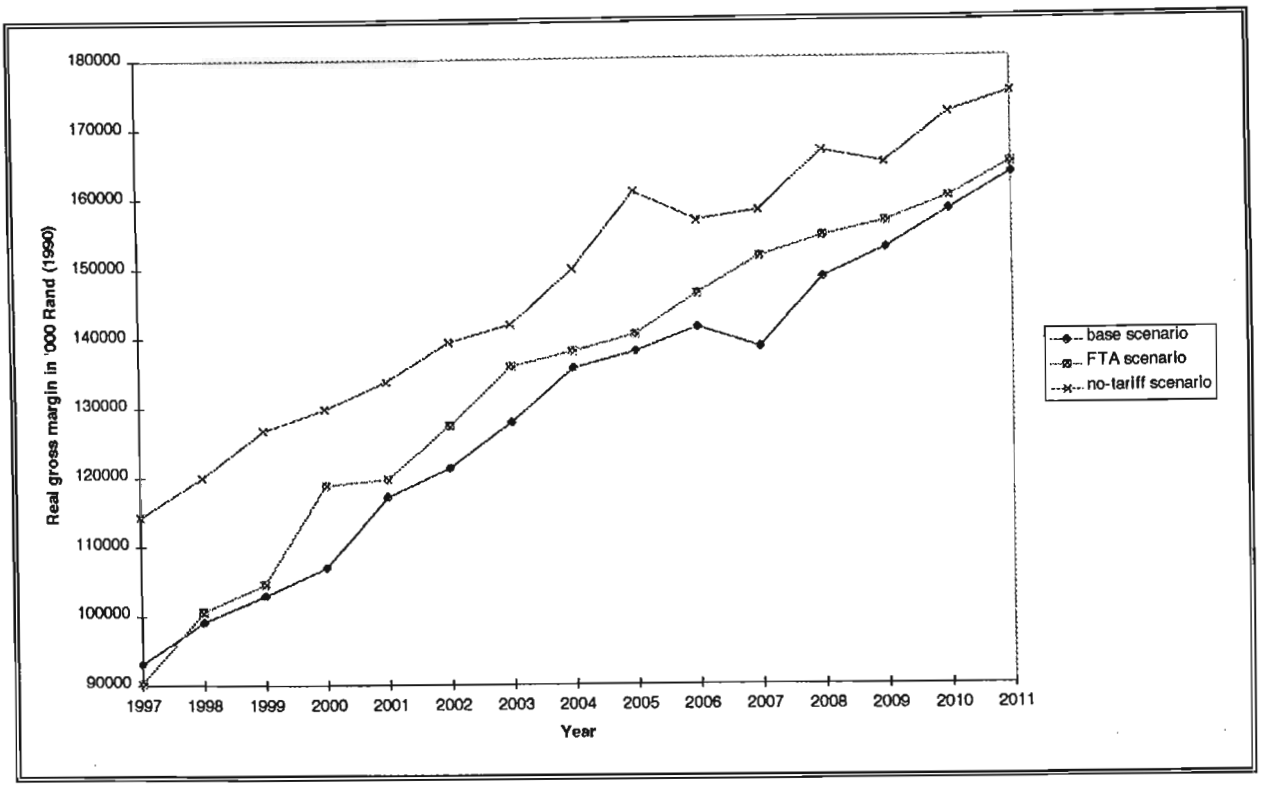

Figure 5.2: Predicted national real gross margin for the different scenarios from 1997 to 2011 in 1990 Rand

As Figure 5.2 illustrates, national real gross margins are increasing dramatically in all three scenarios. On the one hand, total turnover from the orange production is increasing sharply. This is caused by increasing export turnover which accounts for more than 80 percent of total turnover. The declining local earnings only slow down the increase. On the other hand, real production costs per unit are declining (deflated by the CPI). In addition the total area under oranges is increased in all scenarios. Due to the total tariff elimination in the EU from the first year in the no-tariff scenario, the real gross margin for this scenario is considerably higher over the first years. The rate of increase for the no-tariff scenario is smaller than for the other two scenarios. This is expected because the difference in real f.o.b. prices is declining which is mainly caused by the reduction of tariffs by the EU. This effect is only partly outweighed by the faster increase in production for the no-tariff scenario. The difference between the base and the FTA scenario is minimal. It is expected that in the first three years of the simulation period, the real gross margin is the same for both scenarios.

Thereafter it is expected that the FTA scenario is slightly beneficial. This could be confirmed by observing the development of the real gross margins, but the high variability of the results compromise any significance. The coefficient of variation of real gross margins is approximately 20 percent.

Analysing gross margins on a regional basis shows that the regions planted with Valencias have a higher rate of increase in total gross margins than the regions planted with Navels, while gross margins per hectare increase at a similar rate. In terms of per hectare gross margins the difference in increase is higher between regions than between cultivars. Especially, in the Olifants River region, gross margins per hectare are increasing faster than in the other regions. The slowest increase occurs in the North-West region. The average per hectare gross margin is approximately one and a half times higher for Valencia orchards than for Navel orchards. Table 5.15 shows the per hectare real gross margins for the FTA scenario.

Table 5.15: Predicted real per hectare gross margins in the FTA scenario (1990 Rand)

Region	Cultivar	1997	2004	2011
Lowveld	Valencias	11 280	16 878	19 471
North-West	Navels	6 896	9 938	11 347
	Valencias	11 543	16 400	19 031
Sundays River	Navels	7 367	11 586	12 717
	Valencias	11 399	16 382	19 050
Olifants River	Navels	6 563	10 380	11 994
	Valencias	10 049	16 124	18 186
Mean		**9 314**	**14 140**	**16 343**

Gross margins are calculated by adding local and export turnover and subtracting variable costs. Real local turnover declines during the simulation period whereas real export turnover increases. Because export turnover accounts for a larger proportion of total turnover, real total turnover is increasing. Real variable costs are constant if they are deflated by the Producer Price Index (PPI). Technical progress is included via the PPI, which increases more slowly than the Consumer Price Index (CPI). Consequently, the real variable costs deflated by the CPI decrease slightly over the simulation period.

On the side of the South African consumer, the development of the consumer surplus is of interest. Table 5.16 illustrates the total consumer surplus.

Table 5.16: Predicted real total consumer surplus in '000 Rand 1990

	Base Scenario		FTA Scenario		No-tariff Scenario	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
1997	19 796	3 081	20 586	3 048	19 762	3 038
1999	22 799	3 656	22 960	3 107	22 268	3 186
2001	25 181	3 511	24 276	3 398	24 411	3 496
2003	26 033	3 271	26 468	3 618	26 892	3 852
2005	27 910	3 817	27 642	3 859	28 031	4 054
2007	29 269	3 257	28 485	4 215	30 558	3 538
2009	29 539	3 562	30 656	3 927	31 298	4 287
2011	30 318	3 751	30 998	4 506	31 906	4 170

The difference between the scenarios is small and not statistically significant. Results indicate that the no-tariff scenario is the most beneficial for South African consumers especially in the

latter years. For the final years of the simulation period, the FTA scenario seems to be slightly more beneficial for the South African consumer than the base scenario. As there is almost no difference in local prices and only a small difference in production, this result is expected. The predicted increase in real total consumer surplus is twice as high as the South African population growth. Therefore the per capita South African consumer surplus originating from oranges is predicted to increase over the simulation period.

The differences between the scenarios on the EU market with regards to consumer surplus and producer prices is expected to be even more marginal. As South African exports mainly arrive in the EU off-season, most local producers are expected not to be affected by reduced prices due to higher South African supply. But as Spain is diverting its supply into the South African market window by cultivar selection and improved storage, these producers might be affected by increased South African supply. EU consumers are expected to benefit from slightly lower prices of oranges during the South African export season.

5.5 Sensitivity analysis on the South African supply elasticity

As Chapter 4 indicates, no own estimate for the South African supply elasticity could be derived. In addition, literature relating to supply elasticities of oranges is limited. Therefore, a sensitivity analysis on supply elasticities has been conducted. The used supply elasticity for plantings of 2.0 is compared with supply elasticities for plantings of 1.0 and 4.0. Overall this sensitivity analysis showed that supply elasticities have only a small impact. The results in relation to differences between the three scenarios do not differ from the results of the main simulation. A difference between the three scenarios could only be observed in area planted with oranges. Figure 5.3 presents the area under oranges in the FTA scenario.

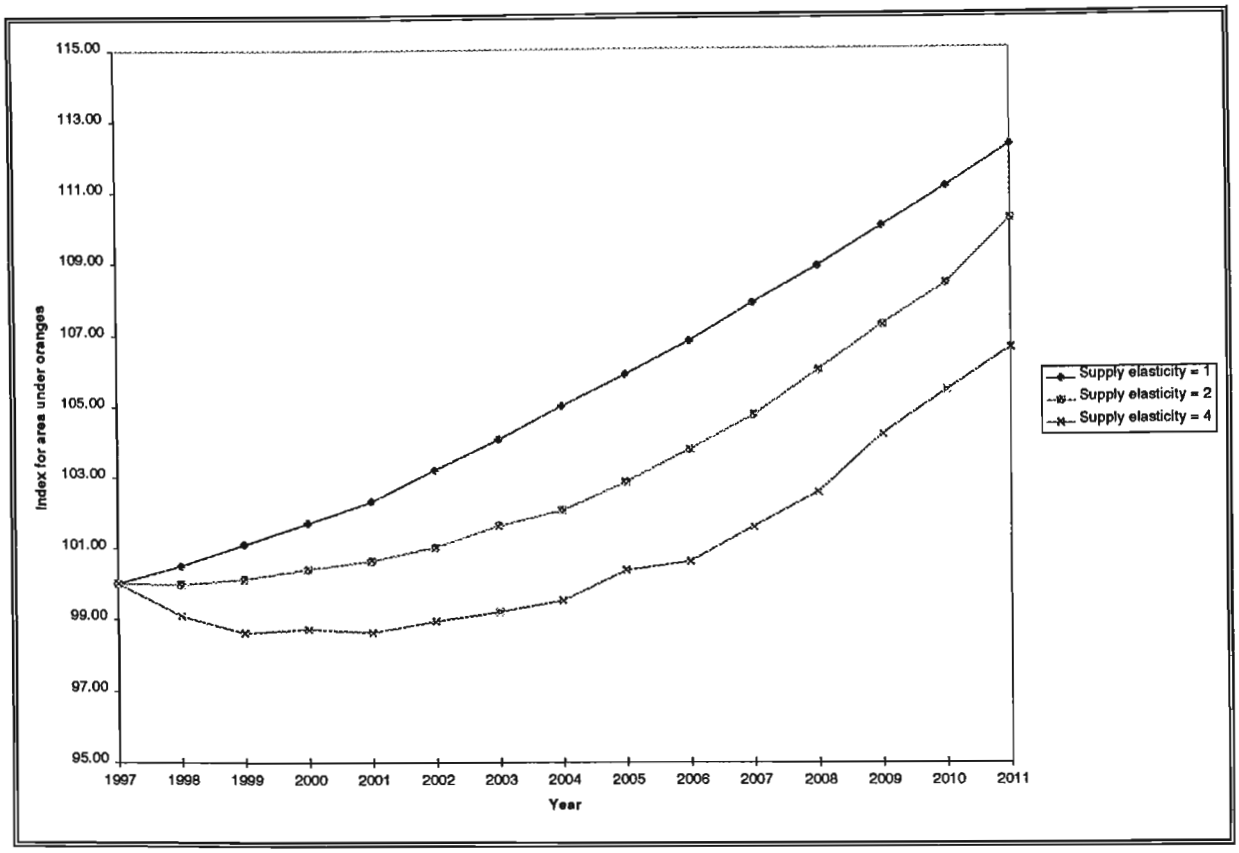

Figure 5.3: Development of area under oranges relating to supply elasticity of plantings

The lower increase in the case of a higher supply elasticity is caused by a high price in the base year, 1995. This results in lower plantings during the first years when average prices are lower. Over the later years of the simulation, higher supply elasticities result in a faster increase of area under oranges. The sensitivity analysis has been conducted on 25 runs per scenario compared to 100 runs in the final simulation. This resulted in a higher coefficient of variation.

As a supply elasticity of 2.0 for plantings is comparable to literature information and no major impact of supply elasticities on model results could be observed, this has been used in the trade simulation model.

Chapter 6: Conclusion

The recently signed "Agreement on Trade, Development and Co-operation" between South Africa and the EU will lead to the formation of a free trade area covering South Africa and the EU. The FTA between South Africa and the EU covers more than 90 percent of all trade between both partners. The EU offer, with regard to industrial products, is more generous than the South African offer. In the case of agricultural trade the situation is reversed. South Africa will eliminate the tariffs on 83 percent of all EU agricultural exports whereas the EU will only eliminate the tariffs on 61 percent of the South African agricultural exports. In addition, 13 percent of South African agricultural exports will receive preferential treatment in the form of tariff quotas by the EU. Oranges, the focus of this study, are included from June until September as the rest of the year is seen as the EU production season. As the EU is self-sufficient in annual terms in the production of oranges, a surplus is produced during its production season while a deficit occurs during the EU off-season. South Africa benefits in this regards from its location in the southern hemisphere, with a thus altered production season. The EU tariff system was designed in such a manner that it enforces a high level of protection during the EU production season and a low level for the off-season. Therefore, the tariff reduction due to the FTA of about three percent is small.

During the negotiation of the FTA, compliance with WTO rules was aspired to. It is questionable whether this objective was fulfilled. As long as no other WTO member challenges the FTA between South Africa and the EU no problem will arise. Since a dispute settlement within the WTO framework would take a long time, the implementation period should be well on its way before a final solution is found. Normally, adjustments may only be required if the FTA between South Africa and the EU is challenged.

Orange trade between South Africa and the EU is important for both. Orange exports account for almost ten percent of all agricultural exports from South Africa. The EU is the destination for over 60 percent of all South Africa oranges. This might even increase further if the Central and Eastern European countries join the EU. They account for another ten percent of the South African orange exports. South Africa is the second largest external supplier of oranges to the EU. It dominates the EU off-season where it reaches a market share of approximately two thirds in the months from July until October. These facts also imply that a small change in the EU tariff regime for fresh oranges may affect the South African fresh orange industry.

The results of the trade simulation model indicate that the FTA has a slightly beneficial effect for both South African orange producers and South African consumers. In the case of South African consumers this is only an indication in the latter years. Due to the high variability of other influential factors, such as weather conditions, exchange rate development, and quality variation, these results are not statistically significant. The consistency of the results makes it very likely that a positive effect occurs. The larger observed increase in orange acreage under the FTA might result in a larger difference in production over time. Due to the time delay between planting and maturity this will only occur at a later stage. A longer simulation period could be useful to obtain such results but this is limited by the assumptions about the orange industry underlying the development of the model.

The observed and significant difference in the future development of area under Navels and Valencias is consistent with recent observations (AgriReview, 1999). A total change from Navels towards Valencias seems to be unlikely. Both cultivars have different ripening seasons

which is beneficial for a more distributed utilisation of the labour force and packhouses. For the whole industry a longer production period is advantageous to obtain market penetration on export markets. This is especially beneficial for branding and advertising.

The FTA is a win-win situation for South Africa because it is estimated that both local producers and consumers benefit from the agreement. Both results are statistically not significant but consistent in the latter years of the simulation period. This is due to the contrary development of real local and real f.o.b. prices. The local consumer benefits from projected lower real local prices. South African local prices are expected to fall as its production is expected to increase, while a constant percentage of this production does not meet export requirements. From the producer side the fall in local price is more than offset by the predicted increase in real f.o.b. prices. The effect of the FTA on the EU market is expected to be limited. South African exports are estimated to increase 9.1 percent overall over the fifteen year simulation period, which increases to 10.5 percent due to the FTA. The increased South African exports are estimated to result in a small decrease in orange prices during the EU summer. This will have a very small impact on EU producers as this is their off-season. It must, however, be kept in mind that Spain, the main EU producer, is diverting its supply into the South African dominated season due to cultivar selection and improved storage possibilities.

EU tariffs have a relatively small negative impact on the South African fresh orange industry. This could be observed if the no-tariff scenario is compared with the base scenario. The clearest difference exists with regard to area under oranges. In the long run, this will lead to differences in all other observed indicators, but this is delayed due to the perennial nature of oranges. South Africa will welcome all tariff reductions in the EU because both producers

and consumers in South Africa are expected to benefit. This is due to the fact that the majority of earnings are derived from exports. At the same time, it is estimated that real local prices decrease due to increased supply and the constancy of the export percentage. South African producers would benefit even more if they could increase their export percentage, which is unlikely (Bower, 1999). The increase in South African production is five percent higher under the no-tariff scenario. Therefore, large differences in relation to the EU market are not expected as described in the comparison between the FTA and the base scenario. Results indicate that the export orientation of the South African fresh orange industry will further increase over time due to a projected increased difference between real local and real f.o.b. price.

The trade simulation model can also be adapted for other products and trade relations. As one of the major advantages of the model is the inclusion of seasonality in trade, it would be more useful for perishable products than others. An extension in relation to more destinations could be useful but then a decision mechanism with regard to how a destination is chosen must be developed. Otherwise, either constant proportions of the product are allocated to one destination or the total production is exported to one destination until another destination is more favourable. As the model is flexible, new information can easily be included to improve parts of the model and thus the whole trade simulation model.

The trade simulation model can be used for future negotiations of trade agreements to evaluate the effects of tariff reductions on export orientated sectors.

Summary

South Africa and the European Union (EU) signed an Agreement on Trade, Development and Co-operation (TDCA) in October 1999. This agreement contains a Free Trade Agreement (FTA). The negotiation towards this agreement lasted for more than four years. It was initiated after the EU denied South Africa full membership in the Lomé Convention. The FTA cannot be seen separately from other trade agreements by either or both, South Africa and the EU.

The most important other agreement is the General Agreement on Tariffs and Trade (GATT), and the World Trade Organization (WTO) which emerged therefrom. South Africa and the EU are members of the WTO and, therefore, the rules set by the WTO are binding for all trade relationships of both contracting parties. Agriculture has always been treated separately within the GATT negotiation rounds but within the Uruguay Round - 1986 until 1994 - agriculture was brought into GATT rules. The WTO was founded during the Uruguay Round and established in 1995. The WTO is now the governing body of world trade.

Within the WTO regulations, rules for the formation of a free trade area are set. The aim of the FTA between South Africa and the EU is the formation of a free trade area. A FTA should cover 'substantially all trade'. It is widely understood that no sector should be totally excluded and that at least 90 percent of the bilateral trade should be included. In addition a time frame of ten years, and in exceptional cases twelve years, is allowed during the transition period. The fulfilment of these requirements was one major objective of the negotiation between South Africa and the EU. There are some questions as to whether this was successful

or not. The problem with this is the vagueness of WTO rules. In addition, no FTA has sought acceptance under WTO rules until now.

Important agreements on the side of South Africa are the Southern African Customs Union (SACU) and the Southern African Development Community (SADC). SACU is a customs union between South Africa, Botswana, Lesotho, Namibia and Swaziland. There are no internal tariffs between member countries and the same external tariffs are applied. The other members of SACU will be the most affected by the FTA between South Africa and the EU. They will lose revenue because the total revenue from tariffs will decline. This is of importance as these countries are highly dependent on tariff revenue. On the other hand, all economic growth introduced by the FTA will easily spill over into these countries. South Africa became a member of SADC in 1994, which is a regional agreement of fourteen Southern African countries. Subsequently SADC was restructured and it intends to become a free trade area in the near future. This puts limits on the FTA between South Africa and the EU because South Africa has to open its market first to SADC and then to the EU.

On the side of the EU, the most important trade agreement is the Lomé Convention which allows 70 countries in Africa, the Caribbean and the Pacific, non reciprocal preferential access to the EU market. South Africa wanted to become a full member of the Lomé Convention but this was denied by the EU. South Africa is now a qualified member which excludes the right to preferential market access. As the Lomé Convention does not conform with WTO rules in its present format, the future is unclear. One option is the formation of free trade agreements between the EU and the other members of the Lomé Convention, in which case the FTA between South Africa and the EU would set a precedent.

The negotiation towards the TDCA between South Africa and the EU started in 1995 and lasted until 1999. The whole agreement includes arrangements for economic co-operation, co-operation in science and technology and a framework for EU aid towards South Africa. This study focuses on the trade part of the FTA. The EU includes 95 percent of all South African exports in the FTA within a ten year period, whereas South Africa includes 86 percent of all EU exports within 12 years. In the field of agriculture, South Africa includes 83 percent of EU exports and the EU 61 percent of South African exports. The EU grants South Africa agricultural tariff quotas which include another 13 percent of South African exports. These are for cheese, cut flowers, processed fruits, and wine. The main EU exclusions from the FTA occur in bovine meat, dairy products, some fruits, maize, sugars, and wines. With regards to oranges, the EU only includes orange imports during the time from June until September. South Africa excludes red meats, dairy products, wheat, barley, maize and sugars.

Recently, several studies were carried out to evaluate effects of the FTA on the South African agricultural sector. Several studies focus on the impact of subsidised EU beef exports. They conclude that South Africa is negatively affected by subsidised EU beef exports and that the situation would worsen if beef were to be included in the FTA. One study observed the possibility of future South African exports in the field of poultry. Other studies look at the general effect on the South African agricultural sectors and emphasise challenges through EU competition and possibilities for South African exports.

South African annual orange production rose to almost one million tons during this decade. South African orange consumption is very dependent on local production and, therefore, it experience many fluctuations. Approximately 100 000 tons are sold on the domestic fresh produce markets annually. The production within the EU is six million tons and occurs

almost entirely in Spain, Italy, Greece and Portugal. The consumption in this area is also dependent on the local harvest, and with 25 kg per person per year, it is three times higher than in the rest of the EU, where the consumption per capita is declining. The absolute consumption within the EU is equivalent to the production. Due to consumer preferences in terms of quality, variety and seasonality the EU is the largest importer of oranges world wide.

South Africa is the second largest external supplier of oranges to the EU and it dominates the EU off-season. The EU is the most important export market for the South African orange industry and the destination for over 60 percent of the South African orange export. Approximately 200 000 tons of South African oranges enter the EU, mainly from June to October, the European off-season. During this time - extended to November - only an *ad valorem* tariff between four and 20 percent is applied by the EU. During the rest of the year the entry price system is additionally in force. A tariff equivalent is charged if the entry price of the product falls below a set threshold price for oranges, which is 36 Euro per 100 kg in 1999. The maximum tariff equivalent is 7.70 Euro per 100 kg, which will be charged if the entry price is lower than 92 percent of the threshold price. Tariff, entry price and maximum tariff equivalents will be reduced between 1995 and 2001 by 20 percent due to the WTO commitment of the EU. Prices in the EU show a clear seasonality on the retail market but this is flattened out in the wholesale market.

The importance of non-tariff barriers in international trade is increasing. Technical barriers of trade (TBT) refer to import bans, technical specifications and information remedies. Oranges, for example, require a quality certificate to enter the EU market. This is generally seen as a smaller problem. For agricultural products, in addition to TBTs, sanitary and phyto-sanitary (SPS) regulations are of importance. With regards to this, South Africa wanted to negotiate

an equivalency agreement with the EU, but this has been postponed due to earlier requests by other countries.

Several studies have analysed demand of oranges using different approaches. Mostly, annual data are used. Some studies divide the year into two seasons to cater for the seasonality of orange trade. In terms of supply of oranges few studies have been published. The perennial nature of the crop and the limited amount of time series data make the analysis of orange supply difficult. Other literature relating to trade and policy models is vast. Only literature relating to the fruit sector or of importance for the model development is presented. Most studies pertaining to the fruit sector use annual data and focus on developed countries. Several studies evaluate the effect of free trade agreements on the agricultural sector.

The trade simulation model is developed on a graphical interface using the programme STELLA to indicate linkages between different variables. In the model, it is possible to use stochastic distributions or random figures to quantify relationships. This has been done where the distribution was known or could be estimated. Each scenario is run 100 times and results are statistically analysed. The trade simulation model consists of several linked sub-models. These include seven production models, a local market model, an exchange rate model and a model for EU demand.

The production of fresh oranges occurs mainly in the following four regions within South Africa: the Lowveld region of the Northern Province and Mpumalanga, the North-West Province, the Sundays River region of the Eastern Cape, and the Olifants River region in the Western Cape. The two main cultivar groups are Navels and Valencias, each with different ripening seasons. As Navels are not planted in the Lowveld region, seven production models

are included for regions and cultivar group. Gross margins, cost and production data are derived by orchard (Ferreira and van Zyl, 1997). The gross margins are based on cross-sectional data from the year 1995. Information provided by Bower (1999) is used to derive a seasonal production distribution within each production model.

The supply response is simulated through planting new orchards, while it is not possible to withdraw orchards before the end of the productive life-span. New plantings are a function of the ratio of turnover over variable costs. Own estimates for a supply elasticity could not be derived because of lack of information about annual increase in acreage. However, Khuele and Darroch (1997) estimate the export supply elasticity for South African oranges to the United Kingdom at 0.248. This estimate refers to production rather than area planted with oranges and it excludes the supply to other destinations as well as the local market. Furthermore, a supply elasticity of 0.128 for perennial products in Italy has been obtained by Sckokai and Moro (1996) which is of a similar magnitude. Approximately five to ten percent of total area is annually replanted or freshly planted. Therefore, a supply elasticity in terms of area planted every year should be ten to 20 times as large, implying a supply elasticity of approximately 2.0 for plantings.

About 40 percent of the South African orange production is either processed or sold locally. The monthly real prices at the four main South African fresh produce markets for oranges - Johannesburg, Pretoria, Durban and Cape Town - are analysed to obtain a local demand function. An influential variable is the actual amount sold over a particular month. The lagged export price influences the local price, due to the linkage between both markets. A trend variable is included in the model to capture the change in consumer preferences over time, especially towards easy-peelers. The price flexibility of demand in the local market is

estimated at -0.301 which is lower than the -0.695 obtained by Hayward-Butt and Ortmann (1994). This is to be expected as short term demand flexibilities are generally smaller than demand flexibilities based on annual data due to the possibility of short term storage.

The exchange rate between the South African Rand and the Euro is important for a trade model. South African producers are interested in the Rand price received for their product, whereas consumers in the EU pay in Euro. The Euro has a fixed exchange rate to eleven European currencies which will replaced by the Euro in 2002. It was introduced in January 1999 as a single currency in eleven EU member countries to replace the ECU (European Currency Unit).

The exchange rate between the Rand and ECU is analysed from 1990 until 1996 to obtain a prediction function for the future exchange rate. Monetary models are based on the assumption of purchasing power parity. This was tested using the Cochrane-Orcutt two step procedure. The coefficients have the expected signs. If the South African price level increases, the Rand depreciates against the Euro. The opposite is the case for the EU price level. The statistical fit is excellent and results are in accordance with theoretical economic expectations. The purchasing power parity model is used to predict future exchange rates in the trade simulation model. As the simulation period starts in 1997, the results of the first three years can be compared with the actual exchange rate. In the first part of 1997 the actual exchange rate was below the 95 percent confidence interval, but thereafter the exchange rate stayed with in the interval. This even includes the period of rapid change in July 1998. Macro-economic indicators included in the model are Consumer Price Index (CPI) on both sides, and Producer Price Index (PPI) and population only on the South African side.

South Africa is generally a price taker on the European market but during the months of July until October, South Africa can influence EU prices significantly. During the later months oranges originating in South Africa account for two thirds of the EU market. For the other months the price of fresh oranges in the EU is seen as an exogenous variable. During the months from July until October, a monthly price flexibility of the import demand for South African oranges is calculated. The following procedure is used. Firstly an annual price flexibility for oranges in the EU is derived at -0.479. Secondly, monthly price flexibilities of the import demand for South African oranges are calculated, using a procedure adapted from Johnson (1971) which includes market shares.

The simulated monthly prices for fresh oranges in the EU are then transformed into free-on-board (f.o.b.) prices in South Africa in Euro. This is achieved by firstly deducting the tariff. In the months from June to November, a division by one plus the *ad valorem* tariff is carried out. For the rest of the year the entry price system in the EU is in force. Therefore, it has to be determined whether the entry price before tariffication is below the threshold. If this is the case, a tariff equilibrium has to be subtracted as well. If not, the same process is used as for the other months. During all months, the cost of transport from South African harbours to the EU point of entry has to be deducted. The transport costs are expected to stay constant in nominal terms at 150 Euro per ton over the time of simulation. To retain the prices in Rand at the South African harbours, the Euro value is multiplied by the predicted exchange rate.

This study compares the future prospects of the South African fresh orange industry under the FTA to a base scenario without the FTA and a no-tariff scenario. The base scenario uses the current EU tariffs and the commitment the EU has submitted to the WTO. The FTA scenario uses the same tariffs and the outcome of the FTA. EU tariffs on fresh oranges are eliminated

from June until September. In the no-tariff scenario, there are no tariffs on oranges in the EU over the whole simulation period from 1997 until 2011. The final year is set according to the end of the implementation period of the FTA between South Africa and the EU. Each scenario is run 100 times and results are analysed also reporting mean and standard deviation.

The exchange rate model predicts a depreciation of the Rand against the Euro from 5.76 Rand per Euro in 1997 to 12.77 Rand per Euro in 2011. The rate of depreciation is predicted to decline with time, assuming a decrease in the South African inflation rate. The exchange rate is one of the major influences in the f.o.b. prices in South Africa. It is used to convert the EU prices in Euro into South African Rand. The South African producer is interested in the prices he receives for his products at comparable places. For the local market, the prices at the fresh produce markets are used. In terms of exports, the f.o.b. prices in the South African harbours are referred to in Rand.

The predicted mean local prices for all three scenarios are similar throughout the simulation period. Even so, due to a higher increase in production for the no-tariff scenario, a lower local price in this scenario would be expected for later stages of the simulation. This difference is not significant in the results because of the high variability. The predicted real local prices are three times as high in January as they are in the peak production season in all scenarios. The real local price is predicted to decrease by 40 percent over the simulation period.

The f.o.b. price in the South African port is of greater importance for the local producer because approximately 60 percent of the crop is exported. This accounts for approximately 80 percent of gross turnover. The seasonality of the f.o.b. prices is inverted with respect to the seasonality of the prices at the fresh produce markets in South Africa. The prices in

September are twice as high as the prices in January and February. The f.o.b. prices for the no-tariff scenario are considerably different from the other two scenarios. The difference is especially large in the months from January until April and November and December. Especially in the months from July until October when South African exports have an impact on the EU prices, real f.o.b. prices in the base scenario benefit from the lower increase in exports. Therefore, the predicted real f.o.b. prices for all three scenarios are similar despite different applied tariffs. The real f.o.b. price in Rand is expected to increase on average by 30 percent. The increase in the EU off-season is smaller than in the EU on-season. This is caused by larger absolute tariff reductions during the on-season than the off-season. The observation of an increasing difference between local and f.o.b. prices for fresh oranges in South Africa can also be made for the current decade.

The area planted with oranges is an indicator for the total production. Due to the time delay between plantings and the first crop, changes in area planted with oranges are an early indicator of future changes in the production. The predicted area under oranges increases by 2.5 percent under the base scenario from 1997 until 2011, by 4 percent under the FTA scenario and 8 percent under the no-tariff scenario. Generally, areas in regions planted with Navels are on a decrease, whereas areas in regions planted with Valencias are on an increase. Recent observations of the cultivar mix in the South African orange industry confirm this observation.

The change in total production is dependent on the total area planted with oranges and on the age of the orchards. Comparing the results of area planted with oranges and total production, the latter increases by ten percent over the first half of the simulation period, whereas the former remains almost constant. The reason is that the proportion of mature trees is

increasing in relation to immature trees. During the second half of the simulation period the total orange production in the base and FTA scenario does not change. By 2011 the total production in the FTA scenario is slightly higher than in the base scenario but it is not statistically significant. With an increase of 15 percent, the no-tariff scenario has a five percent higher increase in production than the other scenarios. Only a longer term simulation will result in clearer differences between the three scenarios.

Real gross margins are increasing dramatically in all three scenarios. Due to the total tariff elimination in the EU from the first year in the no-tariff scenario, the real gross margin for this scenario is considerably higher during the first years. On the other hand, the rate of increase for the no-tariff is smaller than for the other two scenarios. This is expected because the difference in real f.o.b. prices is declining, which is mainly caused by the reduction of EU tariffs. This effect is only partly outweighed by the faster increase in production for the no-tariff scenario. The difference between the base and the FTA scenario is minimal. In the first three years of the simulation period, the real gross margins are predicted to be the same for both scenarios. Thereafter, it is expected that the FTA scenario is predicted to be slightly beneficial. This can be confirmed by observing the development of the real gross margins but the high variability of the results disallow any statistical significance. Analysing gross margins on a regional basis shows that the regions planted with Valencias have a higher rate of increase in area planted than the regions planted with Navels. The difference between both cultivars occurs mainly on total gross margins as per hectare gross margins increase at a similar rate. The average per hectare gross margin is approximately one and a half times higher for Valencia orchards than for Navel orchards.

Analysing real South African consumer surplus indicates that the no-tariff scenario is the most beneficial for South African consumers. During the final years of the simulation period the FTA scenario seems to be slightly more beneficial for the South African consumer than the base scenario. As there is almost no difference in local prices and only a small difference in production, this result is expected. The predicted increase in real total consumer surplus is twice as high as the South African population growth. Therefore, per capita South African consumer surplus originating from oranges will also increase over the simulation period. The differences between the scenarios on the EU market with regards to EU consumer surplus and EU producer prices will be even more marginal. Because South African exports mainly arrive in the EU off-season, most EU producers will only be marginally affected by reduced prices due to higher South African supply. EU consumers will benefit from slightly lower prices of oranges during the South African export season.

South African producers will and consumers may benefit slightly from the FTA between South Africa and the EU, but the FTA only captures parts of the distortion caused by EU protection for fresh oranges. Therefore, the FTA can only be seen as a first step in the direction of free trade in fresh oranges between South Africa and the EU. The trade simulation model could be used to accompany other trade negotiations to evaluate the effects of changes in trade barriers on the local industry and consumers. It is possible to use the trade simulation model for other products. A special advantage would be with regards to products with seasonality in trade.

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Appendix I: Variable list and mathematical model

This appendix shows the complete list of variables and the mathematical model of the base scenario. The type of variable referred to relates to the building blocks within a STELLA model (Chapter 4). Stocks (S) are always shown with all relating Flows (F). Converters (C) are shown on their own. The differences between the base scenario and the FTA scenario and between the base scenario and the no-tariff scenario are given at the end.

List of content

Exchange rate model

Description	Type	Formula
Trend	S	CPI_trend(t) = CPI_trend(t - dt) + (annual_change) * dt INIT CPI_trend = 84
Annual change of trend	F	annual_change = 12
Consumer Price Index previous December	S	CPI_dec1(t) = CPI_dec1(t - dt) + (CPI_decdif) * dt INIT CPI_dec1 = 191.7
Annual change in Consumer Price Index December	F	CPI_decdif = CPI_dec-CPI_dec1
Consumer Price Index previous December	C	CPI_decold = CPI_dec1
Consumer Price Index January	S	CPI_jan0(t) = CPI_jan0(t - dt) + (CPI_jandif) * dt INIT CPI_jan0 = 193.1
Annual change in Consumer Price Index January	F	CPI_jandif = CPI_jan1-CPI_jan0
Consumer Price Index January	C	CPI_jan = CPI_jan0
Consumer Price Index February	C	CPI_feb = normal(1.151605*(CPI_trend+2)+94.153548,1.54282)
Consumer Price Index March	C	CPI_mar = normal(1.151605*(CPI_trend+3)+94.153548,1.54282)
Consumer Price Index April	C	CPI_apr = normal(1.151605*(CPI_trend+4)+94.153548,1.54282)
Consumer Price Index May	C	CPI_may = normal(1.151605*(CPI_trend+5)+94.153548,1.54282)
Consumer Price Index June	C	CPI_jun = normal(1.151605*(CPI_trend+6)+94.153548,1.54282)
Consumer Price Index July	C	CPI_jul = normal(1.151605*(CPI_trend+7)+94.153548,1.54282)
Consumer Price Index August	C	CPI_aug = normal(1.151605*(CPI_trend+8)+94.153548,1.54282)
Consumer Price Index September	C	CPI_sep = normal(1.151605*(CPI_trend+9)+94.153548,1.54282)
Consumer Price Index October	C	CPI_oct = normal(1.151605*(CPI_trend+10)+94.153548,1.54282)
Consumer Price Index November	C	CPI_nov = normal(1.151605*(CPI_trend+11)+94.153548,1.54282)
Consumer Price Index December	C	CPI_dec = normal(1.151605*(CPI_trend+12)+94.153548,1.54282)
Consumer Price index following January	C	CPI_jan1 = normal(1.151605*(CPI_trend+13)+94.153548,1.54282)
Annual Consumer Price Index	C	annual_CPI = (CPI_apr+CPI_aug+CPI_dec+CPI_feb+CPI_jan+CPI_jul+CPI_jun+CPI_mar+CPI_may+CPI_nov+CPI_oct+CPI_sep)/12
Annual Producer Price Index	C	annual_ppi = normal(10.317+0.722*annual_CPI,5.946)
Consumer Price Index EU January	S	CPI_g01old(t) = CPI_g01old(t - dt) + (annual_increase) * dt INIT CPI_g01old = 120.4
Annual change in Consumer Price Index EU January	F	annual_increase = CPI_g01-CPI_g01old
Consumer Price Index EU February	C	CPI_g02 = normal(0.991365*CPI_g01old+1.209146,0.26324)
Consumer Price Index EU March	C	CPI_g03 = normal(0.991365*CPI_g02+1.209146,0.26324)
Consumer Price Index EU April	C	CPI_g04 = normal(0.991365*CPI_g03+1.209146,0.26324)
Consumer Price Index EU May	C	CPI_g05 = normal(0.991365*CPI_g04+1.209146,0.26324)
Consumer Price Index EU June	C	CPI_g06 = normal(0.991365*CPI_g05+1.209146,0.26324)
Consumer Price Index EU July	C	CPI_g07 = normal(0.991365*CPI_g06+1.209146,0.26324)
Consumer Price Index EU August	C	CPI_g08 = normal(0.991365*CPI_g07+1.209146,0.26324)
Consumer Price Index EU September	C	CPI_g09 = normal(0.991365*CPI_g08+1.209146,0.26324)

Consumer Price Index EU October	C	CPI_g10 = normal(0.991365*CPI_g09+1.209146,0.26324)
Consumer Price Index EU November	C	CPI_g11 = normal(0.991365*CPI_g10+1.209146,0.26324)
Consumer Price Index EU December	C	CPI_g12 = normal(0.991365*CPI_g11+1.209146,0.26324)
Consumer Price Index EU following January	C	CPI_g01 = normal(0.991365*CPI_g12+1.209146,0.26324)
Annual Consumer Price Index EU	C	CPI_gyr = (CPI_g01old+CPI_g02+CPI_g03+CPI_g04+CPI_g05+CPI_g06+CPI_g07+CPI_g08+CPI_g09+CPI_g10+CPI_g11+CPI_g12)/12
Exchange rate previous December	S	ex_dec1(t) = ex_dec1(t - dt) + (ex_decdif) * dt INIT ex_dec1 = 5.8212
Annual change in exchange rate December	F	ex_decdif = ex_dec-ex_dec1
Exchange rate previous December	C	ex_decold = ex_dec1
Exchange rate January	S	ex_jan1(t) = ex_jan1(t - dt) + (ex_jandif) * dt INIT ex_jan1 = 5.6231
Annual change in exchange rate January	F	ex_jandif = ex_jan-ex_jan1
Exchange rate January	C	ex_janold = ex_jan1
Exchange rate February	C	ex_feb = EXP(normal((1.395*(logn(CPI_feb)-.961*logn(CPI_jan))-1.179*(logn(CPI_g02)-.961*logn(CPI_g01old))),0.01974)+0.961*logn(ex_janold))
Exchange rate March	C	ex_mar = EXP(normal((1.395*(logn(CPI_mar)-.961*logn(CPI_feb))-1.179*(logn(CPI_g03)-.961*logn(CPI_g02))),0.01974)+0.961*logn(ex_feb))
Exchange rate April	C	ex_apr = EXP(normal((1.395*(logn(CPI_apr)-.961*logn(CPI_mar))-1.179*(logn(CPI_g04)-.961*logn(CPI_g03))),0.01974)+0.961*logn(ex_mar))
Exchange rate May	C	ex_may = EXP(normal((1.395*(logn(CPI_may)-.961*logn(CPI_apr))-1.179*(logn(CPI_g05)-.961*logn(CPI_g04))),0.01974)+0.961*logn(ex_apr))
Exchange rate June	C	ex_jun = EXP(normal((1.395*(logn(CPI_jun)-.961*logn(CPI_may))-1.179*(logn(CPI_g06)-.961*logn(CPI_g05))),0.01974)+0.961*logn(ex_may))
Exchange rate July	C	ex_jul = EXP(normal((1.395*(logn(CPI_jul)-.961*logn(CPI_jun))-1.179*(logn(CPI_g07)-.961*logn(CPI_g06))),0.01974)+0.961*logn(ex_jun))
Exchange rate August	C	ex_aug = EXP(normal((1.395*(logn(CPI_aug)-.961*logn(CPI_jul))-1.179*(logn(CPI_g08)-.961*logn(CPI_g07))),0.01974)+0.961*logn(ex_jul))
Exchange rate September	C	ex_sep = EXP(normal((1.395*(logn(CPI_sep)-.961*logn(CPI_aug))-1.179*(logn(CPI_g09)-.961*logn(CPI_g08))),0.01974)+0.961*logn(ex_aug))
Exchange rate October	C	ex_oct = EXP(normal((1.395*(logn(CPI_oct)-.961*logn(CPI_sep))-1.179*(logn(CPI_g10)-.961*logn(CPI_g09))),0.01974)+0.961*logn(ex_sep))
Exchange rate November	C	ex_nov = EXP(normal((1.395*(logn(CPI_nov)-.961*logn(CPI_oct))-1.179*(logn(CPI_g11)-.961*logn(CPI_g10))),0.01974)+0.961*logn(ex_oct))
Exchange rate December	C	ex_dec = EXP(normal((1.395*(logn(CPI_dec)-.961*logn(CPI_nov))-1.179*(logn(CPI_g12)-.961*logn(CPI_g11))),0.01974)+0.961*logn(ex_nov))
Exchange rate following January	C	ex_jan = EXP(normal((1.395*(logn(CPI_jan1)-.961*logn(CPI_dec))-1.179*(logn(CPI_g01)-.961*logn(CPI_g12))),0.01974)+0.961*logn(ex_dec))
Annual exchange rate	C	ex_ann = (ex_jan1+ex_apr+ex_aug+ex_dec+ex_feb+ex_jul+ex_jun+ex_mar+ex_may+ex_nov+ex_oct+ex_sep)/12
Consumer surplus	C	Consumer_surplus = (670.62/2*(local_productionlv+local_productionnn+local_productionnv+local_productionon+local_productionov+local_pr

		oductionsn+local_productionsv))-(100/(0.9*annual_CPI*2)*(local_turnoverlv+local_turnovernn+local_turnovernv+local_turnoveron+local_turnoverov+local_turnoversn+local_turnoversv))
Population January	S	Pop_01old(t) = Pop_01old(t - dt) + (annual_pop_growth) * dt INIT Pop_01old = 40778973
Annual change in population January	F	annual_pop_growth = pop01-Pop_01old
Population January	C	pop01old = Pop_01old
Population February	C	pop02 = 1.0004572*Pop_01old+46549
Population March	C	pop03 = 1.0004572*pop02+46549
Population April	C	pop04 = 1.0004572*pop03+46549
Population May	C	pop05 = 1.0004572*pop04+46549
Population June	C	pop06 = 1.0004572*pop05+46549
Population July	C	pop07 = 1.0004572*pop06+46549
Population August	C	pop08 = 1.0004572*pop07+46549
Population September	C	pop09 = 1.0004572*pop08+46549
Population October	C	pop10 = 1.0004572*pop09+46549
Population November	C	pop11 = 1.0004572*pop10+46549
Population December	C	pop12 = 1.0004572*pop11+46549
Population following January	C	pop01 = 1.0004572*pop12+46549
Annual population	C	pop_ann = (Pop_01old+pop02+pop03+pop04+pop05+pop06+pop07+pop08+pop09+pop10+pop11+pop12)/12

Export market model

Description	**Type**	**Formula**
Total exports in January in tons	C	exp01 = exp01lv+exp01nn+exp01nv+exp01on+exp01ov+exp01sn+exp01sv
Total exports in February in tons	C	exp02 = exp02lv+exp02nn+exp02nv+exp02on+exp02ov+exp02sn+exp02sv
Total exports in March in tons	C	exp03 = exp03lv+exp03nn+exp03nv+exp03on+exp03ov+exp03sn+exp03sv
Total exports in April in tons	C	exp04 = exp04lv+exp04nn+exp04nv+exp04on+exp04ov+exp04sn+exp04sv
Total exports in May in tons	C	exp05 = exp05lv+exp05nn+exp05nv+exp05on+exp05ov+exp05sn+exp05sv
Total exports in June in tons	C	exp06 = exp06lv+exp06nn+exp06nv+exp06on+exp06ov+exp06sn+exp06sv
Total exports in July in tons	C	exp07 = exp07lv+exp07nn+exp07nv+exp07on+exp07ov+exp07sn+exp07sv
Total exports in August in tons	C	exp08 = exp08lv+exp08nn+exp08nv+exp08on+exp08ov+exp08sn+exp08sv
Total exports in September in tons	C	exp09 = exp09lv+exp09nn+exp09nv+exp09on+exp09ov+exp09sn+exp09sv
Total exports in October in tons	C	exp10 = exp10lv+exp10nn+exp10nv+exp10on+exp10ov+exp10sn+exp10sv
Total exports in November in tons	C	exp11 =

		exp11lv+exp11nn+exp11nv+exp11on+exp11ov+exp11sn+exp11sv
Total exports in December in tons	C	exp12 = exp12lv+exp12nn+exp12nv+exp12on+exp12ov+exp12sn+exp12sv
EU entry price in Euro previous December	S	dec_cif1(t) = dec_cif1(t - dt) + (dec_cifdif) * dt INIT dec_cif1 = 524.76
Annual change in EU entry price in December	F	dec_cifdif = dec_cif-dec_cif1
EU entry price in Euro previous December	C	dec_cifold = dec_cif1
EU entry price in Euro in January	S	jan_cif1(t) = jan_cif1(t - dt) + (jan_cifdif) * dt INIT jan_cif1 = 505.48
Annual change in EU entry price in January	F	jan_cifdif = jan_cif-jan_cif1
EU entry price in Euro in January	C	jan_cifold = jan_cif1
EU entry price in Euro in February	C	feb_cif = normal(347.89,43.37)*CPI_g02/100
EU entry price in Euro in March	C	mar_cif = normal(368.90,51.49)*CPI_g03/100
EU entry price in Euro in April	C	apr_cif = normal(370.80,63.07)*CPI_g04/100
EU entry price in Euro in May	C	may_cif = normal(373.37,69.74)*CPI_g05/100
EU entry price in Euro in June	C	jun_cif = normal(357.10,69.40)*CPI_g06/100
EU entry price in Euro in July	C	jul_cif = normal(exp(-0.228*logn(exp06)+8.271),56.30)*CPI_g07/100
EU entry price in Euro in August	C	aug_cif = normal(exp(-0.401*logn(exp07)+10.202),55.92)*CPI_g08/100
EU entry price in Euro in September	C	sep_cif = normal(exp(-0.287*logn(exp08)+9.031),28.82)*CPI_g09/100
EU entry price in Euro in October	C	oct_cif = normal(exp(-0.324*logn(exp09)+9.241),42.65)*CPI_g10/100
EU entry price in Euro in November	C	nov_cif = normal(409.65,59.64)*CPI_g11/100
EU entry price in Euro in December	C	dec_cif = normal(372.74,73.97)*CPI_g12/100
EU entry price in Euro following January	C	jan_cif = normal(350.95,69.39)*CPI_g01/100
Applied EU tariff in February and March	S	febmar_tar(t) = febmar_tar(t - dt) + (- febmar_red) * dt INIT febmar_tar = 18.6667
EU tariff reduction in February and March	F	febmar_red = .6667
Applied EU tariff in April	S	apr_tar(t) = apr_tar(t - dt) + (- apr_red) * dt INIT apr_tar = 12.1333
EU tariff reduction in April	F	apr_red = .4333
Applied EU tariff in May	S	may_tar(t) = may_tar(t - dt) + (- may_red) * dt INIT may_tar = 4.7
EU tariff reduction in May	F	may_red = 0.1667
Applied EU tariff in June to September	S	junsep_tar(t) = junsep_tar(t - dt) + (- junsep_red) * dt INIT junsep_tar = 3.7
EU tariff reduction in June to September	F	junsep_red = 0.1333
Applied EU tariff in October	S	oct_tar(t) = oct_tar(t - dt) + (- oct_red) * dt INIT oct_tar = 10.8
EU tariff reduction in October	F	oct_red = 0.4
Applied EU tariff in November	S	nov_tar(t) = nov_tar(t - dt) + (- nov_red) * dt INIT nov_tar = 18
EU tariff reduction in November	F	nov_red = 0.6667
Applied EU tariff in December and January	S	decjan_tar(t) = decjan_tar(t - dt) + (- decjan_red) * dt INIT decjan_tar = 18
EU tariff reduction in December and January	F	decjan_red = .6667
EU threshold price for the entry price system	S	entry_price(t) = entry_price(t - dt) + (- entry_red) * dt INIT entry_price = 366
Annual reduction of EU threshold price	F	entry_red = 3
EU maximum tariff equivalent	S	MTE(t) = MTE(t - dt) + (- MTE_red) * dt INIT MTE = 83
Annual change in EU maximum tariff equivalent	F	MTE_red = entry_red
Transport costs between South Africa and the EU in Euro	C	transport = normal(150,10)

f.o.b. price in Euro in February	C	feb_eur = IF(feb_cif/(1+febmar_tar/100)-MTE<0.92*entry_price)THEN((feb_cif-MTE)/(1+febmar_tar/100)-transport)ELSE(feb_cif/(1+febmar_tar/100)-transport)
f.o.b. price in Euro in March	C	mar_eur = IF(mar_cif/(1+febmar_tar/100)-MTE<0.92*entry_price)THEN((mar_cif-MTE)/(1+febmar_tar/100)-transport)ELSE(mar_cif/(1+febmar_tar/100)-transport)
f.o.b. price in Euro in April	C	apr_eur = IF(apr_cif/(1+apr_tar/100)-MTE<0.92*entry_price)THEN((apr_cif-MTE)/(1+apr_tar/100)-transport)ELSE(apr_cif/(1+apr_tar/100)-transport)
f.o.b. price in Euro in May	C	may_eur = IF(may_cif/(1+may_tar/100)-MTE<0.92*entry_price)THEN((may_cif-MTE)/(1+may_tar/100)-transport)ELSE(may_cif/(1+may_tar/100)-transport)
f.o.b. price in Euro in June	C	jun_eur = jun_cif/(1+junsep_tar/100)-transport
f.o.b. price in Euro in July	C	jul_eur = jul_cif/(1+junsep_tar/100)-transport
f.o.b. price in Euro in August	C	aug_eur = aug_cif/(1+junsep_tar/100)-transport
f.o.b. price in Euro in September	C	sep_eur = sep_cif/(1+junsep_tar/100)-transport
f.o.b. price in Euro in October	C	oct_eur = oct_cif/(1+oct_tar/100)-transport
f.o.b. price in Euro in November	C	nov_eur = nov_cif/(1+nov_tar/100)-transport
f.o.b. price in Euro in December	C	dec_eur = IF(dec_cif/(1+decjan_tar/100)-MTE<0.92*entry_price)THEN((dec_cif-MTE)/(1+decjan_tar/100)-transport-entry_red)ELSE(dec_cif/(1+decjan_tar/100)-transport)
f.o.b. price in Euro following January	C	jan_eur = IF(jan_cif/(1+decjan_tar/100)-MTE<0.92*entry_price)THEN((jan_cif-MTE)/(1+decjan_tar/100)-transport-entry_red)ELSE(jan_cif/(1+decjan_tar/100)-transport)
f.o.b. price in Rand in February	C	feb_fob = ex_feb*feb_eur
f.o.b. price in Rand in March	C	mar_fob = ex_mar*mar_eur
f.o.b. price in Rand in April	C	apr_fob = apr_eur*ex_apr
f.o.b. price in Rand in May	C	may_fob = ex_may*may_eur
f.o.b. price in Rand in June	C	jun_fob = ex_jun*jun_eur
f.o.b. price in Rand in July	C	jul_fob = ex_jul*jul_eur
f.o.b. price in Rand in August	C	aug_fob = aug_eur*ex_aug
f.o.b. price in Rand in September	C	sep_fob = ex_sep*sep_eur
f.o.b. price in Rand in October	C	oct_fob = ex_oct*oct_eur
f.o.b. price in Rand in November	C	nov_fob = ex_nov*nov_eur
f.o.b. price in Rand in December	C	dec_fob = dec_eur*ex_dec
f.o.b. price in Rand following January	C	jan_fob = ex_jan*jan_eur

Local market model

Description	**Type**	**Formula**
Total amount sold locally in January in tons	C	fresh01 = (loc01lv+loc01nn+loc01nv+loc01on+loc01ov+loc01sn+loc01sv)
Total amount sold locally in February in tons	C	fresh02 = (loc02lv+loc02nn+loc02nv+loc02on+loc02ov+loc02sn+loc02sv)
Total amount sold locally in March in tons	C	fresh03 = (loc03lv+loc03nn+loc03nv+loc03on+loc03ov+loc03sn+loc03sv)
Total amount sold locally in April in tons	C	fresh04 = (loc04lv+loc04nn+loc04nv+loc04on+loc04ov+loc04sn+loc04sv)

Total amount sold locally in May in tons	C	fresh05 = (loc05lv+loc05nn+loc05nv+loc05on+loc05ov+loc05sn+loc05sv)
Total amount sold locally in June in tons	C	fresh06 = (loc06lv+loc06nn+loc06nv+loc06on+loc06ov+loc06sn+loc06sv)
Total amount sold locally in July in tons	C	fresh07 = (loc07lv+loc07nn+loc07nv+loc07on+loc07ov+loc07sn+loc07sv)
Total amount sold locally in August in tons	C	fresh08 = (loc08lv+loc08nn+loc08nv+loc08on+loc08ov+loc08sn+loc08sv)
Total amount sold locally in September in tons	C	fresh09 = (loc09lv+loc09nn+loc09nv+loc09on+loc09ov+loc09sn+loc09sv)
Total amount sold locally in October in tons	C	fresh10 = (loc10lv+loc10nn+loc10nv+loc10on+loc10ov+loc10sn+loc10sv)
Total amount sold locally in November in tons	C	fresh11 = (loc11lv+loc11nn+loc11nv+loc11on+loc11ov+loc11sn+loc11sv)
Total amount sold locally in December in tons	C	fresh12 = (loc12lv+loc12nn+loc12nv+loc12on+loc12ov+loc12sn+loc12sv)
Trend	S	local_trend(t) = local_trend(t - dt) + (change) * dt INIT local_trend = 84
Annual change in trend	F	change = 12
Local price in Rand in January	C	Jan_price = (exp(normal((4.311-.301*LOGN(fresh01/pop01old*1000)-.0036*(local_trend+1)+.216*logn(ex_decold*dec_cifold/CPI_decold*100)),.1080)))*CPI_jan/100
Local price in Rand in February	C	Feb_price = (exp(normal((4.311-.301*LOGN(fresh02/pop02*1000)-.0036*(local_trend+2)+.216*logn(ex_janold*jan_cifold/CPI_jan*100)),.1080)))*CPI_feb/100
Local price in Rnad in March	C	Mar_price = (exp(normal((4.311-.301*LOGN(fresh03/pop03*1000)-.0036*(local_trend+3)+.216*logn(ex_feb*feb_cif/CPI_feb*100)),.1080)))*CPI_mar/100
Local price in Rand in April	C	Apr_price = (exp(normal((4.311-.301*LOGN(fresh04/pop04*1000)-.0036*(local_trend+4)+.216*logn(ex_mar*mar_cif/CPI_mar*100)),.1080)))*CPI_apr/100
Local price in Rand in May	C	May_price = (exp(normal((4.311-.301*LOGN(fresh05/pop05*1000)-.0036*(local_trend+5)+.216*logn(ex_apr*apr_cif/CPI_apr*100)),.1080)))*CPI_may/100
Local price in Rand in June	C	Jun_price = (exp(normal((4.311-.301*LOGN(fresh06/pop06*1000)-.0036*(local_trend+6)+.216*logn(ex_may*may_cif/CPI_may*100)),.1080)))*CPI_jun/100
Local price in Rand in July	C	Jul_price = (exp(normal((4.311-.301*LOGN(fresh07/pop07*1000)-.0036*(local_trend+7)+.216*logn(ex_jun*jun_cif/CPI_jun*100)),.1080)))*CPI_jul/100
Local price in Rand in August	C	Aug_price = (exp(normal((4.311-.301*LOGN(fresh08/pop08*1000)-.0036*(local_trend+8)+.216*logn(ex_jul*jul_cif/CPI_jul*100)),.1080)))*CPI_aug/100

Local price in Rand in September	C	Sep_price = (exp(normal((4.311-.301*LOGN(fresh09/pop09*1000)-.0036*(local_trend+9)+.216*logn(ex_aug*aug_cif/CPI_aug*100)),.1080)))*CPI_sep/100
Local price in Rand in October	C	Oct_price = (exp(normal((4.311-.301*LOGN(fresh10/pop10*1000)-.0036*(local_trend+10)+.216*logn(ex_sep*sep_cif/CPI_sep*100)),.1080)))*CPI_oct/100
Local price in Rand in November	C	Nov_price = (exp(normal((4.311-.301*LOGN(fresh11/pop11*1000)-.0036*(local_trend+11)+.216*logn(ex_oct*oct_cif/CPI_oct*100)),.1080)))*CPI_nov/100
Local price in Rand in December	C	Dec_price = (exp(normal((4.311-.301*LOGN(fresh12/pop12*1000)-.0036*(local_trend+12)+.216*logn(ex_nov*nov_cif/CPI_nov*100)),.1080)))*CPI_dec/100

Production model Lowveld (Valencias) (LV)

Description	Type	Formula
Area with trees in year 1 LV	S	Year_01lv(t) = Year_01lv(t - dt) + (Area_plantedlv - y01lv) * dt INIT Year_01lv = 158.69
Area of new planted trees LV	F	Area_plantedlv = exp(3.5109+2*logn((local_turnoverlv+export_turnoverlv)/total_costlv))
Ageing of trees from 1st to 2nd year LV	F	y01lv = Year_01lv
Area with trees in year 2 LV	S	Year_02lv(t) = Year_02lv(t - dt) + (y01lv - y02lv) * dt INIT Year_02lv = 158.69
Ageing of trees from 1st to 2nd year LV	F	y01lv = Year_01lv
Ageing of trees from 2nd to 3rd year LV	F	y02lv = Year_02lv
Area with trees in year 3 LV	S	Year_03lv(t) = Year_03lv(t - dt) + (y02lv - y03lv) * dt INIT Year_03lv = 158.69
Ageing of trees from 2nd to 3rd year LV	F	y02lv = Year_02lv
Ageing of trees from 3rd to 4th year LV	F	y03lv = Year_03lv
Area with trees in year 4 LV	S	Year_04lv(t) = Year_04lv(t - dt) + (y03lv - y04lv) * dt INIT Year_04lv = 158.69
Ageing of trees from 3rd to 4th year LV	F	y03lv = Year_03lv
Ageing of trees from 4th to 5th year LV	F	y04lv = Year_04lv
Area with trees in year 5 LV	S	Year_05lv(t) = Year_05lv(t - dt) + (y04lv - y05lv) * dt INIT Year_05lv = 158.69
Ageing of trees from 4th to 5th year LV	F	y04lv = Year_04lv
Ageing of trees from 5th to 6th year LV	F	y05lv = Year_05lv
Area with trees in year 6 LV	S	Year_06lv(t) = Year_06lv(t - dt) + (y05lv - y06lv) * dt INIT Year_06lv = 207.18
Ageing of trees from 5th to 6th year LV	F	y05lv = Year_05lv
Ageing of trees from 6th to 7th year LV	F	y06lv = Year_06lv
Area with trees in year 7 LV	S	Year_07lv(t) = Year_07lv(t - dt) + (y06lv - y07lv) * dt INIT Year_07lv = 207.18
Ageing of trees from 6th to 7th year LV	F	y06lv = Year_06lv
Ageing of trees from 7th to 8th year LV	F	y07lv = Year_07lv
Area with trees in year 8 LV	S	Year_08lv(t) = Year_08lv(t - dt) + (y07lv - y08lv) * dt INIT Year_08lv = 207.18
Ageing of trees from 7th to 8th year LV	F	y07lv = Year_07lv
Ageing of trees from 8th to 9th year LV	F	y08lv = Year_08lv
Area with trees in year 9 LV	S	Year_09lv(t) = Year_09lv(t - dt) + (y08lv - y09lv) * dt INIT Year_09lv = 207.18
Ageing of trees from 8th to 9th year LV	F	y08lv = Year_08lv

Ageing of trees from 9th to 10th year LV	F	y09lv = Year_09lv
Area with trees in year 10 LV	S	Year_10lv(t) = Year_10lv(t - dt) + (y09lv - y10lv) * dt INIT Year_10lv = 207.18
Ageing of trees from 9th to 10th year LV	F	y09lv = Year_09lv
Ageing of trees from 10th to 11th year LV	F	y10lv = Year_10lv
Area with trees in year 11 LV	S	Year_11lv(t) = Year_11lv(t - dt) + (y10lv - y11lv) * dt INIT Year_11lv = 133.71
Ageing of trees from 10th to 11th year LV	F	y10lv = Year_10lv
Ageing of trees from 11th year to maturity LV	F	y11lv = Year_11lv
Area with mature trees LV	S	Maturelv(t) = Maturelv(t - dt) + (y11lv - withdrawellv) * dt INIT Maturelv = 1710.34
Ageing of trees from 11th year to maturity LV	F	y11lv = Year_11lv
Withdrawal of orchards LV	F	withdrawellv = 0.052*Maturelv
Total area plated with oranges LV	C	Total_Arealv = Year_01lv+Year_02lv+Year_03lv+Year_04lv+Year_05lv+Year_06lv+Year_07lv+Year_08lv+Year_09lv+Year_10lv+Year_11lv+Maturelv
Yield per hectare of 3 year old trees LV	C	yi03lv = 0
Yield per hectare of 4 year old trees LV	C	yi04lv = 11.42
Yield per hectare of 5 year old trees LV	C	yi05lv = 17.52
Yield per hectare of 6 year old trees LV	C	yi06lv = 22.26
Yield per hectare of 7 year old trees LV	C	yi07lv = 32.9
Yield per hectare of 8 year old trees LV	C	yi08lv = 38.71
Yield per hectare of 9 year old trees LV	C	yi09lv = 43.55
Yield per hectare of 10 year old trees LV	C	yi10lv = 50.32
Yield per hectare of 11 year old trees LV	C	yi11lv = 54.19
Yield per hectare of mature trees LV	C	yimatlv = 60
Total production of 3 year old trees LV	C	prod03lv = yi03lv*Year_03lv
Total production of 4 year old trees LV	C	prod04lv = Year_04lv*yi04lv
Total production of 5 year old trees LV	C	prod05lv = Year_05lv*yi05lv
Total production of 6 year old trees LV	C	prod06lv = Year_06lv*yi06lv
Total production of 7 year old trees LV	C	prod07lv = yi07lv*Year_07lv
Total production of 8 year old trees LV	C	prod08lv = Year_08lv*yi08lv
Total production of 9 year old trees LV	C	prod09lv = Year_09lv*yi09lv
Total production of 10 year old trees LV	C	prod10lv = Year_10lv*yi10lv
Total production of 11 year old trees LV	C	prod11lv = yi11lv*Year_11lv
Total production of mature trees LV	C	prodmatlv = yimatlv*Maturelv
Yield variation LV	C	yieldlv = normal(1,0.1)
Total annual production in tons LV	C	total_productionlv = (prod03lv+prod04lv+prod05lv+prod06lv+prod07lv+prod08lv+prod09lv+prod10lv+prod11lv+prodmatlv)*yieldlv
Export share year 3 LV	C	ex%3lv = 0
Export share year 4 LV	C	ex%4lv = 0.4154
Export share year 5 LV	C	ex%5lv = 0.5159
Export share year 6 LV	C	ex%6lv = 0.6164
Export share year 7 LV	C	ex%7lv = 0.6633
Export share year 8 onwards LV	C	ex%8lv = 0.67
Variation of export share LV	C	exportlv = normal(1,0.1)
Total export amount in tons LV	C	export_productionlv = ((prodmatlv+prod11lv+prod10lv+prod09lv+prod08lv)*ex%8lv+prod07lv*ex%7lv+prod06lv*ex%6lv+ex%5lv*prod05lv+prod04lv*ex%4lv+ex%3lv*prod03lv)*exportlv*yieldlv
Production share January LV	C	jan%lv = 0
Production share February LV	C	feb%lv = 0
Production share March LV	C	mar%lv = 0.01
Production share April LV	C	apr%lv = 0.02
Production share May LV	C	may%lv = 0.08

Production share June LV	C	jun%lv = 0.18
Production share July LV	C	jul%lv = 0.22
Production share August LV	C	aug%lv = 0.25
Production share September LV	C	sep%lv = 0.16
Production share October LV	C	oct%lv = 0.05
Production share November LV	C	nov%lv = 0.02
Production share December LV	C	dec%lv = 0.01
Export amount January LV	C	exp01lv = jan%lv*export_productionlv
Export amount February LV	C	exp02lv = feb%lv*export_productionlv
Export amount March LV	C	exp03lv = mar%lv*export_productionlv
Export amount April LV	C	exp04lv = apr%lv*export_productionlv
Export amount May LV	C	exp05lv = may%lv*export_productionlv
Export amount June LV	C	exp06lv = jun%lv*export_productionlv
Export amount July LV	C	exp07lv = jul%lv*export_productionlv
Export amount August LV	C	exp08lv = aug%lv*export_productionlv
Export amount September LV	C	exp09lv = sep%lv*export_productionlv
Export amount October LV	C	exp10lv = oct%lv*export_productionlv
Export amount November LV	C	exp11lv = nov%lv*export_productionlv
Export amount December LV	C	exp12lv = dec%lv*export_productionlv
Turnover resulting from exports in Rand LV	C	export_turnoverlv = exp01lv*feb_fob+exp02lv*mar_fob+exp03lv*apr_fob+exp04lv*may_fob+exp05lv*jun_fob+exp06lv*jul_fob+exp07lv*aug_fob+exp08lv*sep_fob+exp09lv*oct_fob+exp10lv*nov_fob+exp11lv*dec_fob+exp12lv*jan_fob
Amount sold locally in January LV	C	loc01lv = jan%lv*local_productionlv
Amount sold locally in February LV	C	loc02lv = feb%lv*local_productionlv
Amount sold locally in March LV	C	loc03lv = mar%lv*local_productionlv
Amount sold locally in April LV	C	loc04lv = apr%lv*local_productionlv
Amount sold locally in May LV	C	loc05lv = may%lv*local_productionlv
Amount sold locally in June LV	C	loc06lv = jun%lv*local_productionlv
Amount sold locally in July LV	C	loc07lv = jul%lv*local_productionlv
Amount sold locally in August LV	C	loc08lv = aug%lv*local_productionlv
Amount sold locally in September LV	C	loc09lv = sep%lv*local_productionlv
Amount sold locally in October LV	C	loc10lv = oct%lv*local_productionlv
Amount sold locally in November LV	C	loc11lv = nov%lv*local_productionlv
Amount sold locally in December LV	C	loc12lv = dec%lv*local_productionlv
Total amount sold locally in tons LV	C	local_productionlv = total_productionlv-export_productionlv
Total turnover from production sold locally in Rand LV	C	local_turnoverlv = (Jan_price*loc01lv+loc02lv*Feb_price+Mar_price*loc03lv+loc04lv*Apr_price+May_price*loc05lv+loc06lv*Jun_price+Jul_price*loc07lv+loc08lv*Aug_price+Sep_price*loc09lv+loc10lv*Oct_price+Nov_price*loc11lv+loc12lv*Dec_price)*0.9
Real production cost year 1 LV	C	c01lv = 10253.83
Real production cost year 2 LV	C	c02lv = 1647.70
Real production cost year 3 LV	C	c03lv = 2328.23
Real production cost year 4 LV	C	c04lv = 2943.84
Real production cost year 5 LV	C	c05lv = 3606.86
Real production cost year6 LV	C	c06lv = 4306.35
Real production cost year 7 LV	C	c07lv = 4838.07
Real production cost year 8 LV	C	c08lv = 5159.74
Real production cost year 9 LV	C	c09lv = 5393.14
Real production cost year 10 onwards LV	C	c10lv = 5638.22
Total real production cost LV	C	production_costlv = Year_01lv*c01lv+Year_02lv*c02lv+c03lv*Year_03lv+Year_04lv*c04lv+c05lv*Year_05lv+Year_06lv*c06lv+Year_07lv*c07lv+Year_08lv*c08lv+Year_09lv*c09lv+(Year_10lv+Year_11lv+Maturelv)*c10lv

Real packing and transport cost per ton exported LV	C	pack&tr_exlv = 386.62
Real packing and transport cost per ton sold locally LV	C	pack&tr_loclv = 145.88
Real total packing and transport cost LV	C	packaging_transport_costlv = export_productionlv*(pack&tr_exlv)+local_productionlv*(pack&tr_loclv)
Real harvest cost per ton LV	C	hc_per_tonlv = 14.92
Real total harvest cost LV	C	harvest_costlv = hc_per_tonlv*total_productionlv
Total nominal costs LV	C	total_costlv = (harvest_costlv+packaging_transport_costlv+production_costlv)*annual_ppi/100

Production model North-West (Navels) (NN)

Description	Type	Formula
Area with trees in year 1 NN	S	Year01nn(t) = Year01nn(t - dt) + (Area_plantednn - y01nn) * dt INIT Year01nn = 38.48
Area of new planted trees NN	F	Area_plantednn = exp(2.4033+2*logn((local_turnovernn+export_turnovernn)/total_costnn))
Ageing of trees from 1st to 2nd year NN	F	y01nn = Year01nn
Area with trees in year 2 NN	S	Year02nn(t) = Year02nn(t - dt) + (y01nn - y02nn) * dt INIT Year02nn = 38.48
Ageing of trees from 1st to 2nd year NN	F	y01nn = Year01nn
Ageing of trees from 2nd to 3rd year NN	F	y02nn = Year02nn
Area with trees in year 3 NN	S	Year03nn(t) = Year03nn(t - dt) + (y02nn - y03nn) * dt INIT Year03nn = 38.48
Ageing of trees from 2nd to 3rd year NN	F	y02nn = Year02nn
Ageing of trees from 3rd to 4th year NN	F	y03nn = Year03nn
Area with trees in year 4 NN	S	Year04nn(t) = Year04nn(t - dt) + (y03nn - y04nn) * dt INIT Year04nn = 38.48
Ageing of trees from 3rd to 4th year NN	F	y03nn = Year03nn
Ageing of trees from 4th to 5th year NN	F	y04nn = Year04nn
Area with trees in year 5 NN	S	Year05nn(t) = Year05nn(t - dt) + (y04nn - y05nn) * dt INIT Year05nn = 38.48
Ageing of trees from 4th to 5th year NN	F	y04nn = Year04nn
Ageing of trees from 5th to 6th year NN	F	y05nn = Year05nn
Area with trees in year 6 NN	S	Year06nn(t) = Year06nn(t - dt) + (y05nn - y06nn) * dt INIT Year06nn = 35.92
Ageing of trees from 5th to 6th year NN	F	y05nn = Year05nn
Ageing of trees from 6th to 7th year NN	F	y06nn = Year06nn
Area with trees in year 7 NN	S	Year07nn(t) = Year07nn(t - dt) + (y06nn - y07nn) * dt INIT Year07nn = 35.92
Ageing of trees from 6th to 7th year NN	F	y06nn = Year06nn
Ageing of trees from 7th to 8th year NN	F	y07nn = Year07nn
Area with trees in year 8 NN	S	Year08nn(t) = Year08nn(t - dt) + (y07nn - y08nn) * dt INIT Year08nn = 35.92
Ageing of trees from 7th to 8th year NN	F	y07nn = Year07nn
Ageing of trees from 8th to 9th year NN	F	y08nn = Year08nn
Area with trees in year 9 NN	S	Year09nn(t) = Year09nn(t - dt) + (y08nn - y09nn) * dt INIT Year09nn = 35.92
Ageing of trees from 8th to 9th year NN	F	y08nn = Year08nn
Ageing of trees from 9th to 10th year NN	F	y09nn = Year09nn
Area with trees in year 10 NN	S	Year10nn(t) = Year10nn(t - dt) + (y09nn - y10nn) * dt INIT Year10nn = 35.92
Ageing of trees from 9th to 10th year NN	F	y09nn = Year09nn

Ageing of trees from 10^{th} to 11^{th} year NN	F	y10nn = Year10nn
Area with trees in year 11 NN	S	Year11nn(t) = Year11nn(t - dt) + (y10nn - y11nn) * dt INIT Year11nn = 46.18
Ageing of trees from 10^{th} to 11^{th} year NN	F	y10nn = Year10nn
Ageing of trees from 11^{th} to 12^{th} year NN	F	y11nn = Year11nn
Area with trees in year 12 NN	S	Year12nn(t) = Year12nn(t - dt) + (y11nn - y12nn) * dt INIT Year12nn = 46.18
Ageing of trees from 11^{th} to 12^{th} year NN	F	y11nn = Year11nn
Ageing of trees from 12^{th} to 13^{th} year NN	F	y12nn = Year12nn
Area with trees in year 13 NN	S	Year13nn(t) = Year13nn(t - dt) + (y12nn - y13nn) * dt INIT Year13nn = 46.18
Ageing of trees from 12^{th} to 13^{th} year NN	F	y12nn = Year12nn
Ageing of trees from 13^{th} to 14^{th} year NN	F	y13nn = Year13nn
Area with trees in year 14 NN	S	Year14nn(t) = Year14nn(t - dt) + (y13nn - y14nn) * dt INIT Year14nn = 46.18
Ageing of trees from 13^{th} to 14^{th} year NN	F	y13nn = Year13nn
Ageing of trees from 14^{th} year to maturity NN	F	y14nn = Year14nn
Area with mature trees NN	S	Maturenn(t) = Maturenn(t - dt) + (y14nn - withdrawelnn) * dt INIT Maturenn = 855.20
Ageing of trees from 14^{th} year to maturity NN	F	y14nn = Year14nn
Withdrawal of orchards NN	F	withdrawelnn = 0.052*Maturenn
Total area plated with oranges NN	C	Total_Areann = Year01nn+Year02nn+Year03nn+Year04nn+Year05nn+Year06nn+Year07nn+Year08nn+Year09nn+Year10nn+Year11nn+Year12nn+Year13nn+Year14nn+Maturenn
Yield per hectare of 3 year old trees NN	C	yi03nn = 0
Yield per hectare of 4 year old trees NN	C	yi04nn = 4
Yield per hectare of 5 year old trees NN	C	yi05nn = 7
Yield per hectare of 6 year old trees NN	C	yi06nn = 11
Yield per hectare of 7 year old trees NN	C	yi07nn = 16.5
Yield per hectare of 8 year old trees NN	C	yi08nn = 20.5
Yield per hectare of 9 year old trees NN	C	yi09nn = 25.25
Yield per hectare of 10 year old trees NN	C	yi10nn = 29.25
Yield per hectare of 11 year old trees NN	C	yi11nn = 32.75
Yield per hectare of 12 year old trees NN	C	yi12nn = 35
Yield per hectare of 13 year old trees NN	C	yi13nn = 37.25
Yield per hectare of 14 year old trees NN	C	yi14nn = 40
Yield per hectare of mature trees NN	C	yimatnn = 42
Total production of 3 year old trees NN	C	prod03nn = yi03nn*Year03nn
Total production of 4 year old trees NN	C	prod04nn = Year04nn*yi04nn
Total production of 5 year old trees NN	C	prod05nn = Year05nn*yi05nn
Total production of 6 year old trees NN	C	prod06nn = Year06nn*yi06nn
Total production of 7 year old trees NN	C	prod07nn = yi07nn*Year07nn
Total production of 8 year old trees NN	C	prod08nn = Year08nn*yi08nn
Total production of 9 year old trees NN	C	prod09nn = Year09nn*yi09nn
Total production of 10 year old trees NN	C	prod10nn = Year10nn*yi10nn
Total production of 11 year old trees NN	C	prod11nn = yi11nn*Year11nn
Total production of 12 year old trees NN	C	prod12nn = yi12nn*Year12nn
Total production of 13 year old trees NN	C	prod13nn = yi13nn*Year13nn
Total production of 14 year old trees NN	C	prod14nn = yi14nn*Year14nn
Total production of mature trees NN	C	prodmatnn = yimatnn*Maturenn
Yield variation NN	C	yieldnn = normal(1,0.1)
Total annual production in tons NN	C	total_productionnn = (prod03nn+prod04nn+prod05nn+prod06nn+prod07nn+prod08nn+prod09nn+prod10nn+prod11nn+prod12nn+prod13nn+prod14nn+prodmatnn)*yieldnn
Export share year 3 NN	C	ex%3nn = 0

Export share year 4 NN	C	ex%4nn = 0.48
Export share year 5 NN	C	ex%5nn = 0.515
Export share year 6 NN	C	ex%6nn = 0.575
Export share year 7 NN	C	ex%7nn = 0.6
Export share year 8 onwards NN	C	ex%8nn = 0.605
Variation of export share NN	C	exportnn = normal(1,0.1)
Total export amount in tons NN	C	export_productionnn = ((prodmatnn+prod14nn+prod13nn+prod12nn+prod11nn+prod10nn+prod09nn+prod08nn)*ex%8nn+prod07nn*ex%7nn+prod06nn*ex%6nn+ex%5nn*prod05nn+prod04nn*ex%4nn+ex%3nn*prod03nn)*exportnn*yieldnn
Total amount sold locally in tons NN	C	local_productionnn = total_productionnn-export_productionnn
Production share January NN	C	jan%nn = 0.02
Production share February NN	C	feb%nn = 0.04
Production share March NN	C	mar%nn = 0.08
Production share April NN	C	apr%nn = 0.18
Production share May NN	C	may%nn = 0.25
Production share June NN	C	jun%nn = 0.20
Production share July NN	C	jul%nn = 0.10
Production share August NN	C	aug%nn = 0.07
Production share September NN	C	sep%nn = 0.03
Production share October NN	C	oct%nn = 0.01
Production share November NN	C	nov%nn = 0
Production share December NN	C	dec%nn = 0
Export amount January NN	C	exp01nn = jan%nn*export_productionnn
Export amount February NN	C	exp02nn = feb%nn*export_productionnn
Export amount March NN	C	exp03nn = mar%nn*export_productionnn
Export amount April NN	C	exp04nn = apr%nn*export_productionnn
Export amount May NN	C	exp05nn = may%nn*export_productionnn
Export amount June NN	C	exp06nn = jun%nn*export_productionnn
Export amount July NN	C	exp07nn = jul%nn*export_productionnn
Export amount August NN	C	exp08nn = aug%nn*export_productionnn
Export amount September NN	C	exp09nn = sep%nn*export_productionnn
Export amount October NN	C	exp10nn = oct%nn*export_productionnn
Export amount November NN	C	exp11nn = nov%nn*export_productionnn
Export amount December NN	C	exp12nn = dec%nn*export_productionnn
Turnover resulting from exports in Rand NN	C	export_turnovernn = exp01nn*feb_fob+exp02nn*mar_fob+exp03nn*apr_fob+exp04nn*may_fob+exp05nn*jun_fob+exp06nn*jul_fob+exp07nn*aug_fob+exp08nn*sep_fob+exp09nn*oct_fob+exp10nn*nov_fob+exp11nn*dec_fob+exp12nn*jan_fob
Amount sold locally in January NN	C	loc01nn = jan%nn*local_productionnn
Amount sold locally in February NN	C	loc02nn = feb%nn*local_productionnn
Amount sold locally in March NN	C	loc03nn = mar%nn*local_productionnn
Amount sold locally in April NN	C	loc04nn = apr%nn*local_productionnn
Amount sold locally in May NN	C	loc05nn = may%nn*local_productionnn
Amount sold locally in June NN	C	loc06nn = jun%nn*local_productionnn
Amount sold locally in July NN	C	loc07nn = jul%nn*local_productionnn
Amount sold locally in August NN	C	loc08nn = aug%nn*local_productionnn
Amount sold locally in September NN	C	loc09nn = sep%nn*local_productionnn
Amount sold locally in October NN	C	loc10nn = oct%nn*local_productionnn
Amount sold locally in November NN	C	loc11nn = nov%nn*local_productionnn
Amount sold locally in December NN	C	loc12nn = dec%nn*local_productionnn
Total turnover from production sold locally in Rand NN	C	local_turnovernn = (Jan_price*loc01nn+loc02nn*Feb_price+Mar_price*loc03nn+loc04nn*Apr_price+May_price*loc05nn+loc06nn*Jun_pric

		e+Jul_price*loc07nn+loc08nn*Aug_price+Sep_price*loc09nn+loc10nn*Oct_price+Nov_price*loc11nn+loc12nn*Dec_price)*0.9
Real production cost year 1 NN	C	c01nn = 13654.37
Real production cost year 2 NN	C	c02nn = 1396.57
Real production cost year 3 NN	C	c03nn = 2255.84
Real production cost year 4 NN	C	c04nn = 3126.55
Real production cost year 5 NN	C	c05nn = 3706.82
Real production cost year6 NN	C	c06nn = 4375.06
Real production cost year 7 NN	C	c07nn = 4945.86
Real production cost year 8 NN	C	c08nn = 4970.36
Real production cost year 9 NN	C	c09nn = 5000.42
Real production cost year 10 onwards NN	C	c10nn = 5157.97
Total real production cost NN	C	production_costnn = Year01nn*c01nn+Year02nn*c02nn+c03nn*Year03nn+Year04nn*c04nn+c05nn*Year05nn+Year06nn*c06nn+Year07nn*c07nn+Year08nn*c08nn+Year09nn*c09nn+(Year10nn+Year11nn+Year12nn+Year13nn+Year14nn+Maturenn)*c10nn
Real packing and transport cost per ton exported NN	C	pack&tr_exnn = 386.62
Real packing and transport cost per ton sold locally NN	C	pack&tr_locnn = 145.88
Real total packing and transport cost NN	C	packaging_transport_costnn = export_productionnn*(pack&tr_exnn)+local_productionnn*(pack&tr_locnn)
Real harvest cost per ton NN	C	hc_per_tonnn = 14.92
Real total harvest cost NN	C	harvest_costnn = hc_per_tonnn*total_productionnn
Total nominal costs NN	C	total_costnn = (harvest_costnn+packaging_transport_costnn+production_costnn)*annual_ppi/100

Production model North-West (Valencias) (NV)

Description	**Type**	**Formula**
Area with trees in year 1 NV	S	Year01nv(t) = Year01nv(t - dt) + (Area_plantednv - y01nv) * dt INIT Year01nv = 27.60
Area of new planted trees NV	F	Area_plantednv = exp(1.7606+2*logn((local_turnovernv+export_turnovernv)/total_costnv))
Ageing of trees from 1st to 2nd year NV	F	y01nv = Year01nv
Area with trees in year 2 NV	S	Year02nv(t) = Year02nv(t - dt) + (y01nv - y02nv) * dt INIT Year02nv = 27.60
Ageing of trees from 1st to 2nd year NV	F	y01nv = Year01nv
Ageing of trees from 2nd to 3rd year NV	F	y02nv = Year02nv
Area with trees in year 3 NV	S	Year03nv(t) = Year03nv(t - dt) + (y02nv - y03nv) * dt INIT Year03nv = 27.60
Ageing of trees from 2nd to 3rd year NV	F	y02nv = Year02nv
Ageing of trees from 3rd to 4th year NV	F	y03nv = Year03nv
Area with trees in year 4 NV	S	Year04nv(t) = Year04nv(t - dt) + (y03nv - y04nv) * dt INIT Year04nv = 27.60
Ageing of trees from 3rd to 4th year NV	F	y03nv = Year03nv
Ageing of trees from 4th to 5th year NV	F	y04nv = Year04nv
Area with trees in year 5 NV	S	Year05nv(t) = Year05nv(t - dt) + (y04nv - y05nv) * dt INIT Year05nv = 27.60
Ageing of trees from 4th to 5th year NV	F	y04nv = Year04nv
Ageing of trees from 5th to 6th year NV	F	y05nv = Year05nv
Area with trees in year 6 NV	S	Year06nv(t) = Year06nv(t - dt) + (y05nv - y06nv) * dt INIT

		Year06nv = 36.03
Ageing of trees from 5th to 6th year NV	F	y05nv = Year05nv
Ageing of trees from 6th to 7th year NV	F	y06nv = Year06nv
Area with trees in year 7 NV	S	Year07nv(t) = Year07nv(t - dt) + (y06nv - y07nv) * dt INIT Year07nv = 36.03
Ageing of trees from 6th to 7th year NV	F	y06nv = Year06nv
Ageing of trees from 7th to 8th year NV	F	y07nv = Year07nv
Area with trees in year 8 NV	S	Year08nv(t) = Year08nv(t - dt) + (y07nv - y08nv) * dt INIT Year08nv = 36.03
Ageing of trees from 7th to 8th year NV	F	y07nv = Year07nv
Ageing of trees from 8th to 9th year NV	F	y08nv = Year08nv
Area with trees in year 9 NV	S	Year09nv(t) = Year09nv(t - dt) + (y08nv - y09nv) * dt INIT Year09nv = 36.03
Ageing of trees from 8th to 9th year NV	F	y08nv = Year08nv
Ageing of trees from 9th to 10th year NV	F	y09nv = Year09nv
Area with trees in year 10 NV	S	Year10nv(t) = Year10nv(t - dt) + (y09nv - y10nv) * dt INIT Year10nv = 36.03
Ageing of trees from 9th to 10th year NV	F	y09nv = Year09nv
Ageing of trees from 10th to 11th year NV	F	y10nv = Year10nv
Area with trees in year 11 NV	S	Year11nv(t) = Year11nv(t - dt) + (y10nv - y11nv) * dt INIT Year11nv = 23.25
Ageing of trees from 10th to 11th year NV	F	y10nv = Year10nv
Ageing of trees from 11th year to maturity NV	F	y11nv = Year11nv
Area with mature trees NV	S	Maturenv(t) = Maturenv(t - dt) + (y11nv - withdrawelnv) * dt INIT Maturenv = 297.45
Ageing of trees from 11th year to maturity NV	F	y11nv = Year11nv
Withdrawal of orchards NV	F	withdrawelnv = 0.052*Maturenv
Total area plated with oranges NV	C	Total_Areanv = Year01nv+Year02nv+Year03nv+Year04nv+Year05nv+Year06nv+Year07nv+Year08nv+Year09nv+Year10nv+Year11nv+Maturenv
Yield per hectare of 3 year old trees NV	C	yi03nv = 0
Yield per hectare of 4 year old trees NV	C	yi04nv = 11.42
Yield per hectare of 5 year old trees NV	C	yi05nv = 17.52
Yield per hectare of 6 year old trees NV	C	yi06nv = 22.26
Yield per hectare of 7 year old trees NV	C	yi07nv = 32.9
Yield per hectare of 8 year old trees NV	C	yi08nv = 38.71
Yield per hectare of 9 year old trees NV	C	yi09nv = 43.55
Yield per hectare of 10 year old trees NV	C	yi10nv = 50.32
Yield per hectare of 11 year old trees NV	C	yi11nv = 54.19
Yield per hectare of mature trees NV	C	yimatnv = 60
Total production of 3 year old trees NV	C	prod03nv = yi03nv*Year03nv
Total production of 4 year old trees NV	C	prod04nv = Year04nv*yi04nv
Total production of 5 year old trees NV	C	prod05nv = Year05nv*yi05nv
Total production of 6 year old trees NV	C	prod06nv = Year06nv*yi06nv
Total production of 7 year old trees NV	C	prod07nv = yi07nv*Year07nv
Total production of 8 year old trees NV	C	prod08nv = Year08nv*yi08nv
Total production of 9 year old trees NV	C	prod09nv = Year09nv*yi09nv
Total production of 10 year old trees NV	C	prod10nv = Year10nv*yi10nv
Total production of 11 year old trees NV	C	prod11nv = yi11nv*Year11nv
Total production of mature trees NV	C	prodmatnv = yimatnv*Maturenv
Yield variation NV	C	yieldnv = normal(1,0.1)
Total annual production in tons NV	C	total_productionnv = (prod03nv+prod04nv+prod05nv+prod06nv+prod07nv+prod08nv+prod09nv+prod10nv+prod11nv+prodmatnv)*yieldnv
Export share year 3 NV	C	ex%3nv = 0
Export share year 4 NV	C	ex%4nv = 0.4154

Export share year 5 NV	C	ex%5nv = 0.5159
Export share year 6 NV	C	ex%6nv = 0.6164
Export share year 7 NV	C	ex%7nv = 0.6633
Export share year 8 onwards NV	C	ex%8nv = 0.67
Variation of export share NV	C	exportnv = normal(1,0.1)
Total export amount in tons NV	C	export_productionnv = ((prodmatnv+prod11nv+prod10nv+prod09nv+prod08nv)*ex%8nv+prod07nv*ex%7nv+prod06nv*ex%6nv+ex%5nv*prod05nv+prod04nv*ex%4nv+ex%3nv*prod03nv)*exportnv*yieldnv
Total amount sold locally in tons NV	C	local_productionnv = total_productionnv-export_productionnv
Production share January NV	C	jan%nv = 0
Production share February NV	C	feb%nv = 0
Production share March NV	C	mar%nv = 0
Production share April NV	C	apr%nv = 0.01
Production share May NV	C	may%nv = 0.08
Production share June NV	C	jun%nv = 0.16
Production share July NV	C	jul%nv = 0.24
Production share August NV	C	aug%nv = 0.26
Production share September NV	C	sep%nv = 0.16
Production share October NV	C	oct%nv = 0.06
Production share November NV	C	nov%nv = 0.02
Production share December NV	C	dec%nv = 0.01
Export amount January NV	C	exp01nv = jan%nv*export_productionnv
Export amount February NV	C	exp02nv = feb%nv*export_productionnv
Export amount March NV	C	exp03nv = mar%nv*export_productionnv
Export amount April NV	C	exp04nv = apr%nv*export_productionnv
Export amount May NV	C	exp05nv = may%nv*export_productionnv
Export amount June NV	C	exp06nv = jun%nv*export_productionnv
Export amount July NV	C	exp07nv = jul%nv*export_productionnv
Export amount August NV	C	exp08nv = aug%nv*export_productionnv
Export amount September NV	C	exp09nv = sep%nv*export_productionnv
Export amount October NV	C	exp10nv = oct%nv*export_productionnv
Export amount November NV	C	exp11nv = nov%nv*export_productionnv
Export amount December NV	C	exp12nv = dec%nv*export_productionnv
Turnover resulting from exports in Rand NV	C	export_turnovernv = exp01nv*feb_fob+exp02nv*mar_fob+exp03nv*apr_fob+exp04nv*may_fob+exp05nv*jun_fob+exp06nv*jul_fob+exp07nv*aug_fob+exp08nv*sep_fob+exp09nv*oct_fob+exp10nv*nov_fob+exp11nv*dec_fob+exp12nv*jan_fob
Amount sold locally in January NV	C	loc01nv = jan%nv*local_productionnv
Amount sold locally in February NV	C	loc02nv = feb%nv*local_productionnv
Amount sold locally in March NV	C	loc03nv = mar%nv*local_productionnv
Amount sold locally in April NV	C	loc04nv = apr%nv*local_productionnv
Amount sold locally in May NV	C	loc05nv = may%nv*local_productionnv
Amount sold locally in June NV	C	loc06nv = jun%nv*local_productionnv
Amount sold locally in July NV	C	loc07nv = jul%nv*local_productionnv
Amount sold locally in August NV	C	loc08nv = aug%nv*local_productionnv
Amount sold locally in September NV	C	loc09nv = sep%nv*local_productionnv
Amount sold locally in October NV	C	loc10nv = oct%nv*local_productionnv
Amount sold locally in November NV	C	loc11nv = nov%nv*local_productionnv
Amount sold locally in December NV	C	loc12nv = dec%nv*local_productionnv
Total turnover from production sold locally in Rand NV	C	local_turnovernv = (Jan_price*loc01nv+loc02nv*Feb_price+Mar_price*loc03nv+loc04nv*Apr_price+May_price*loc05nv+loc06nv*Jun_price+Jul_price*loc07nv+loc08nv*Aug_price+Sep_price*loc09nv

		+loc10nv*Oct_price+Nov_price*loc11nv+loc12nv*Dec_price)*0.9
Real production cost year 1 NV	C	c01nv = 10253.83
Real production cost year 2 NV	C	c02nv = 1647.70
Real production cost year 3 NV	C	c03nv = 2328.23
Real production cost year 4 NV	C	c04nv = 2943.84
Real production cost year 5 NV	C	c05nv = 3606.86
Real production cost year6 NV	C	c06nv = 4306.35
Real production cost year 7 NV	C	c07nv = 4838.07
Real production cost year 8 NV	C	c08nv = 5159.74
Real production cost year 9 NV	C	c09nv = 5393.14
Real production cost year 10 onwards NV	C	c10nv = 5638.22
Total real production cost NV	C	production_costnv = Year01nv*c01nv+Year02nv*c02nv+c03nv*Year03nv+Year04nv*c04nv+c05nv*Year05nv+Year06nv*c06nv+Year07nv*c07nv+Year08nv*c08nv+Year09nv*c09nv+(Year10nv+Year11nv+Maturenv)*c10nv
Real packing and transport cost per ton exported NV	C	pack&tr_exnv = 386.62
Real packing and transport cost per ton sold locally NV	C	pack&tr_locnv = 145.88
Real total packing and transport cost NV	C	packaging_transport_costnv = export_productionnv*(pack&tr_exnv)+local_productionnv*(pack&tr_locnv)
Real harvest cost per ton NV	C	hc_per_tonnv = 14.92
Real total harvest cost NV	C	harvest_costnv = hc_per_tonnv*total_productionnv
Total nominal costs NV	C	total_costnv = (harvest_costnv+packaging_transport_costnv+production_costnv)*annual_ppi/100

Production model Olifants River (Navels) (ON)

Description	Type	Formula
Area with trees in year 1 ON	S	Year01on(t) = Year01on(t - dt) + (Area_plantedon - y01on) * dt INIT Year01on = 27.72
Area of new planted trees ON	F	Area_plantedon = exp(2.0511+2*logn((local_turnoveron+export_turnoveron)/total_coston))
Ageing of trees from 1st to 2nd year ON	F	y01on = Year01on
Area with trees in year 2 ON	S	Year02on(t) = Year02on(t - dt) + (y01on - y02on) * dt INIT Year02on = 27.72
Ageing of trees from 1st to 2nd year ON	F	y01on = Year01on
Ageing of trees from 2nd to 3rd year ON	F	y02on = Year02on
Area with trees in year 3 ON	S	Year03on(t) = Year03on(t - dt) + (y02on - y03on) * dt INIT Year03on = 27.72
Ageing of trees from 2nd to 3rd year ON	F	y02on = Year02on
Ageing of trees from 3rd to 4th year ON	F	y03on = Year03on
Area with trees in year 4 ON	S	Year04on(t) = Year04on(t - dt) + (y03on - y04on) * dt INIT Year04on = 27.72
Ageing of trees from 3rd to 4th year ON	F	y03on = Year03on
Ageing of trees from 4th to 5th year ON	F	y04on = Year04on
Area with trees in year 5 ON	S	Year05on(t) = Year05on(t - dt) + (y04on - y05on) * dt INIT Year05on = 27.72
Ageing of trees from 4th to 5th year ON	F	y04on = Year04on
Ageing of trees from 5th to 6th year ON	F	y05on = Year05on
Area with trees in year 6 ON	S	Year06on(t) = Year06on(t - dt) + (y05on - y06on) * dt INIT Year06on = 51.00

Ageing of trees from 5th to 6th year ON	F	y05on = Year05on
Ageing of trees from 6th to 7th year ON	F	y06on = Year06on
Area with trees in year 7 ON	S	Year07on(t) = Year07on(t - dt) + (y06on - y07on) * dt INIT Year07on = 51.00
Ageing of trees from 6th to 7th year ON	F	y06on = Year06on
Ageing of trees from 7th to 8th year ON	F	y07on = Year07on
Area with trees in year 8 ON	S	Year08on(t) = Year08on(t - dt) + (y07on - y08on) * dt INIT Year08on = 51.00
Ageing of trees from 7th to 8th year ON	F	y07on = Year07on
Ageing of trees from 8th to 9th year ON	F	y08on = Year08on
Area with trees in year 9 ON	S	Year09on(t) = Year09on(t - dt) + (y08on - y09on) * dt INIT Year09on = 51.00
Ageing of trees from 8th to 9th year ON	F	y08on = Year08on
Ageing of trees from 9th to 10th year ON	F	y09on = Year09on
Area with trees in year 10 ON	S	Year10on(t) = Year10on(t - dt) + (y09on - y10on) * dt INIT Year10on = 51.00
Ageing of trees from 9th to 10th year ON	F	y09on = Year09on
Ageing of trees from 10th to 11th year ON	F	y10on = Year10on
Area with trees in year 11 ON	S	Year11on(t) = Year11on(t - dt) + (y10on - y11on) * dt INIT Year11on = 59.87
Ageing of trees from 10th to 11th year ON	F	y10on = Year10on
Ageing of trees from 11th to 12th year ON	F	y11on = Year11on
Area with trees in year 12 ON	S	Year12on(t) = Year12on(t - dt) + (y11on - y12on) * dt INIT Year12on = 59.87
Ageing of trees from 11th to 12th year ON	F	y11on = Year11on
Ageing of trees from 12th to 13th year ON	F	y12on = Year12on
Area with trees in year 13 ON	S	Year13on(t) = Year13on(t - dt) + (y12on - y13on) * dt INIT Year13on = 59.87
Ageing of trees from 12th to 13th year ON	F	y12on = Year12on
Ageing of trees from 13th to 14th year ON	F	y13on = Year13on
Area with trees in year 14 ON	S	Year14on(t) = Year14on(t - dt) + (y13on - y14on) * dt INIT Year14on = 59.87
Ageing of trees from 13th to 14th year ON	F	y13on = Year13on
Ageing of trees from 14th year to maturity ON	F	y14on = Year14on
Area with mature trees ON	S	Matureon(t) = Matureon(t - dt) + (y14on - withdrawelon) * dt INIT Matureon = 475.61
Ageing of trees from 14th year to maturity ON	F	y14on = Year14on
Withdrawal of orchards ON	F	withdrawelon = 0.052*Matureon
Total area plated with oranges ON	C	Total_Areaon = Year01on+Year02on+Year03on+Year04on+Year05on+Year06on+Year07on+Year08on+Year09on+Year10on+Year11on+Year12on+Year13on+Year14on+Matureon
Yield per hectare of 3 year old trees ON	C	yi03on = 0
Yield per hectare of 4 year old trees ON	C	yi04on = 4
Yield per hectare of 5 year old trees ON	C	yi05on = 8
Yield per hectare of 6 year old trees ON	C	yi06on = 14
Yield per hectare of 7 year old trees ON	C	yi07on = 17.6
Yield per hectare of 8 year old trees ON	C	yi08on = 22
Yield per hectare of 9 year old trees ON	C	yi09on = 26
Yield per hectare of 10 year old trees ON	C	yi10on = 28.8
Yield per hectare of 11 year old trees ON	C	yi11on = 31.6
Yield per hectare of 12 year old trees ON	C	yi12on = 34
Yield per hectare of 13 year old trees ON	C	yi13on = 36.8
Yield per hectare of 14 year old trees ON	C	yi14on = 38.8
Yield per hectare of mature trees ON	C	yimaton = 40
Total production of 3 year old trees ON	C	prod03on = yi03on*Year03on
Total production of 4 year old trees ON	C	prod04on = Year04on*yi04on

Total production of 5 year old trees ON	C	prod05on = Year05on*yi05on
Total production of 6 year old trees ON	C	prod06on = Year06on*yi06on
Total production of 7 year old trees ON	C	prod07on = yi07on*Year07on
Total production of 8 year old trees ON	C	prod08on = Year08on*yi08on
Total production of 9 year old trees ON	C	prod09on = Year09on*yi09on
Total production of 10 year old trees ON	C	prod10on = Year10on*yi10on
Total production of 11 year old trees ON	C	prod11on = yi11on*Year11on
Total production of 12 year old trees ON	C	prod12on = yi12on*Year12on
Total production of 13 year old trees ON	C	prod13on = yi13on*Year13on
Total production of 14 year old trees ON	C	prod14on = yi14on*Year14on
Total production of mature trees ON	C	prodmaton = yimaton*Matureon
Yield variation ON	C	yieldon = normal(1,0.1)
Total annual production in tons ON	C	total_productionon = (prod03on+prod04on+prod05on+prod06on+prod07on+prod08on+prod09on+prod10on+prod11on+prod12on+prod13on+prod14on+prodmaton)*yieldon
Export share year 3 ON	C	ex%3on = 0
Export share year 4 ON	C	ex%4on = 0.52
Export share year 5 ON	C	ex%5on = 0.5525
Export share year 6 ON	C	ex%6on = 0.6175
Export share year 7 ON	C	ex%7on = 0.6435
Export share year 8 onwards ON	C	ex%8on = 0.65
Variation of export share ON	C	exporton = normal(1,0.1)
Total export amount in tons ON	C	export_productionon = ((prodmaton+prod14on+prod13on+prod12on+prod11on+prod10on+prod09on+prod08on)*ex%8on+prod07on*ex%7on+prod06on*ex%6on+ex%5on*prod05on+prod04on*ex%4on+ex%3on*prod03on)*exporton*yieldon
Total amount sold locally in tons ON	C	local_productionon = total_productionon-export_productionon
Production share January ON	C	jan%on = 0
Production share February ON	C	feb%on = 0
Production share March ON	C	mar%on = 0.02
Production share April ON	C	apr%on = 0.04
Production share May ON	C	may%on = 0.19
Production share June ON	C	jun%on = 0.22
Production share July ON	C	jul%on = 0.23
Production share August ON	C	aug%on = 0.15
Production share September ON	C	sep%on = 0.10
Production share October ON	C	oct%on = 0.04
Production share November ON	C	nov%on = 0.01
Production share December ON	C	dec%on = 0
Export amount January ON	C	exp01on = jan%on*export_productionon
Export amount February ON	C	exp02on = feb%on*export_productionon
Export amount March ON	C	exp03on = mar%on*export_productionon
Export amount April ON	C	exp04on = apr%on*export_productionon
Export amount May ON	C	exp05on = may%on*export_productionon
Export amount June ON	C	exp06on = jun%on*export_productionon
Export amount July ON	C	exp07on = jul%on*export_productionon
Export amount August ON	C	exp08on = aug%on*export_productionon
Export amount September ON	C	exp09on = sep%on*export_productionon
Export amount October ON	C	exp10on = oct%on*export_productionon
Export amount November ON	C	exp11on = nov%on*export_productionon
Export amount December ON	C	exp12on = dec%on*export_productionon
Turnover resulting from exports in Rand ON	C	export_turnoveron = exp01on*feb_fob+exp02on*mar_fob+exp03on*apr_fob+exp04on*may_fob+exp05on*jun_fob+exp06on*jul_fob+exp07o

		n*aug_fob+exp08on*sep_fob+exp09on*oct_fob+exp10on*nov_fob+exp11on*dec_fob+exp12on*jan_fob
Amount sold locally in January ON	C	loc01on = jan%on*local_productionon
Amount sold locally in February ON	C	loc02on = feb%on*local_productionon
Amount sold locally in March ON	C	loc03on = mar%on*local_productionon
Amount sold locally in April ON	C	loc04on = apr%on*local_productionon
Amount sold locally in May ON	C	loc05on = may%on*local_productionon
Amount sold locally in June ON	C	loc06on = jun%on*local_productionon
Amount sold locally in July ON	C	loc07on = jul%on*local_productionon
Amount sold locally in August ON	C	loc08on = aug%on*local_productionon
Amount sold locally in September ON	C	loc09on = sep%on*local_productionon
Amount sold locally in October ON	C	loc10on = oct%on*local_productionon
Amount sold locally in November ON	C	loc11on = nov%on*local_productionon
Amount sold locally in December ON	C	loc12on = dec%on*local_productionon
Total turnover from production sold locally in Rand ON	C	local_turnoveron = (Jan_price*loc01on+loc02on*Feb_price+Mar_price*loc03on+loc04on*Apr_price+May_price*loc05on+loc06on*Jun_price+Jul_price*loc07on+loc08on*Aug_price+Sep_price*loc09on+loc10on*Oct_price+Nov_price*loc11on+loc12on*Dec_price)*0.9
Real production cost year 1 ON	C	c01on = 17171.41
Real production cost year 2 ON	C	c02on = 1322.39
Real production cost year 3 ON	C	c03on = 1840.99
Real production cost year 4 ON	C	c04on = 2546.32
Real production cost year 5 ON	C	c05on = 2894.24
Real production cost year6 ON	C	c06on = 3343.54
Real production cost year 7 ON	C	c07on = 3647.70
Real production cost year 8 ON	C	c08on = 3849.02
Real production cost year 9 ON	C	c09on = 3928.52
Real production cost year 10 onwards ON	C	c10on = 4010.94
Total real production cost ON	C	production_coston = Year01on*c01on+Year02on*c02on+c03on*Year03on+Year04on*c04on+c05on*Year05on+Year06on*c06on+Year07on*c07on+Year08on*c08on+Year09on*c09on+(Year10on+Year11on+Year12on+Year13on+Year14on+Matureon)*c10on
Real packing and transport cost per ton exported ON	C	pack&tr_exon = 396.60
Real packing and transport cost per ton sold locally ON	C	pack&tr_locon = 226.11
Real total packing and transport cost ON	C	packaging_transport_coston = export_productionon*(pack&tr_exon)+local_productionon*(pack&tr_locon)
Real harvest cost per ton ON	C	hc_per_tonon = 29.60
Real total harvest cost ON	C	harvest_coston = hc_per_tonon*total_productionon
Total nominal costs ON	C	total_coston = (harvest_coston+packaging_transport_coston+production_coston)*annual_ppi/100

Production model Olifants River (Valencias) (OV)

Description	Type	Formula
Area with trees in year 1 OV	S	Year01ov(t) = Year01ov(t - dt) + (Area_plantedov - y01ov) * dt INIT Year01ov = 19.56
Area of new planted trees OV	F	Area_plantedov = exp(1.4748+2*logn((local_turnoverov+export_turnoverov)/total_costov))
Ageing of trees from 1st to 2nd year OV	F	y01ov = Year01ov

Area with trees in year 2 OV	S	Year02ov(t) = Year02ov(t - dt) + (y01ov - y02ov) * dt INIT Year02ov = 19.56
Ageing of trees from 1st to 2nd year OV	F	y01ov = Year01ov
Ageing of trees from 2nd to 3rd year OV	F	y02ov = Year02ov
Area with trees in year 3 OV	S	Year03ov(t) = Year03ov(t - dt) + (y02ov - y03ov) * dt INIT Year03ov = 19.56
Ageing of trees from 2nd to 3rd year OV	F	y02ov = Year02ov
Ageing of trees from 3rd to 4th year OV	F	y03ov = Year03ov
Area with trees in year 4 OV	S	Year04ov(t) = Year04ov(t - dt) + (y03ov - y04ov) * dt INIT Year04ov = 19.56
Ageing of trees from 3rd to 4th year OV	F	y03ov = Year03ov
Ageing of trees from 4th to 5th year OV	F	y04ov = Year04ov
Area with trees in year 5 OV	S	Year05ov(t) = Year05ov(t - dt) + (y04ov - y05ov) * dt INIT Year05ov = 19.56
Ageing of trees from 4th to 5th year OV	F	y04ov = Year04ov
Ageing of trees from 5th to 6th year OV	F	y05ov = Year05ov
Area with trees in year 6 OV	S	Year06ov(t) = Year06ov(t - dt) + (y05ov - y06ov) * dt INIT Year06ov = 13.86
Ageing of trees from 5th to 6th year OV	F	y05ov = Year05ov
Ageing of trees from 6th to 7th year OV	F	y06ov = Year06ov
Area with trees in year 7 OV	S	Year07ov(t) = Year07ov(t - dt) + (y06ov - y07ov) * dt INIT Year07ov = 13.86
Ageing of trees from 6th to 7th year OV	F	y06ov = Year06ov
Ageing of trees from 7th to 8th year OV	F	y07ov = Year07ov
Area with trees in year 8 OV	S	Year08ov(t) = Year08ov(t - dt) + (y07ov - y08ov) * dt INIT Year08ov = 13.86
Ageing of trees from 7th to 8th year OV	F	y07ov = Year07ov
Ageing of trees from 8th to 9th year OV	F	y08ov = Year08ov
Area with trees in year 9 OV	S	Year09ov(t) = Year09ov(t - dt) + (y08ov - y09ov) * dt INIT Year09ov = 13.86
Ageing of trees from 8th to 9th year OV	F	y08ov = Year08ov
Ageing of trees from 9th to 10th year OV	F	y09ov = Year09ov
Area with trees in year 10 OV	S	Year10ov(t) = Year10ov(t - dt) + (y09ov - y10ov) * dt INIT Year10ov = 13.86
Ageing of trees from 9th to 10th year OV	F	y09ov = Year09ov
Ageing of trees from 10th to 11th year OV	F	y10ov = Year10ov
Area with trees in year 11 OV	S	Year11ov(t) = Year11ov(t - dt) + (y10ov - y11ov) * dt INIT Year11ov = 11.41
Ageing of trees from 10th to 11th year OV	F	y10ov = Year10ov
Ageing of trees from 11th year to maturity OV	F	y11ov = Year11ov
Area with mature trees OV	S	Matureov(t) = Matureov(t - dt) + (y11ov - withdrawelov) * dt INIT Matureov = 229.03
Ageing of trees from 11th year to maturity OV	F	y11ov = Year11ov
Withdrawal of orchards OV	F	withdrawelov = 0.052*Matureov
Total area plated with oranges OV	C	Total_Areaov = Year01ov+Year02ov+Year03ov+Year04ov+Year05ov+Year06ov+Year07ov+Year08ov+Year09ov+Year10ov+Year11ov+Matureov
Yield per hectare of 3 year old trees OV	C	yi03ov = 3.3
Yield per hectare of 4 year old trees OV	C	yi04ov = 12.1
Yield per hectare of 5 year old trees OV	C	yi05ov = 20.9
Yield per hectare of 6 year old trees OV	C	yi06ov = 28.6
Yield per hectare of 7 year old trees OV	C	yi07ov = 35.2
Yield per hectare of 8 year old trees OV	C	yi08ov = 41.25
Yield per hectare of 9 year old trees OV	C	yi09ov = 45.1
Yield per hectare of 10 year old trees OV	C	yi10ov = 49.5
Yield per hectare of 11 year old trees OV	C	yi11ov = 52.25

Yield per hectare of mature trees OV	C	yimatov = 55
Total production of 3 year old trees OV	C	prod03ov = yi03ov*Year03ov
Total production of 4 year old trees OV	C	prod04ov = Year04ov*yi04ov
Total production of 5 year old trees OV	C	prod05ov = Year05ov*yi05ov
Total production of 6 year old trees OV	C	prod06ov = Year06ov*yi06ov
Total production of 7 year old trees OV	C	prod07ov = yi07ov*Year07ov
Total production of 8 year old trees OV	C	prod08ov = Year08ov*yi08ov
Total production of 9 year old trees OV	C	prod09ov = Year09ov*yi09ov
Total production of 10 year old trees OV	C	prod10ov = Year10ov*yi10ov
Total production of 11 year old trees OV	C	prod11ov = yi11ov*Year11ov
Total production of mature trees OV	C	prodmatov = yimatov*Matureov
Yield variation OV	C	yieldov = normal(1,0.1)
Total annual production in tons OV	C	total_productionov = (prod03ov+prod04ov+prod05ov+prod06ov+prod07ov+prod08ov+prod09ov+prod10ov+prod11ov+prodmatov)*yieldov
Export share year 3 OV	C	ex%3ov = 0.432
Export share year 4 OV	C	ex%4ov = 0.4464
Export share year 5 OV	C	ex%5ov = 0.5544
Export share year 6 OV	C	ex%6ov = 0.6624
Export share year 7 OV	C	ex%7ov = 0.7128
Export share year 8 onwards OV	C	ex%8ov = 0.72
Variation of export share OV	C	exportov = normal(1,0.1)
Total export amount in tons OV	C	export_productionov = ((prodmatov+prod11ov+prod10ov+prod09ov+prod08ov)*ex%8ov+prod07ov*ex%7ov+prod06ov*ex%6ov+ex%5ov*prod05ov+prod04ov*ex%4ov+ex%3ov*prod03ov)*exportov*yieldov
Total amount sold locally in tons OV	C	local_productionov = total_productionov-export_productionov
Production share January OV	C	jan%ov = 0.03
Production share February OV	C	feb%ov = 0
Production share March OV	C	mar%ov = 0
Production share April OV	C	apr%ov = 0
Production share May OV	C	may%ov = 0
Production share June OV	C	jun%ov = 0.05
Production share July OV	C	jul%ov = 0.18
Production share August OV	C	aug%ov = 0.21
Production share September OV	C	sep%ov = 0.25
Production share October OV	C	oct%ov = 0.15
Production share November OV	C	nov%ov = 0.08
Production share December OV	C	dec%ov = 0.05
Export amount January OV	C	exp01ov = jan%ov*export_productionov
Export amount February OV	C	exp02ov = feb%ov*export_productionov
Export amount March OV	C	exp03ov = mar%ov*export_productionov
Export amount April OV	C	exp04ov = apr%ov*export_productionov
Export amount May OV	C	exp05ov = may%ov*export_productionov
Export amount June OV	C	exp06ov = jun%ov*export_productionov
Export amount July OV	C	exp07ov = jul%ov*export_productionov
Export amount August OV	C	exp08ov = aug%ov*export_productionov
Export amount September OV	C	exp09ov = sep%ov*export_productionov
Export amount October OV	C	exp10ov = oct%ov*export_productionov
Export amount November OV	C	exp11ov = nov%ov*export_productionov
Export amount December OV	C	exp12ov = dec%ov*export_productionov
Turnover resulting from exports in Rand OV	C	export_turnoverov = exp01ov*feb_fob+exp02ov*mar_fob+exp03ov*apr_fob+exp04ov*may_fob+exp05ov*jun_fob+exp06ov*jul_fob+exp07ov*aug_fob+exp08ov*sep_fob+exp09ov*oct_fob+exp10ov*no

		v_fob+exp11ov*dec_fob+exp12ov*jan_fob
Amount sold locally in January OV	C	loc01ov = jan%ov*local_productionov
Amount sold locally in February OV	C	loc02ov = feb%ov*local_productionov
Amount sold locally in March OV	C	loc03ov = mar%ov*local_productionov
Amount sold locally in April OV	C	loc04ov = apr%ov*local_productionov
Amount sold locally in May OV	C	loc05ov = may%ov*local_productionov
Amount sold locally in June OV	C	loc06ov = jun%ov*local_productionov
Amount sold locally in July OV	C	loc07ov = jul%ov*local_productionov
Amount sold locally in August OV	C	loc08ov = aug%ov*local_productionov
Amount sold locally in September OV	C	loc09ov = sep%ov*local_productionov
Amount sold locally in October OV	C	loc10ov = oct%ov*local_productionov
Amount sold locally in November OV	C	loc11ov = nov%ov*local_productionov
Amount sold locally in December OV	C	loc12ov = dec%ov*local_productionov
Total turnover from production sold locally in Rand OV	C	local_turnoverov = (Jan_price*loc01ov+loc02ov*Feb_price+Mar_price*loc03ov +loc04ov*Apr_price+May_price*loc05ov+loc06ov*Jun_price +Jul_price*loc07ov+loc08ov*Aug_price+Sep_price*loc09ov +loc10ov*Oct_price+Nov_price*loc11ov+loc12ov*Dec_pric e)*0.9
Real production cost year 1 OV	C	c01ov = 12894.97
Real production cost year 2 OV	C	c02ov = 1560.18
Real production cost year 3 OV	C	c03ov = 1900.07
Real production cost year 4 OV	C	c04ov = 2397.52
Real production cost year 5 OV	C	c05ov = 2816.19
Real production cost year6 OV	C	c06ov = 3291.03
Real production cost year 7 OV	C	c07ov = 3568.2
Real production cost year 8 OV	C	c08ov = 3727.21
Real production cost year 9 OV	C	c09ov = 4237.05
Real production cost year 10 onwards OV	C	c10ov = 4384.39
Total real production cost OV	C	production_costov = Year01ov*c01ov+Year02ov*c02ov+c03ov*Year03ov+Year0 4ov*c04ov+c05ov*Year05ov+Year06ov*c06ov+Year07ov*c 07ov+Year08ov*c08ov+Year09ov*c09ov+(Year10ov+Year1 1ov+Matureov)*c10ov
Real packing and transport cost per ton exported OV	C	pack&tr_exov = 396.60
Real packing and transport cost per ton sold locally OV	C	pack&tr_locov = 226.11
Real total packing and transport cost OV	C	packaging_transport_costov = export_productionov*(pack&tr_exov)+local_productionov*(p ack&tr_locov)
Real harvest cost per ton OV	C	hc_per_tonov = 29.60
Real total harvest cost OV	C	harvest_costov = hc_per_tonov*total_productionov
Total nominal costs OV	C	total_costov = (harvest_costov+packaging_transport_costov+production_c ostov)*annual_ppi/100

Production model Sundays River (Navels) (SN)

Description	**Type**	**Formula**
Area with trees in year 1 SN	S	Year01sn(t) = Year01sn(t - dt) + (Area_plantedsn - y01sn) * dt INIT Year01sn = 47.12
Area of new planted trees SN	F	Area_plantedsn = exp(2.4808+2*logn((local_turnoversn+export_turnoversn)/to tal_costsn))
Ageing of trees from 1st to 2nd year SN	F	y01sn = Year01sn
Area with trees in year 2 SN	S	Year02sn(t) = Year02sn(t - dt) + (y01sn - y02sn) * dt INIT

		Year02sn = 47.12
Ageing of trees from 1st to 2nd year SN	F	y01sn = Year01sn
Ageing of trees from 2nd to 3rd year SN	F	y02sn = Year02sn
Area with trees in year 3 SN	S	Year03sn(t) = Year03sn(t - dt) + (y02sn - y03sn) * dt INIT Year03sn = 47.12
Ageing of trees from 2nd to 3rd year SN	F	y02sn = Year02sn
Ageing of trees from 3rd to 4th year SN	F	y03sn = Year03sn
Area with trees in year 4 SN	S	Year04sn(t) = Year04sn(t - dt) + (y03sn - y04sn) * dt INIT Year04sn = 47.12
Ageing of trees from 3rd to 4th year SN	F	y03sn = Year03sn
Ageing of trees from 4th to 5th year SN	F	y04sn = Year04sn
Area with trees in year 5 SN	S	Year05sn(t) = Year05sn(t - dt) + (y04sn - y05sn) * dt INIT Year05sn = 47.12
Ageing of trees from 4th to 5th year SN	F	y04sn = Year04sn
Ageing of trees from 5th to 6th year SN	F	y05sn = Year05sn
Area with trees in year 6 SN	S	Year06sn(t) = Year06sn(t - dt) + (y05sn - y06sn) * dt INIT Year06sn = 86.70
Ageing of trees from 5th to 6th year SN	F	y05sn = Year05sn
Ageing of trees from 6th to 7th year SN	F	y06sn = Year06sn
Area with trees in year 7 SN	S	Year07sn(t) = Year07sn(t - dt) + (y06sn - y07sn) * dt INIT Year07sn = 86.70
Ageing of trees from 6th to 7th year SN	F	y06sn = Year06sn
Ageing of trees from 7th to 8th year SN	F	y07sn = Year07sn
Area with trees in year 8 SN	S	Year08sn(t) = Year08sn(t - dt) + (y07sn - y08sn) * dt INIT Year08sn = 86.70
Ageing of trees from 7th to 8th year SN	F	y07sn = Year07sn
Ageing of trees from 8th to 9th year SN	F	y08sn = Year08sn
Area with trees in year 9 SN	S	Year09sn(t) = Year09sn(t - dt) + (y08sn - y09sn) * dt INIT Year09sn = 86.70
Ageing of trees from 8th to 9th year SN	F	y08sn = Year08sn
Ageing of trees from 9th to 10th year SN	F	y09sn = Year09sn
Area with trees in year 10 SN	S	Year10sn(t) = Year10sn(t - dt) + (y09sn - y10sn) * dt INIT Year10sn = 86.70
Ageing of trees from 9th to 10th year SN	F	y09sn = Year09sn
Ageing of trees from 10th to 11th year SN	F	y10sn = Year10sn
Area with trees in year 11 SN	S	Year11sn(t) = Year11sn(t - dt) + (y10sn - y11sn) * dt INIT Year11sn = 101.77
Ageing of trees from 10th to 11th year SN	F	y10sn = Year10sn
Ageing of trees from 11th to 12th year SN	F	y11sn = Year11sn
Area with trees in year 12 SN	S	Year12sn(t) = Year12sn(t - dt) + (y11sn - y12sn) * dt INIT Year12sn = 101.77
Ageing of trees from 11th to 12th year SN	F	y11sn = Year11sn
Ageing of trees from 12th to 13th year SN	F	y12sn = Year12sn
Area with trees in year 13 SN	S	Year13sn(t) = Year13sn(t - dt) + (y12sn - y13sn) * dt INIT Year13sn = 101.77
Ageing of trees from 12th to 13th year SN	F	y12sn = Year12sn
Ageing of trees from 13th to 14th year SN	F	y13sn = Year13sn
Area with trees in year 14 SN	S	Year14sn(t) = Year14sn(t - dt) + (y13sn - y14sn) * dt INIT Year14sn = 101.77
Ageing of trees from 13th to 14th year SN	F	y13sn = Year13sn
Ageing of trees from 14th year to maturity SN	F	y14sn = Year14sn
Area with mature trees SN	S	Maturesn(t) = Maturesn(t - dt) + (y14sn - withdrawelsn) * dt INIT Maturesn = 808.53
Ageing of trees from 14th year to maturity SN	F	y14sn = Year14sn
Withdrawal of orchards SN	F	withdrawelsn = 0.052*Maturesn
Total area plated with oranges SN	C	Total_Areasn = Year01sn+Year02sn+Year03sn+Year04sn+Year05sn+Year

		06sn+Year07sn+Year08sn+Year09sn+Year10sn+Year11sn +Year12sn+Year13sn+Year14sn+Maturesn
Yield per hectare of 3 year old trees SN	C	yi03sn = 0
Yield per hectare of 4 year old trees SN	C	yi04sn = 4
Yield per hectare of 5 year old trees SN	C	yi05sn = 8
Yield per hectare of 6 year old trees SN	C	yi06sn = 14
Yield per hectare of 7 year old trees SN	C	yi07sn = 17.6
Yield per hectare of 8 year old trees SN	C	yi08sn = 22
Yield per hectare of 9 year old trees SN	C	yi09sn = 26
Yield per hectare of 10 year old trees SN	C	yi10sn = 28.8
Yield per hectare of 11 year old trees SN	C	yi11sn = 31.6
Yield per hectare of 12 year old trees SN	C	yi12sn = 34
Yield per hectare of 13 year old trees SN	C	yi13sn = 36.8
Yield per hectare of 14 year old trees SN	C	yi14sn = 38.8
Yield per hectare of mature trees SN	C	yimatsn = 40
Total production of 3 year old trees SN	C	prod03sn = yi03sn*Year03sn
Total production of 4 year old trees SN	C	prod04sn = Year04sn*yi04sn
Total production of 5 year old trees SN	C	prod05sn = Year05sn*yi05sn
Total production of 6 year old trees SN	C	prod06sn = Year06sn*yi06sn
Total production of 7 year old trees SN	C	prod07sn = yi07sn*Year07sn
Total production of 8 year old trees SN	C	prod08sn = Year08sn*yi08sn
Total production of 9 year old trees SN	C	prod09sn = Year09sn*yi09sn
Total production of 10 year old trees SN	C	prod10sn = Year10sn*yi10sn
Total production of 11 year old trees SN	C	prod11sn = yi11sn*Year11sn
Total production of 12 year old trees SN	C	prod12sn = yi12sn*Year12sn
Total production of 13 year old trees SN	C	prod13sn = yi13sn*Year13sn
Total production of 14 year old trees SN	C	prod14sn = yi14sn*Year14sn
Total production of mature trees SN	C	prodmatsn = yimatsn*Maturesn
Yield variation SN	C	yieldsn = normal(1,0.1)
Total annual production in tons SN	C	total_productionsn = (prod03sn+prod04sn+prod05sn+prod06sn+prod07sn+prod 08sn+prod09sn+prod10sn+prod11sn+prod12sn+prod13sn+ prod14sn+prodmatsn)*yieldsn
Export share year 3 SN	C	ex%3sn = 0
Export share year 4 SN	C	ex%4sn = 0.52
Export share year 5 SN	C	ex%5sn = 0.5525
Export share year 6 SN	C	ex%6sn = 0.6175
Export share year 7 SN	C	ex%7sn = 0.6435
Export share year 8 onwards SN	C	ex%8sn = 0.65
Variation of export share SN	C	exportsn = normal(1,0.1)
Total export amount in tons SN	C	export_productionsn = ((prodmatsn+prod14sn+prod13sn+prod12sn+prod11sn+pro d10sn+prod09sn+prod08sn)*ex%8sn+prod07sn*ex%7sn+p rod06sn*ex%6sn+ex%5sn*prod05sn+prod04sn*ex%4sn+e x%3sn*prod03sn)*exportsn*yieldsn
Total amount sold locally in tons SN	C	local_productionsn = total_productionsn- export_productionsn
Production share January SN	C	jan%sn = 0
Production share February SN	C	feb%sn = 0.01
Production share March SN	C	mar%sn = 0.02
Production share April SN	C	apr%sn = 0.08
Production share May SN	C	may%sn = 0.20
Production share June SN	C	jun%sn = 0.23
Production share July SN	C	jul%sn = 0.23
Production share August SN	C	aug%sn = 0.12
Production share September SN	C	sep%sn = 0.12
Production share October SN	C	oct%sn = 0.02

Production share November SN	C	nov%sn = 0
Production share December SN	C	dec%sn = 0
Export amount January SN	C	exp01sn = jan%sn*export_productionsn
Export amount February SN	C	exp02sn = feb%sn*export_productionsn
Export amount March SN	C	exp03sn = mar%sn*export_productionsn
Export amount April SN	C	exp04sn = apr%sn*export_productionsn
Export amount May SN	C	exp05sn = may%sn*export_productionsn
Export amount June SN	C	exp06sn = jun%sn*export_productionsn
Export amount July SN	C	exp07sn = jul%sn*export_productionsn
Export amount August SN	C	exp08sn = aug%sn*export_productionsn
Export amount September SN	C	exp09sn = sep%sn*export_productionsn
Export amount October SN	C	exp10sn = oct%sn*export_productionsn
Export amount November SN	C	exp11sn = nov%sn*export_productionsn
Export amount December SN	C	exp12sn = dec%sn*export_productionsn
Turnover resulting from exports in Rand SN	C	export_turnoversn = exp01sn*feb_fob+exp02sn*mar_fob+exp03sn*apr_fob+exp04sn*may_fob+exp05sn*jun_fob+exp06sn*jul_fob+exp07sn*aug_fob+exp08sn*sep_fob+exp09sn*oct_fob+exp10sn*nov_fob+exp11sn*dec_fob+exp12sn*jan_fob
Amount sold locally in January SN	C	loc01sn = jan%sn*local_productionsn
Amount sold locally in February SN	C	loc02sn = feb%sn*local_productionsn
Amount sold locally in March SN	C	loc03sn = mar%sn*local_productionsn
Amount sold locally in April SN	C	loc04sn = apr%sn*local_productionsn
Amount sold locally in May SN	C	loc05sn = may%sn*local_productionsn
Amount sold locally in June SN	C	loc06sn = jun%sn*local_productionsn
Amount sold locally in July SN	C	loc07sn = jul%sn*local_productionsn
Amount sold locally in August SN	C	loc08sn = aug%sn*local_productionsn
Amount sold locally in September SN	C	loc09sn = sep%sn*local_productionsn
Amount sold locally in October SN	C	loc10sn = oct%sn*local_productionsn
Amount sold locally in November SN	C	loc11sn = nov%sn*local_productionsn
Amount sold locally in December SN	C	loc12sn = dec%sn*local_productionsn
Total turnover from production sold locally in Rand SN	C	local_turnoversn = (Jan_price*loc01sn+loc02sn*Feb_price+Mar_price*loc03sn+loc04sn*Apr_price+May_price*loc05sn+loc06sn*Jun_price+Jul_price*loc07sn+loc08sn*Aug_price+Sep_price*loc09sn+loc10sn*Oct_price+Nov_price*loc11sn+loc12sn*Dec_price)*0.9
Real production cost year 1 SN	C	c01sn = 17171.41
Real production cost year 2 SN	C	c02sn = 1322.39
Real production cost year 3 SN	C	c03sn = 1840.99
Real production cost year 4 SN	C	c04sn = 2546.32
Real production cost year 5 SN	C	c05sn = 2894.24
Real production cost year6 SN	C	c06sn = 3343.54
Real production cost year 7 SN	C	c07sn = 3647.70
Real production cost year 8 SN	C	c08sn = 3849.02
Real production cost year 9 SN	C	c09sn = 3928.52
Real production cost year 10 onwards SN	C	c10sn = 4010.94
Total real production cost SN	C	production_costsn = Year01sn*c01sn+Year02sn*c02sn+c03sn*Year03sn+Year04sn*c04sn+c05sn*Year05sn+Year06sn*c06sn+Year07sn*c07sn+Year08sn*c08sn+Year09sn*c09sn+(Year10sn+Year11sn+Year12sn+Year13sn+Year14sn+Maturesn)*c10sn
Real packing and transport cost per ton exported SN	C	pack&tr_exsn = 383.51
Real packing and transport cost per ton sold locally SN	C	pack&tr_locsn = 196.94
Real total packing and transport cost SN	C	packaging_transport_costsn =

		export_productionsn*(pack&tr_exsn)+local_productionsn*(pack&tr_locsn)
Real harvest cost per ton SN	C	hc_per_tonsn = 22.83
Real total harvest cost SN	C	harvest_costsn = hc_per_tonsn*total_productionsn
Total nominal costs SN	C	total_costsn = (harvest_costsn+packaging_transport_costsn+production_costsn)*annual_ppi/100

Production model Sundays River (Valencias) (SV)

Description	Type	Formula
Area with trees in year 1 SV	S	Year01sv(t) = Year01sv(t - dt) + (Area_plantedsv - y01sv) * dt INIT Year01sv = 27.39
Area of new planted trees SV	F	Area_plantedsv = exp(1.7188+2*logn((local_turnoversv+export_turnoversv)/total_costsv))
Ageing of trees from 1st to 2nd year SV	F	y01sv = Year01sv
Area with trees in year 2 SV	S	Year02sv(t) = Year02sv(t - dt) + (y01sv - y02sv) * dt INIT Year02sv = 27.39
Ageing of trees from 1st to 2nd year SV	F	y01sv = Year01sv
Ageing of trees from 2nd to 3rd year SV	F	y02sv = Year02sv
Area with trees in year 3 SV	S	Year03sv(t) = Year03sv(t - dt) + (y02sv - y03sv) * dt INIT Year03sv = 27.39
Ageing of trees from 2nd to 3rd year SV	F	y02sv = Year02sv
Ageing of trees from 3rd to 4th year SV	F	y03sv = Year03sv
Area with trees in year 4 SV	S	Year04sv(t) = Year04sv(t - dt) + (y03sv - y04sv) * dt INIT Year04sv = 27.39
Ageing of trees from 3rd to 4th year SV	F	y03sv = Year03sv
Ageing of trees from 4th to 5th year SV	F	y04sv = Year04sv
Area with trees in year 5 SV	S	Year05sv(t) = Year05sv(t - dt) + (y04sv - y05sv) * dt INIT Year05sv = 27.39
Ageing of trees from 4th to 5th year SV	F	y04sv = Year04sv
Ageing of trees from 5th to 6th year SV	F	y05sv = Year05sv
Area with trees in year 6 SV	S	Year06sv(t) = Year06sv(t - dt) + (y05sv - y06sv) * dt INIT Year06sv = 19.40
Ageing of trees from 5th to 6th year SV	F	y05sv = Year05sv
Ageing of trees from 6th to 7th year SV	F	y06sv = Year06sv
Area with trees in year 7 SV	S	Year07sv(t) = Year07sv(t - dt) + (y06sv - y07sv) * dt INIT Year07sv = 19.40
Ageing of trees from 6th to 7th year SV	F	y06sv = Year06sv
Ageing of trees from 7th to 8th year SV	F	y07sv = Year07sv
Area with trees in year 8 SV	S	Year08sv(t) = Year08sv(t - dt) + (y07sv - y08sv) * dt INIT Year08sv = 19.40
Ageing of trees from 7th to 8th year SV	F	y07sv = Year07sv
Ageing of trees from 8th to 9th year SV	F	y08sv = Year08sv
Area with trees in year 9 SV	S	Year09sv(t) = Year09sv(t - dt) + (y08sv - y09sv) * dt INIT Year09sv = 19.40
Ageing of trees from 8th to 9th year SV	F	y08sv = Year08sv
Ageing of trees from 9th to 10th year SV	F	y09sv = Year09sv
Area with trees in year 10 SV	S	Year10sv(t) = Year10sv(t - dt) + (y09sv - y10sv) * dt INIT Year10sv = 19.40
Ageing of trees from 9th to 10th year SV	F	y09sv = Year09sv
Ageing of trees from 10th to 11th year SV	F	y10sv = Year10sv
Area with trees in year 11 SV	S	Year11sv(t) = Year11sv(t - dt) + (y10sv - y11sv) * dt INIT Year11sv = 15.97
Ageing of trees from 10th to 11th year SV	F	y10sv = Year10sv
Ageing of trees from 11th year to maturity SV	F	y11sv = Year11sv

Area with mature trees SV	S	Maturesv(t) = Maturesv(t - dt) + (y11sv - withdrawelsv) * dt INIT Maturesv = 320.64
Ageing of trees from 11th year to maturity SV	F	y11sv = Year11sv
Withdrawal of orchards SV	F	withdrawelsv = 0.052*Maturesv
Total area plated with oranges SV	C	Total_Areasv = Year01sv+Year02sv+Year03sv+Year04sv+Year05sv+Year06sv+Year07sv+Year08sv+Year09sv+Year10sv+Year11sv+Maturesv
Yield per hectare of 3 year old trees SV	C	yi03sv = 3.3
Yield per hectare of 4 year old trees SV	C	yi04sv = 12.1
Yield per hectare of 5 year old trees SV	C	yi05sv = 20.9
Yield per hectare of 6 year old trees SV	C	yi06sv = 28.6
Yield per hectare of 7 year old trees SV	C	yi07sv = 35.2
Yield per hectare of 8 year old trees SV	C	yi08sv = 41.25
Yield per hectare of 9 year old trees SV	C	yi09sv = 45.1
Yield per hectare of 10 year old trees SV	C	yi10sv = 49.5
Yield per hectare of 11 year old trees SV	C	yi11sv = 52.25
Yield per hectare of mature trees SV	C	yimatsv = 55
Total production of 3 year old trees SV	C	prod03sv = yi03sv*Year03sv
Total production of 4 year old trees SV	C	prod04sv = Year04sv*yi04sv
Total production of 5 year old trees SV	C	prod05sv = Year05sv*yi05sv
Total production of 6 year old trees SV	C	prod06sv = Year06sv*yi06sv
Total production of 7 year old trees SV	C	prod07sv = yi07sv*Year07sv
Total production of 8 year old trees SV	C	prod08sv = Year08sv*yi08sv
Total production of 9 year old trees SV	C	prod09sv = Year09sv*yi09sv
Total production of 10 year old trees SV	C	prod10sv = Year10sv*yi10sv
Total production of 11 year old trees SV	C	prod11sv = yi11sv*Year11sv
Total production of mature trees SV	C	prodmatsv = yimatsv*Maturesv
Yield variation SV	C	yieldsv = normal(1,0.1)
Total annual production in tons SV	C	total_productionsv = (prod03sv+prod04sv+prod05sv+prod06sv+prod07sv+prod08sv+prod09sv+prod10sv+prod11sv+prodmatsv)*yieldsv
Export share year 3 SV	C	ex%3sv = 0.432
Export share year 4 SV	C	ex%4sv = 0.4464
Export share year 5 SV	C	ex%5sv = 0.5544
Export share year 6 SV	C	ex%6sv = 0.6624
Export share year 7 SV	C	ex%7sv = 0.7128
Export share year 8 onwards SV	C	ex%8sv = 0.72
Variation of export share SV	C	exportsv = normal(1,0.1)
Total export amount in tons SV	C	export_productionsv = ((prodmatsv+prod11sv+prod10sv+prod09sv+prod08sv)*ex%8sv+prod07sv*ex%7sv+prod06sv*ex%6sv+ex%5sv*prod05sv+prod04sv*ex%4sv+ex%3sv*prod03sv)*exportsv*yieldsv
Total amount sold locally in tons SV	C	local_productionsv = total_productionsv-export_productionsv
Production share January SV	C	jan%sv = 0.01
Production share February SV	C	feb%sv = 0
Production share March SV	C	mar%sv = 0
Production share April SV	C	apr%sv = 0
Production share May SV	C	may%sv = 0.02
Production share June SV	C	jun%sv = 0.08
Production share July SV	C	jul%sv = 0.19
Production share August SV	C	aug%sv = 0.23
Production share September SV	C	sep%sv = 0.25
Production share October SV	C	oct%sv = 0.14
Production share November SV	C	nov%sv = 0.06

Production share December SV	C	dec%sv = 0.02
Export amount January SV	C	exp01sv = jan%sv*export_productionsv
Export amount February SV	C	exp02sv = feb%sv*export_productionsv
Export amount March SV	C	exp03sv = mar%sv*export_productionsv
Export amount April SV	C	exp04sv = apr%sv*export_productionsv
Export amount May SV	C	exp05sv = may%sv*export_productionsv
Export amount June SV	C	exp06sv = jun%sv*export_productionsv
Export amount July SV	C	exp07sv = jul%sv*export_productionsv
Export amount August SV	C	exp08sv = aug%sv*export_productionsv
Export amount September SV	C	exp09sv = sep%sv*export_productionsv
Export amount October SV	C	exp10sv = oct%sv*export_productionsv
Export amount November SV	C	exp11sv = nov%sv*export_productionsv
Export amount December SV	C	exp12sv = dec%sv*export_productionsv
Turnover resulting from exports in Rand SV	C	export_turnoversv = exp01sv*feb_fob+exp02sv*mar_fob+exp03sv*apr_fob+exp04sv*may_fob+exp05sv*jun_fob+exp06sv*jul_fob+exp07sv*aug_fob+exp08sv*sep_fob+exp09sv*oct_fob+exp10sv*nov_fob+exp11sv*dec_fob+exp12sv*jan_fob
Amount sold locally in January SV	C	loc01sv = jan%sv*local_productionsv
Amount sold locally in February SV	C	loc02sv = feb%sv*local_productionsv
Amount sold locally in March SV	C	loc03sv = mar%sv*local_productionsv
Amount sold locally in April SV	C	loc04sv = apr%sv*local_productionsv
Amount sold locally in May SV	C	loc05sv = may%sv*local_productionsv
Amount sold locally in June SV	C	loc06sv = jun%sv*local_productionsv
Amount sold locally in July SV	C	loc07sv = jul%sv*local_productionsv
Amount sold locally in August SV	C	loc08sv = aug%sv*local_productionsv
Amount sold locally in September SV	C	loc09sv = sep%sv*local_productionsv
Amount sold locally in October SV	C	loc10sv = oct%sv*local_productionsv
Amount sold locally in November SV	C	loc11sv = nov%sv*local_productionsv
Amount sold locally in December SV	C	loc12sv = dec%sv*local_productionsv
Total turnover from production sold locally in Rand SV	C	local_turnoversv = (Jan_price*loc01sv+loc02sv*Feb_price+Mar_price*loc03sv+loc04sv*Apr_price+May_price*loc05sv+loc06sv*Jun_price+Jul_price*loc07sv+loc08sv*Aug_price+Sep_price*loc09sv+loc10sv*Oct_price+Nov_price*loc11sv+loc12sv*Dec_price)*0.9
Real production cost year 1 SV	C	c01sv = 12894.97
Real production cost year 2 SV	C	c02sv = 1560.18
Real production cost year 3 SV	C	c03sv = 1900.07
Real production cost year 4 SV	C	c04sv = 2397.52
Real production cost year 5 SV	C	c05sv = 2816.19
Real production cost year6 SV	C	c06sv = 3291.03
Real production cost year 7 SV	C	c07sv = 3568.20
Real production cost year 8 SV	C	c08sv = 3727.21
Real production cost year 9 SV	C	c09sv = 4237.05
Real production cost year 10 onwards SV	C	c10sv = 4384.39
Total real production cost SV	C	production_costsv = Year01sv*c01sv+Year02sv*c02sv+c03sv*Year03sv+Year04sv*c04sv+c05sv*Year05sv+Year06sv*c06sv+Year07sv*c07sv+Year08sv*c08sv+Year09sv*c09sv+(Year10sv+Year11sv+Maturesv)*c10sv
Real packing and transport cost per ton exported SV	C	pack&tr_exsv = 383.51
Real packing and transport cost per ton sold locally SV	C	pack&tr_locsv = 196.94
Real total packing and transport cost SV	C	packaging_transport_costsv = export_productionsv*(pack&tr_exsv)+local_productionsv*(p

		ack&tr_locsv)
Real harvest cost per ton SV	C	hc_per_tonsv = 22.83
Real total harvest cost SV	C	harvest_costsv = hc_per_tonsv*total_productionsv
Total nominal costs SV	C	total_costsv = (harvest_costsv+packaging_transport_costsv+production_costsv)*annual_ppi/100

Changes from base to FTA scenario

EU tariff reduction in June to September	F	junsep_red = if (TIME=3)then(3.4333)else(0.1333)

Changes from base to no-tariff scenario

Applied EU tariff in February and March	S	febmar_tar(t) = febmar_tar(t - dt) + (- febmar_red) * dt INIT febmar_tar = 0
Applied EU tariff in April	S	apr_tar(t) = apr_tar(t - dt) + (- apr_red) * dt INIT apr_tar = 0
Applied EU tariff in May	S	may_tar(t) = may_tar(t - dt) + (- may_red) * dt INIT may_tar = 0
Applied EU tariff in June to September	S	junsep_tar(t) = junsep_tar(t - dt) + (- junsep_red) * dt INIT junsep_tar = 0
Applied EU tariff in October	S	oct_tar(t) = oct_tar(t - dt) + (- oct_red) * dt INIT oct_tar = 0
Applied EU tariff in November	S	nov_tar(t) = nov_tar(t - dt) + (- nov_red) * dt INIT nov_tar = 0
Applied EU tariff in December and January	S	decjan_tar(t) = decjan_tar(t - dt) + (- decjan_red) * dt INIT decjan_tar = 0
EU threshold price for the entry price system	S	entry_price(t) = entry_price(t - dt) + (- entry_red) * dt INIT entry_price = 0
EU maximum tariff equivalent	S	MTE(t) = MTE(t - dt) + (- MTE_red) * dt INIT MTE = 0

Appendix II: Table of Results

The following pages content the means and standard deviations of several model parameters. As for each scenarios 100 runs were carried out the presentation of the results is limited to mean and standard deviation. The variable names are the same as used in Appendix I. The values of several variables have no meaning as such and they are, therefore, presented in the result chapter only in a percentage term.

The results are one possible outcome as the model results in each single simulation run in different outcomes. A rerun of the model would result in different values.

Base Scenario

mean	Total Arealv	Total Areann	Total Areanv	Total Areaon	Total Areaov	Total Areasn	Total Areasv	Area plantedlv	Area plantednn	Area plantednv
1997	3673,4	1411,92	638,85	1108,69	407,54	1884,71	570,56	109,9104	29,0093	19,5963
1998	3694,3729	1396,459	642,9791	1103,3777	408,6472	1877,4285	572,8026	114,9622	29,943	20,0968
1999	3718,069	1381,8426	647,2037	1096,849	410,3699	1867,9765	575,5503	117,0592	30,8749	20,4434
2000	3737,8354	1368,0738	650,7272	1089,3919	412,2711	1856,9253	578,5105	120,5027	31,8086	20,9768
2001	3755,3308	1355,1588	653,7905	1080,4028	414,7333	1843,3555	582,0063	127,9964	34,3998	22,2937
2002	3774,9022	1344,7603	657,2281	1071,7924	417,8918	1830,6699	586,9921	130,608	35,5788	23,0002
2003	3791,9509	1336,0015	660,48	1062,337	421,4306	1818,3062	592,5499	137,5954	36,9054	24,2369
2004	3811,1181	1329,0068	664,1217	1053,5684	425,5723	1806,2845	598,8748	146,5771	38,6019	25,1582
2005	3837,1738	1324,1236	668,3196	1044,9085	430,4988	1793,3378	605,5904	150,1236	38,8316	26,5995
2006	3864,791	1319,8635	673,6139	1036,1343	435,8679	1781,0906	613,3133	153,5457	40,0192	26,9269
2007	3893,9488	1317,1644	678,9083	1027,5726	441,4254	1768,9269	621,257	150,6683	40,8452	27,0312
2008	3918,446	1315,5114	683,9973	1018,3002	446,1415	1756,4615	628,3213	161,9702	41,7952	28,1883
2009	3952,553	1315,0179	689,9485	1011,3662	452,0347	1747,7401	636,9095	167,5456	43,1812	29,772
2010	3993,17	1316,1074	697,6205	1005,3237	459,1379	1741,3311	646,9225	175,4958	44,412	30,6016
2011	4042,359	1318,6168	706,2263	1002,2847	466,8784	1736,4932	657,7572			
standard deviation	Total Arealv	Total Areann	Total Areanv	Total Areaon	Total Areaov	Total Areasn	Total Areasv	Area plantedlv	Area plantednn	Area plantednv
1997	0	0	0	0	0	0	0	23,07077727	7,1311911	4,587098136
1998	23,07062662	7,13147972	4,586889381	4,547563492	3,000326676	8,362694348	4,467877263	21,98433554	7,059791144	3,900138685
1999	31,65994705	10,63763936	6,162916461	7,016770411	4,152883214	12,315938	6,020037451	25,54013957	7,582838188	5,15925212
2000	43,31495987	13,3331024	8,482685433	9,159714139	5,663721903	16,23039472	7,670482954	27,25124015	8,608530771	5,134476581
2001	55,52412306	15,86492296	10,60855036	11,06835607	7,537978118	19,63370206	10,14874807	29,87063376	9,664164421	5,753074596
2002	70,81449971	20,3179795	13,76029721	14,48430123	9,414290242	24,70407329	13,04855895	27,64136856	8,605814462	5,14272126
2003	82,18662359	23,52309624	15,3761501	16,29915798	10,3664663	29,26251731	14,14593472	29,18500781	8,762964044	5,18148139
2004	95,02231025	26,13688206	17,27913389	18,2274224	11,80534208	33,11357336	16,70692614	29,9304242	9,288297443	5,016074637
2005	104,3438752	28,91134485	18,65214186	19,44756773	12,37812032	36,40224937	17,34474981	35,52571236	10,24573782	6,402147355
2006	115,9290969	30,80820506	20,37745072	21,36985649	13,5282787	39,29100057	19,1548585	30,02837982	10,55996739	6,044905573
2007	120,3508568	32,71298859	21,26867377	21,9707997	14,5589629	41,16645699	20,29049041	32,49341767	9,988707071	6,522385343
2008	121,0444229	32,96694972	21,92789561	22,96517807	14,6125176	41,15720502	20,72812986	32,50068984	10,69013559	6,379723984
2009	128,8804323	35,04447178	23,62521883	24,98216155	15,95791242	44,89531235	22,99199767	38,44191752	11,28866531	7,560687006
2010	130,0966238	38,87529446	24,25474499	25,65663429	16,32462338	47,94200528	23,93070811	39,19009712	10,47922564	7,311403521
2011	142,3888822	40,00696267	26,10521594	26,95847045	17,03806748	51,32270606	25,69946163			

FTA Scenario

mean	Total Arealv	Total Areann	Total Areanv	Total Areaon	Total Areaov	Total Areasn	Total Areasv	Area plantedlv	Area plantednn	Area plantednv
1997	3673,4	1411,92	638,85	1108,69	407,54	1884,71	570,56	107,2996	28,2063	18,9248
1998	3691,762	1395,6558	642,3074	1102,9846	407,8271	1876,1496	571,7664	116,4879	30,2808	20,5398
1999	3716,984	1381,3775	646,9755	1097,4166	409,694	1868,0162	575,1278	117,5626	31,8433	20,4396
2000	3737,2529	1368,5767	650,4949	1090,0316	411,3663	1857,1131	578,1336	133,0502	35,216	23,5034
2001	3767,2957	1359,0692	656,0843	1084,2737	414,5746	1849,7303	583,0904	134,083	34,7878	23,5657
2002	3792,9546	1349,0584	660,7937	1076,1296	417,8863	1838,2463	588,0847	137,9409	37,3549	24,5942
2003	3817,3349	1342,0757	665,6393	1068,9518	421,7197	1826,9853	593,908	148,8088	38,1704	25,7883
2004	3847,7155	1336,3455	670,8319	1061,6551	426,731	1816,7496	601,6229	150,6112	38,8291	25,9043
2005	3877,8061	1331,6901	675,7764	1053,9878	432,3598	1806,0241	609,3563	151,5455	39,7806	26,4091
2006	3906,8457	1328,3796	680,8788	1045,6548	437,4882	1794,3436	617,3097	159,5888	40,4322	28,3427
2007	3942,0467	1326,0935	687,5892	1037,8659	443,8147	1782,8967	626,3112	164,2675	42,6917	28,9774
2008	3980,1432	1326,2872	694,6236	1031,0256	449,639	1774,6874	634,9905	168,868	43,5653	30,0714
2009	4021,1472	1327,564	702,4585	1025,7394	456,3304	1767,781	644,3411	170,397	45,788	30,0709
2010	4064,7511	1331,2613	710,464	1021,5819	463,2844	1762,8149	653,4179	175,5838	45,5087	30,5857
2011	4114,0775	1334,8667	719,1644	1017,6556	471,1037	1758,7478	664,6588			
standard deviation	Total Arealv	Total Areann	Total Areanv	Total Areaon	Total Areaov	Total Areasn	Total Areasv	Area plantedlv	Area plantednn	Area plantednv
1997	0	0	0	0	0	0	0	17,50825565	6,809377748	3,444740768
1998	17,50742385	6,809344488	3,445016871	4,147506581	2,180038208	7,344610122	3,126270788	25,63828502	7,038631214	4,60852579
1999	32,55709195	10,33655323	5,774870107	6,43115571	4,048422409	11,69050895	5,974451034	25,64807403	7,738704679	4,695333198
2000	40,91978718	12,18471165	7,381114346	7,543028532	5,305371552	13,55508921	7,60606712	31,11113691	10,28114955	5,576505935
2001	56,74588641	16,3686648	10,06606917	10,56121382	6,913448838	20,08700791	9,668682012	34,12730331	9,957323393	6,321699812
2002	75,18589383	21,13024944	13,54929536	13,07517342	8,993770472	25,64522605	12,45130157	32,37759374	10,27396978	6,572653221
2003	88,65752396	25,24690555	16,43909567	16,2043229	11,06420015	30,93646045	15,65326943	29,24037275	9,592798541	5,250165532
2004	96,87432968	27,82564355	16,7646083	17,67136738	12,26787133	33,30669449	16,53892223	32,70272433	10,10356631	6,025219042
2005	108,7394644	30,61952366	19,02626293	20,52684406	13,51061138	37,05651956	17,80845208	32,44225668	10,35396743	5,90163623
2006	119,0163553	32,41388628	20,79474363	23,0630212	15,20280608	41,27542188	20,39572423	40,09291305	11,79137444	8,434518582
2007	132,2336998	36,19850371	23,78095498	26,92674247	17,27656143	47,1900235	22,10256638	35,99575079	12,00776016	6,580535635
2008	140,293382	38,63373177	25,63228521	28,07858292	18,62914509	50,26348204	24,12503759	36,94488925	11,93791878	7,177286537
2009	147,5167394	39,7062693	27,06103606	29,59804885	19,78934177	51,21644739	25,07637354	39,10675616	12,59328726	7,78048393
2010	148,024418	41,11174182	27,52907169	31,09684211	19,66211773	53,47877589	24,89176146	34,5782376	11,81421996	7,433097773
2011	154,969961	42,88618876	28,55311291	32,51191583	21,24417909	55,68352826	26,81058352			

No-tariff Scenario

mean	Total Arealv	Total Areann	Total Areanv	Total Areaon	Total Areaov	Total Areasn	Total Areasv	Area plantedlv	Area plantednn	Area plantednv
1997	3673,4	1411,92	638,85	1108,69	407,54	1884,71	570,56	131,6042	34,9373	23,1245
1998	3716,0665	1402,3869	646,5067	1106,8309	413,279	1883,0948	577,9727	134,7655	36,9959	23,5419
1999	3759,5659	1394,8234	654,1765	1103,8673	419,0059	1880,6447	585,8051	141,0772	37,1916	24,3634
2000	3803,3502	1387,3712	661,6197	1099,6188	425,5957	1875,9415	594,6876	140,2129	38,4769	24,1946
2001	3840,5547	1381,1251	667,9002	1094,2725	431,7873	1868,7009	603,1441	145,1805	39,1237	25,1928
2002	3877,311	1375,4496	674,2372	1087,845	438,7067	1860,1394	612,5015	148,5964	39,0837	26,0574
2003	3912,3476	1370,1963	680,5462	1080,7318	445,6847	1850,8685	622,1323	150,7582	40,03	25,8497
2004	3944,6768	1366,3263	685,8002	1074,0019	452,9945	1841,1564	631,025	160,9393	42,358	27,8865
2005	3985,0946	1365,1993	692,727	1067,8512	461,6016	1832,3395	642,4683	170,0021	45,1271	29,7631
2006	4032,5907	1367,2354	701,1849	1062,8313	470,4736	1826,7267	654,9204	167,9743	44,9328	29,3591
2007	4076,178	1369,4488	708,912	1055,9943	479,1905	1817,3182	666,2009	165,2834	44,7201	29,305
2008	4115,289	1371,6702	716,2741	1048,9653	486,7552	1809,0672	676,6086	177,123	45,5746	30,9547
2009	4164,5507	1374,956	724,993	1044,4826	495,4982	1803,4313	688,9914	175,5229	45,0713	30,9802
2010	4212,0158	1377,9356	733,6891	1039,8312	504,4069	1798,0454	701,6405	183,007	48,1692	31,5704
2011	4266,6176	1384,2014	742,9107	1037,9032	513,9393	1795,9162	715,0344			
standard deviation	Total Arealv	Total Areann	Total Areanv	Total Areaon	Total Areaov	Total Areasn	Total Areasv	Area plantedlv	Area plantednn	Area plantednv
1997	0	0	0	0	0	0	0	23,03067442	6,517595547	4,293221722
1998	23,03044122	6,517732841	4,293262875	4,657775026	3,688655175	8,060491732	4,577196272	29,15281363	9,004708335	5,361377192
1999	38,58302492	10,45787332	7,238332318	7,892501613	5,661105563	13,73269897	7,118381487	29,3411419	9,060404706	5,494444689
2000	54,02862823	14,30218692	9,856067923	10,45024376	7,383695586	18,16300192	10,0222303	29,44922149	9,488615778	5,300368557
2001	61,29186322	17,9865043	11,02924258	12,12016637	8,53335665	22,03968821	12,26373614	33,17125706	9,780391572	5,688822388
2002	74,03179985	21,8689367	12,2196347	13,81062435	9,596159413	25,55525714	13,70095926	30,27612999	8,928789241	5,615526444
2003	88,16944668	25,30652057	14,57197967	15,41290429	11,87051848	28,50843052	16,00640059	35,86042784	9,567114403	6,09466315
2004	100,4304457	28,47576558	16,72488876	18,19401389	12,83847829	32,45637076	17,93744243	34,18160831	10,25208779	6,50315806
2005	108,4227591	31,50341278	18,39683465	19,92619097	13,96273073	34,00980707	20,00576572	35,00163091	11,74484366	7,232886933
2006	116,4300157	34,49046059	20,33348915	21,28745117	14,97806039	37,05162469	21,31909107	37,81516112	11,40756171	6,803839812
2007	119,5813361	36,05242453	21,52134306	22,25079757	15,83335311	37,71936178	22,43851832	34,30884715	10,9498826	6,917990532
2008	128,9334022	38,01855994	23,00924619	23,8182979	17,73212477	40,7675715	24,27878531	35,30565574	11,81376684	7,443388806
2009	138,6938974	43,09989814	25,31710459	26,73487616	19,34060596	45,72874546	26,1947586	35,33794398	11,31717638	6,814568802
2010	145,2140186	44,98614707	27,35013434	28,34896066	20,81186199	47,20584737	28,54502448	42,15001928	12,94148235	7,422989683
2011	155,1668723	48,31333218	29,55083783	30,5331135	22,56087411	52,21053602	31,18912039			

Base Scenario

mean	Area plantedon	Area plantedov	Area plantedsn	Area plantedsv	jan fob	feb fob	mar fob	apr fob	may fob	jun fob
1997	19,4189	13,0168	34,7627	18,9154	854,4793	755,8104	977,8798	1249,3241	1393,3851	1566,8988
1998	20,0303	13,606	35,6974	19,385	1119,781	931,6838	1154,5124	1399,1225	1510,782	1660,388
1999	20,8346	13,8877	37,0416	19,7406	1250,8958	1022,876	1299,1437	1515,9597	1765,5195	1764,9371
2000	20,9447	14,5458	37,3154	20,4117	1430,0749	1179,4528	1442,5264	1756,941	1954,5157	1956,8225
2001	22,8791	15,3346	40,8441	22,0312	1748,1228	1373,0174	1695,7161	1852,1338	2293,0561	2067,4129
2002	23,049	15,8025	42,8918	22,726	1768,2869	1622,0653	1948,9799	2080,4202	2471,2793	2390,2582
2003	24,6976	16,4881	44,8691	23,6097	1829,4427	1868,5069	2158,8112	2359,7907	2655,2894	2634,6351
2004	25,7189	17,6492	45,4939	24,5256	2228,6523	2020,8748	2363,5709	2614,5148	2797,675	2746,0359
2005	26,4669	18,4465	47,6631	26,0304	2510,816	2203,5552	2581,3001	2817,6105	2963,6987	2878,3026
2006	27,5012	18,9718	49,1388	26,7237	2594,0397	2497,1925	2689,4302	3003,7427	3159,0972	3075,84
2007	26,3552	18,4503	48,1011	26,2929	2723,1545	2591,7344	3019,1912	3268,1246	3436,3301	3245,2186
2008	28,2826	19,9299	51,1446	28,2408	3002,6521	2722,0625	3217,9608	3344,2903	3488,4827	3669,4855
2009	28,784	21,0875	52,7955	29,6265	3374,3387	3178,4537	3330,6708	3496,1606	3757,6149	3578,762
2010	31,4185	21,7044	53,7373	30,4377	3372,9551	3269,5673	3577,4061	3898,3602	4052,3755	3953,8228
2011					3854,145	3562,4299	4022,4956	4145,3914	4501,0816	4163,9733
standard deviation	Area plantedon	Area plantedov	Area plantedsn	Area plantedsv	jan fob	feb fob	mar fob	apr fob	may fob	jun fob
1997	4,547639584	3,000486587	8,362878315	4,467538566	532,0058123	282,9968484	397,7269758	544,4719063	636,1842748	443,907778
1998	4,704973423	2,932203608	7,806763685	3,858625273	713,2252732	335,9186141	508,1343627	600,070177	688,0547683	521,896086
1999	5,23685257	3,150830003	9,762596347	4,579922886	698,925512	366,6324667	587,5267187	639,5299566	672,2204687	566,0013254
2000	5,131907142	3,80559435	9,84711363	5,244958924	789,7042627	497,3070726	550,7554163	683,2923859	856,9580895	627,6446991
2001	6,250201292	3,805497713	11,51666784	5,667481501	843,4513903	565,2847778	585,8311734	719,8311153	849,2261329	701,5041462
2002	6,173969631	3,393806233	11,79273347	5,108272506	878,7247797	588,786246	648,3044708	732,9584017	796,1069888	768,9843107
2003	5,638540967	3,682521608	10,96675824	5,812842584	922,4411658	634,1831024	655,0756396	802,3369978	854,3732066	739,6507505
2004	5,967128438	3,901053109	10,46416216	4,830381832	1004,859524	653,9702234	607,3601931	822,8227269	857,277973	756,8988003
2005	6,79890722	4,162455375	13,08308585	5,68587283	1104,420877	681,485937	731,6311819	750,4381067	975,9723096	990,5445569
2006	6,732666081	4,195014036	12,90107238	5,635650744	1094,313875	679,7668694	830,9537883	951,4302595	1072,205013	825,6011377
2007	6,486308115	4,033201075	12,5804445	5,997041153	1011,592142	645,5468454	696,1316113	903,0344351	1059,9968	1016,803377
2008	7,129539203	4,456115011	12,83824353	6,701144481	1124,790759	707,6507134	754,6075277	955,9874554	1077,458445	1011,489187
2009	7,654886544	5,078795207	13,59394361	7,773162339	1136,66118	680,7026424	800,7090559	1109,003184	1105,506761	1097,968672
2010	7,022517124	4,662051119	13,36228535	6,53160315	1272,380856	668,8231709	776,413902	1102,693047	1048,275614	997,5517035
2011					1191,76592	744,8294224	934,0239636	1065,90566	1335,317473	1232,265213

FTA Scenario

mean	Area plantedon	Area plantedov	Area plantedsn	Area plantedsv	jan fob	feb fob	mar fob	apr fob	may fob	jun fob
1997	19,0264	12,1968	33,4833	17,88	963,3356	819,9754	1004,4038	1111,302	1314,4612	1577,5596
1998	20,9914	13,7511	37,0158	19,9982	1049,2249	858,6739	1167,0806	1324,2186	1464,153	1836,1565
1999	20,9055	13,6582	37,1907	19,787	1256,951	1050,066	1380,4842	1622,8898	1765,0851	1880,2385
2000	24,1756	15,2924	43,5018	21,8728	1382,6316	1311,5068	1437,2846	1771,5317	2000,2346	2178,4825
2001	23,3462	15,4878	42,0473	22,0406	1432,626	1312,8276	1629,0256	1909,7914	2113,0745	2187,1086
2002	25,3271	16,0972	43,9951	22,9919	1813,3824	1717,8029	1847,8966	2196,0444	2415,6844	2503,2325
2003	26,1685	17,3588	46,6549	24,999	1923,5959	1790,5204	2020,3894	2182,9032	2463,5473	2662,3321
2004	26,7098	18,3501	47,715	25,5432	2370,4959	1953,4916	2345,9483	2669,9908	2765,8451	2685,3823
2005	26,9104	18,2061	48,2298	26,2611	2297,1601	2236,2077	2496,8165	2610,1175	3044,9453	3068,51
2006	28,2725	19,7402	49,8563	27,7807	2482,8347	2391,158	2617,2709	3005,3724	3237,9236	3191,2115
2007	28,7875	19,5587	52,3568	27,9076	2767,1875	2720,7654	3023,3759	3216,9845	3219,1897	3533,3214
2008	29,9303	20,7285	52,96	29,0029	2913,1733	2830,3277	3246,4387	3377,9839	3503,4476	3611,8622
2009	30,6695	20,895	54,2374	28,636	3310,337	3110,1055	3410,1042	3689,5795	3957,9603	3906,4252
2010	30,531	21,7508	54,5079	30,824	3208,994	3301,9396	3579,1148	3807,0162	4037,9662	3998,2166
2011					3771,1851	3445,9569	3713,4224	4148,839	4338,21	4097,4546
standard deviation	Area plantedon	Area plantedov	Area plantedsn	Area plantedsv	jan fob	feb fob	mar fob	apr fob	may fob	jun fob
1997	4,147793515	2,18005499	7,344043444	3,125922904	591,9378095	277,4619009	455,8628196	501,3712688	700,4147573	455,4215914
1998	4,907251781	3,344729255	8,837806196	4,943993402	654,669725	361,0411934	471,0137101	570,2657261	690,8706442	527,8205812
1999	4,919211192	3,171297646	9,463231927	4,582713716	677,1718839	424,0411739	538,1550544	726,4021654	699,3329328	568,4637824
2000	6,743206406	3,761446828	13,03840591	5,171310874	785,3221976	513,0534413	556,5169557	755,4250631	775,0178373	750,7757684
2001	6,244837702	3,908241697	11,58978549	5,434614213	781,7594342	587,6395735	620,8701199	759,6106162	852,3261484	636,6465669
2002	7,187490424	3,872636332	11,64336365	5,777764913	866,9865447	575,1847462	702,8394514	764,8767299	874,4990459	797,707021
2003	6,092026161	3,753090534	10,02519232	5,425257137	913,1981487	618,9445469	706,2707471	835,2767856	887,3447003	709,6493893
2004	7,193676804	3,997225411	11,89061525	5,647584949	928,0051596	668,6239843	683,8509251	914,5923278	913,2766234	921,8261866
2005	7,152301716	4,354414288	12,84445756	6,554442599	1069,03095	705,7024278	774,9346537	861,8846327	1050,614337	870,3361934
2006	9,335326923	4,880723098	14,47519953	6,666856869	1079,157564	686,2924413	817,28067	961,3968597	1081,486514	1047,954317
2007	7,893675997	4,29900748	13,90007611	6,166382427	1073,435964	728,7139801	752,9886815	1048,226116	1142,99555	979,9724711
2008	7,866433684	4,789325083	13,35505036	5,987464621	1158,625193	699,4113495	686,7847335	938,4756406	1044,082458	1068,442112
2009	8,259426781	5,689484423	14,77995302	6,783578112	1021,122345	801,4655508	790,6439621	932,7390633	1139,887413	1078,750146
2010	7,774284597	5,215466936	15,05034467	7,062413044	1182,700809	587,5447049	781,1217241	1075,81764	1300,700509	1217,111458
2011					1266,767574	753,948854	1060,447153	1266,853116	1161,028448	1261,831273

No-tariff Scenario

mean	Area plantedon	Area plantedov	Area plantedsn	Area plantedsv	jan fob	feb fob	mar fob	apr fob	may fob	jun fob
1997	22,873	17,6488	40,4284	24,0858	1721,0132	1499,5433	1690,2826	1630,8707	1646,5578	1626,5877
1998	23,5959	17,6103	42,6998	24,4697	1774,8659	1704,9777	1828,4761	1835,0182	1865,5802	1884,0501
1999	24,0429	18,5761	43,3909	25,6634	2111,1545	1829,572	2003,7881	2061,4606	2091,1261	1883,8903
2000	24,5869	18,2749	43,6442	25,3738	2202,09	2020,2461	2187,225	2190,3876	2276,5786	2236,6029
2001	25,0619	19,0965	44,9691	26,4027	2457,8227	2230,0205	2334,8659	2562,0093	2349,0418	2243,5772
2002	25,3924	19,2418	45,9848	26,7989	2523,3588	2315,2618	2626,9471	2545,5953	2600,1372	2400,8429
2003	26,7363	19,6567	47,1795	26,177	2685,3993	2371,1708	2725,9174	2757,451	2743,2758	2628,4964
2004	28,2263	21,329	49,6237	29,2534	2893,6559	2590,5269	3020,0426	2967,9253	2993,2973	2918,9994
2005	30,2224	21,9485	54,2968	30,76	2998,7432	2862,9915	2994,8017	3075,1643	3305,7087	3228,9106
2006	29,2258	22,1314	51,8948	30,0593	3382,5156	3059,0189	3281,219	3371,33	3494,4214	3201,7563
2007	28,5989	21,2988	52,3141	29,6367	3332,6423	3166,2653	3562,6841	3605,9074	3611,5528	3556,6849
2008	30,7345	22,7807	54,2307	32,034	3680,9396	3412,5751	3801,4983	3874,732	3812,987	3702,1737
2009	30,1749	23,1337	53,8182	32,5318	3651,3697	3652,7566	3677,5921	4043,8336	4029,0084	3778,8785
2010	32,5286	23,9324	56,4464	33,5152	4130,5071	3761,0658	4109,1281	4320,3243	4285,4288	4145,5102
2011					4177,739	3901,7134	4444,4074	4341,9564	4439,6585	4366,6091
standard deviation	Area plantedon	Area plantedov	Area plantedsn	Area plantedsv	jan fob	feb fob	mar fob	apr fob	may fob	jun fob
1997	4,657432447	3,688812622	8,060968269	4,577566423	554,1753188	279,7149612	396,6105031	429,4297516	434,2938334	468,7554654
1998	6,264974397	3,738531384	11,33608892	5,319191189	535,5586651	332,9845656	389,3527747	477,6344455	575,8474357	494,5669846
1999	5,699229824	3,904663083	10,30858459	5,365097803	627,1336166	358,968705	418,6909598	570,9517641	573,8135984	527,8841192
2000	6,186981767	4,03775643	10,98573695	5,684223391	700,9656716	406,927925	518,223369	555,7009439	687,3934934	617,5700011
2001	6,405864921	4,299061613	11,86957237	6,234617848	685,159704	447,6809264	509,4702249	600,1261987	584,524708	681,5540201
2002	5,465118502	4,237808957	10,302124	5,332165394	768,9141721	459,5343004	560,3985872	661,4176339	677,1135217	707,0968501
2003	7,122828884	4,469564644	12,1459694	5,467078653	792,1992763	464,7234152	608,7268141	670,9706784	715,3320003	725,6825887
2004	7,787154635	5,085392315	12,93294016	6,963621934	829,8247234	479,4930751	649,418109	747,5241306	832,6145701	918,6437583
2005	7,924282191	4,727880154	13,88710898	6,712523966	976,5325053	599,5336171	705,665371	805,0570149	925,728131	922,9896679
2006	7,281337814	4,95119077	13,92475238	7,381424016	986,3991229	546,5068788	755,1963541	856,5335426	1002,102956	948,9836234
2007	6,236565063	4,85621072	13,62185634	7,054315566	1093,025664	619,2156306	669,1478849	866,6337069	893,8712857	945,2756889
2008	7,827683358	5,112436455	12,8242023	7,414970263	1192,753126	719,5654919	772,5591726	958,2993691	1129,918519	1173,722256
2009	7,571204725	5,416980645	12,29606493	7,051236541	1170,544704	646,2926416	905,2228528	1097,797745	1013,249811	1179,041526
2010	9,060167881	5,517458495	15,08783394	8,126992738	1187,448802	827,4767449	760,1353828	1108,429505	1189,567529	1201,896151
2011					1462,848227	851,8149563	919,9017267	995,7907473	1262,958906	1154,668795

Base Scenario

mean	jul fob	aug fob	sep fob	oct fob	nov fob	dec fob	Jan price	Feb price	Mar price	Apr price
1997	1446,1219	1580,9599	1725,6305	1447,2308	1656,0912	1132,8216	1898,3635	1588,3709	1120,1273	872,5858
1998	1658,633	1679,8113	1896,1102	1503,7196	1837,1389	1373,2683	1877,8667	1589,6077	1150,6144	904,4528
1999	1769,5131	1811,7794	2083,9103	1626,0521	1884,521	1533,9445	1907,5907	1626,9737	1198,2313	928,0558
2000	1853,4825	1932,9951	2220,8464	1717,1329	2221,5317	1663,8534	1971,3985	1717,6711	1227,4638	941,3074
2001	2144,5021	2059,8259	2330,5513	1921,4234	2306,3868	1976,3322	1997,2782	1724,0852	1241,4837	974,1053
2002	2149,6954	2285,4688	2516,0683	2053,4012	2558,5226	2179,5943	2078,7377	1782,8105	1282,1977	986,2166
2003	2267,3579	2424,7729	2753,3908	2292,4434	2783,2437	2235,0747	2092,6094	1816,7028	1326,803	998,4453
2004	2595,678	2702,5253	2983,284	2337,1984	2960,6585	2496,2892	2113,2815	1790,1252	1332,4142	1031,4362
2005	2770,3249	2833,4607	3219,3702	2539,5412	3327,2025	2809,4473	2129,3731	1850,284	1344,4157	1039,783
2006	2854,0629	3036,6343	3408,5759	2725,0843	3481,9943	2852,33	2172,2019	1870,9039	1351,9217	1027,9683
2007	3032,7649	3105,3596	3538,7853	2870,0837	3573,3099	3146,5814	2200,3449	1945,5783	1379,5926	1077,3563
2008	3197,4685	3375,4721	3751,2851	3079,0553	3910,7073	3575,009	2220,8195	1937,1705	1393,499	1060,4823
2009	3452,7596	3618,6961	3996,097	3303,7816	4231,8706	3531,0644	2245,3184	1887,8263	1388,8921	1087,4361
2010	3582,8905	3924,9816	4171,9811	3531,8502	4363,8561	3949,4419	2231,3696	1880,0595	1398,4042	1071,6209
2011	3791,6273	3862,9567	4453,013	3877,563	4961,2655	4109,6368	2215,8466	1972,4828	1425,8621	1087,5733
standard deviation	jul fob	aug fob	sep fob	oct fob	nov fob	dec fob	Jan price	Feb price	Mar price	Apr price
1997	366,9582248	374,3699668	219,8448549	333,1531472	383,3416455	654,9734308	225,8999935	181,607364	124,3336047	93,3633937
1998	400,7956751	430,8571535	246,6630854	322,1701223	530,6438792	688,3922975	258,5537736	207,8329926	151,7249773	104,2364323
1999	469,2765239	533,9644655	315,050494	372,1196766	459,5873332	740,005185	228,6140944	190,0281347	145,9052027	110,1398066
2000	507,848777	511,3750677	306,596205	361,4649396	500,2489207	734,1345494	254,0247618	199,4709529	141,9579087	118,6194821
2001	483,8965927	569,5248695	335,3305914	453,2803886	533,6779102	768,3937974	240,8329239	203,2932229	142,8517429	117,0501357
2002	610,0789634	611,1872074	361,3145601	404,411511	599,4173901	827,0422864	293,1802203	226,2002231	127,7065583	139,2460059
2003	615,9334772	655,466258	393,1494633	481,1532015	654,3392366	1065,577362	304,7876351	201,7678048	148,3861761	115,2396338
2004	658,8519153	653,9424783	370,9237815	476,8445392	595,9243334	970,3120914	249,1276245	235,2913861	171,3379396	122,7028743
2005	736,7529609	800,8527883	453,7119331	511,9624451	693,1709604	1010,917964	302,4252961	215,7240215	162,8993019	142,5742805
2006	752,1130473	726,9484392	455,3067294	488,3546563	832,826768	947,2590782	280,6978752	255,3652651	153,18921	113,7330479
2007	752,9183677	893,7188748	455,2607155	589,7601125	811,4855111	1087,914205	303,4972867	249,6444802	191,763954	126,1815405
2008	816,9222211	713,5918574	576,954072	678,3850044	917,2210747	1151,212024	287,7520518	276,663785	165,3003374	112,3627466
2009	914,6314907	931,386576	644,8773471	786,8984215	975,1985494	1181,975143	308,4642636	234,5363114	150,8970284	120,9012977
2010	896,6967728	938,4062003	601,8760425	724,1652262	932,5710305	1343,240967	286,6701421	202,529633	165,1522753	112,5372203
2011	1063,511663	913,0872109	640,3745198	691,9467692	968,0983546	1364,841151	309,7550569	267,7339337	174,7549166	117,8062226

FTA Scenario

mean	jul fob	aug fob	sep fob	oct fob	nov fob	dec fob	Jan price	Feb price	Mar price	Apr price
1997	1490,3965	1560,2647	1748,3753	1375,7267	1532,5196	1017,5959	1880,0163	1630,927	1148,4837	872,5466
1998	1565,2953	1700,0664	1897,2737	1595,777	1778,9436	1215,1657	1845,2172	1615,4951	1137,2657	906,6801
1999	1742,2019	1829,387	2036,1388	1606,493	1914,4066	1316,9158	1900,2512	1644,7245	1187,4027	951,7273
2000	2039,2143	2065,3909	2360,6974	1810,5779	2148,9199	1642,0668	1973,0792	1689,639	1248,598	954,3595
2001	2234,9979	2080,8071	2506,7172	1913,4195	2262,4383	1842,5916	2010,4206	1754,105	1262,5087	964,8319
2002	2238,3579	2378,2891	2716,4939	2064,2467	2439,0864	1941,2753	2016,0188	1746,8707	1276,9944	979,768
2003	2565,6856	2509,655	2924,6056	2207,2754	2801,1137	2352,173	2077,5888	1789,1009	1312,2568	999,4657
2004	2584,1938	2727,2937	3052,2909	2451,4743	3056,8469	2477,7743	2119,9617	1840,6044	1317,5451	1027,9658
2005	2710,5447	2823,6294	3207,5565	2582,6657	3226,5005	2762,1924	2135,258	1879,6648	1353,3551	1037,6853
2006	2837,935	3229,0224	3456,6946	2742,7536	3500,3351	3048,95	2207,9758	1875,9051	1346,8751	1030,3797
2007	3096,5726	3322,1071	3655,3274	2924,8242	3655,1222	3113,5596	2192,922	1895,845	1386,3852	1058,018
2008	3437,8186	3545,4474	3850,5056	3021,7126	3917,586	3396,7473	2228,6936	1907,9659	1383,4632	1067,8838
2009	3538,4118	3581,862	4073,4797	3268,8381	4126,6274	3539,443	2178,7892	1898,4416	1385,3501	1068,1323
2010	3688,7484	3854,0713	4343,7094	3540,7926	4386,6707	3585,4136	2229,7402	1964,5879	1423,6995	1078,7272
2011	4051,3476	3905,1351	4463,2057	3682,0611	4582,6192	3946,743	2210,1245	1933,2741	1369,1682	1051,7274
standard deviation	jul fob	aug fob	sep fob	oct fob	nov fob	dec fob	Jan price	Feb price	Mar price	Apr price
1997	418,3974288	415,9485082	245,603502	291,0154904	372,3299942	640,1021581	210,2406113	199,700731	136,6555313	105,0971646
1998	417,6272861	443,4244052	272,680615	340,6839161	428,9790021	672,9972321	227,8366832	208,5624399	130,2159949	98,60056789
1999	549,7418161	469,5091449	302,2275469	397,3323863	489,2395876	722,9474868	228,1082484	225,616717	148,9380034	105,8366106
2000	545,7902012	507,4888736	318,1344515	384,3792984	459,1561214	762,5290886	221,5911314	220,6935007	174,95594	108,6700069
2001	581,9910917	650,2781441	352,5469276	464,2542383	517,9857976	807,6776923	244,9013447	240,9569158	151,8784072	101,3850971
2002	642,291232	705,4323969	343,2063583	429,4514252	569,9278427	841,8189164	282,509179	225,5744732	145,1268257	118,9280939
2003	656,1971911	568,7488894	398,8479452	456,1561985	548,2009208	958,8672954	252,8531027	211,9937904	157,6841268	120,0965154
2004	646,6614063	733,2507648	439,121132	533,9687905	660,0160434	946,044277	274,5174734	205,5634189	142,0558165	119,8717722
2005	718,1991419	698,9531737	445,0978974	568,6250965	694,7977297	1013,375066	263,1649198	209,4392842	171,5029133	116,6878994
2006	717,5722047	834,1662133	496,5043594	577,3715382	724,6739825	1143,856549	288,8128107	244,0553188	160,7352053	109,7944472
2007	773,9198172	915,0355982	475,4173228	618,4678395	823,5788302	1049,880685	289,2575398	256,6054418	180,6709565	138,1607084
2008	915,0711202	886,0789451	576,0994947	573,7457923	774,9720546	1148,873042	306,6554798	235,9149941	164,301842	118,1578736
2009	836,2941366	1002,018914	574,8938466	715,9331109	928,5611883	1354,829913	271,6004341	225,5049454	160,6532714	127,0498474
2010	948,4178923	1021,75497	556,7859887	771,3118598	926,5448494	1306,147652	278,7166707	279,298269	166,141246	121,2613033
2011	1061,659956	910,1522348	572,0050676	866,5087071	959,0360918	1301,704854	278,0752616	250,9017198	143,8136461	126,4442044

No-tariff Scenario

mean	jul fob	aug fob	sep fob	oct fob	nov fob	dec fob	Jan price	Feb price	Mar price	Apr price
1997	1603,7717	1747,7083	1892,8278	1629,5565	2071,4292	1832,3395	1890,5028	1604,8043	1116,1629	853,4558
1998	1648,8345	1843,2908	2039,4886	1739,2285	2260,5041	1887,5928	1860,4741	1601,7437	1196,8408	898,3539
1999	1899,3043	1970,1755	2183,3309	1955,474	2443,0848	2247,8201	1880,068	1601,3708	1211,2978	935,5341
2000	1923,3618	2053,9052	2308,2402	2027,261	2740,5372	2300,2486	1993,1683	1691,6095	1232,1358	948,1801
2001	1997,14	2239,9587	2498,9464	2192,009	2917,0326	2545,3659	2022,1203	1728,8351	1267,23	963,2702
2002	2359,9087	2313,5944	2670,8687	2317,1664	3115,6788	2863,8145	2040,3272	1794,082	1277,2202	976,0806
2003	2439,6779	2472,8192	2842,0543	2461,9235	3287,2806	2831,781	2114,1976	1805,7066	1305,7188	992,3984
2004	2609,5541	2693,3961	3098,8942	2740,3115	3532,9027	3139,6929	2080,0207	1784,8286	1303,2158	1027,5078
2005	2922,493	3041,8977	3193,4142	2834,4307	3971,6562	3440,4799	2130,3696	1832,1895	1333,58	1010,7927
2006	3081,658	3054,8246	3449,8304	3064,3024	3898,9749	3536,7563	2162,7059	1895,8949	1370,0376	1048,6765
2007	3020,6119	3286,7071	3511,2458	3186,8384	4174,8593	3693,4605	2148,9248	1876,3895	1329,5761	1036,7051
2008	3406,2095	3396,3969	3905,5066	3388,9183	4388,5319	4127,8812	2148,7511	1895,4882	1386,4295	1050,6633
2009	3459,8175	3688,9207	4125,9533	3408,9215	4814,0262	4221,7507	2173,1781	1934,5439	1363,5733	1069,0162
2010	3871,9707	3663,9026	4271,1555	3869,4224	5067,979	4395,2314	2164,3905	1918,2809	1358,8244	1043,5869
2011	4015,8167	3848,5838	4404,2316	3797,0066	5355,0986	4689,5689	2214,7195	1963,1114	1371,4553	1083,5041
standard deviation	jul fob	aug fob	sep fob	oct fob	nov fob	dec fob	Jan price	Feb price	Mar price	Apr price
1997	402,3069911	368,468457	235,4245716	341,870701	411,6971344	584,38919	179,2439629	187,0567158	115,1516799	99,07190978
1998	457,9948619	425,7480422	289,0297265	384,9168865	496,9672576	517,6676503	270,8770548	220,4335885	142,4982891	91,39157666
1999	514,072283	449,807285	317,4833839	383,8570125	520,4651291	639,4409507	245,9751963	186,3414698	145,9356052	137,4765284
2000	532,2410294	499,8645129	326,234759	414,8560907	550,8395037	691,3729052	256,1457685	205,7369544	126,7581947	104,8252976
2001	540,9277232	666,0496323	341,1588015	470,3072577	677,5409388	883,645428	247,9213087	217,2961072	144,9506134	108,3489797
2002	581,208838	620,2176165	346,3571529	521,9073126	622,7396352	810,7147542	271,3405065	219,6578373	142,2008133	113,3422281
2003	635,9685981	616,5848315	345,7204692	481,3487464	693,2089283	890,8916236	267,513172	224,791731	161,077707	130,6528465
2004	667,2997434	821,0292033	414,3338152	599,0202473	785,5354548	921,8374406	317,1488632	215,3616994	155,3736881	126,1665165
2005	814,8549057	744,3254035	491,8959501	603,4266005	820,9283987	865,3637861	249,4290403	239,9468884	159,9513062	125,7932424
2006	747,0646643	804,1083734	483,3931272	586,9149622	893,6209398	1059,976027	253,3489241	216,2673074	140,4456007	108,9431138
2007	831,5049776	800,4606822	498,8282404	656,6030194	934,5871068	1153,441732	278,0589329	254,9920385	153,1165846	111,1430245
2008	935,8219512	816,0409752	558,6589177	718,0487958	934,0473174	1217,685589	238,2034366	216,7769692	147,6335505	111,5996578
2009	907,1573411	854,2737014	546,7668566	741,0621045	1100,370474	1147,375136	279,577958	211,0638976	155,8881414	124,2193767
2010	922,2471271	975,3230394	668,7635573	720,8196683	1066,788044	1340,44605	251,1362272	260,6975449	151,0832711	111,9128424
2011	976,5411158	1164,091783	649,1601467	828,686284	1027,27244	1380,705461	275,118662	266,62503	161,8254752	117,0514543

Base Scenario

mean	May price	Jun price	Jul price	Aug price	Sep price	Oct price	Nov price	Dec price	export productionlv
1997	669,6653	597,6195	596,7576	594,4578	670,3132	931,9335	1240,6187	1635,0844	101809,3956
1998	697,743	621,181	599,4197	611,1571	676,6204	947,5188	1240,9522	1680,6768	107040,2809
1999	716,2143	643,1629	604,7441	617,2389	684,3177	980,0942	1301,8476	1706,1507	108244,6506
2000	729,5927	645,9863	628,8908	635,5539	701,4486	979,4875	1335,1128	1781,0792	113052,3571
2001	729,8616	667,1522	628,2874	646,8993	695,8653	975,8515	1323,5685	1749,006	116210,75
2002	756,4064	671,9204	642,9834	653,4977	720,8925	1028,6079	1343,8066	1807,491	116306,5834
2003	768,4106	698,9784	665,7079	658,3909	747,1756	1011,8012	1396,3294	1763,7439	117494,852
2004	782,0887	694,9477	658,4434	666,0455	745,7898	1032,4319	1366,279	1827,1539	120007,3558
2005	786,5406	702,7794	658,7877	673,1242	759,0449	1044,9964	1374,8044	1827,2758	117210,852
2006	778,3545	718,7682	680,3858	682,2289	757,5586	1052,5076	1392,2058	1835,7326	117986,365
2007	805,4118	709,2557	665,656	672,3043	745,2071	1035,7919	1428,629	1813,4435	117362,7542
2008	796,6375	719,243	688,8415	688,058	774,4221	1063,6508	1401,4404	1859,0506	120887,888
2009	811,7657	716,4425	686,4299	687,7258	785,1398	1064,0164	1405,9899	1881,7236	119279,2445
2010	806,2294	733,4453	692,2946	693,083	779,7487	1084,6723	1440,9218	1896,4713	120675,1188
2011	818,4177	728,7063	679,2167	703,0078	774,9238	1064,6326	1441,1548	1868,3808	122436,1032
standard deviation	May price	Jun price	Jul price	Aug price	Sep price	Oct price	Nov price	Dec price	export productionlv
1997	84,02133343	71,41293481	76,78409955	71,71420329	71,40655405	104,8686943	165,366205	198,6770542	14302,06499
1998	69,13446532	79,38736651	73,05000128	80,63722327	74,97713682	96,99272096	143,8331958	188,7138474	13837,2103
1999	87,36214781	90,73326337	76,53143656	76,78963143	89,33549561	122,1602013	154,8795773	245,4484737	14175,272
2000	75,752417	80,92889458	76,52954204	71,97791481	80,09939221	111,7118872	154,3916218	226,6149625	14980,29036
2001	89,09378793	85,85720751	81,61568749	67,23523083	85,85874527	116,9141065	171,0921555	207,1416072	15598,29244
2002	81,22047605	82,69882866	83,79192434	75,89640224	86,45589594	104,6748936	152,6615621	229,5622816	16428,76225
2003	92,90552424	75,28965895	78,39112874	80,45645384	83,40015409	107,3258281	162,7125342	185,6906127	17899,56249
2004	99,21922392	77,77992131	79,39580672	73,74717245	93,45968432	124,1056526	153,5875801	236,1983756	16846,58794
2005	91,96515455	78,33624243	83,2797091	80,27168107	94,36081337	132,1186475	156,7054093	238,8017989	16926,90809
2006	89,55966786	92,54577312	86,67675067	80,40562103	91,29126675	132,014413	162,749295	224,6483114	15325,09203
2007	90,68969783	77,77913589	82,92699495	82,18217778	86,04855983	113,7249917	169,6267397	187,82036	17667,00391
2008	91,8463027	78,73356479	91,63582959	88,82533755	93,73389033	114,6001015	172,6814976	243,2005291	18039,25146
2009	109,2709702	81,03526279	78,23417074	80,79917393	114,8644388	114,4060467	162,3529577	212,670724	15642,59415
2010	89,39220257	100,9896344	86,74635933	85,47583666	98,78887172	133,3274191	176,6274936	231,6284125	16659,93574
2011	105,3020282	95,8214515	77,26336211	91,16184075	88,84092834	149,6005013	195,4013676	215,2836076	16030,89835

FTA Scenario

mean	May price	Jun price	Jul price	Aug price	Sep price	Oct price	Nov price	Dec price	export productionlv
1997	659,0725	597,6742	578,3435	590,8392	654,2762	916,9148	1231,5071	1586,0093	101490,5361
1998	692,2089	626,3371	598,5511	603,0033	664,6242	949,6394	1268,812	1648,9814	105856,58
1999	710,1422	625,3524	610,8827	613,5681	694,6103	979,7979	1267,0847	1659,9438	110974,3218
2000	732,8623	657,4064	621,6237	638,9203	693,5695	978,283	1321,7511	1718,3578	109756,2973
2001	735,4309	662,4981	630,7619	647,5482	705,1287	1006,4387	1347,5842	1738,2492	114188,5445
2002	758,5355	672,1618	650,4753	651,1937	705,8381	1009,7419	1314,8639	1759,0314	115520,6343
2003	751,9563	684,1572	658,0018	654,8946	736,9753	1026,3458	1351,8644	1826,5068	118050,7947
2004	793,545	709,794	659,6537	680,5163	755,0903	1052,9476	1390,2085	1810,5286	118685,6567
2005	792,2918	696,9189	669,5786	675,4436	744,536	1049,0977	1397,8501	1817,3484	120484,4043
2006	792,8634	707,6314	667,3616	672,6673	763,6365	1065,6052	1392,6277	1836,6999	119176,6021
2007	804,7124	714,994	689,2955	697,6383	761,5594	1042,3563	1411,6049	1869,8125	121171,1321
2008	799,5731	710,3845	683,2335	685,3568	766,0147	1074,5906	1413,5908	1861,6361	119960,6148
2009	807,6911	717,7324	696,8444	687,6555	759,2921	1065,7577	1422,7766	1812,2548	120432,8831
2010	808,12	711,7192	683,9665	684,542	772,836	1077,4949	1386,8138	1820,7857	121467,052
2011	806,9022	734,4378	685,753	696,3863	766,523	1074,5143	1389,0789	1835,4377	125454,4741
standard deviation	May price	Jun price	Jul price	Aug price	Sep price	Oct price	Nov price	Dec price	export productionlv
1997	69,51028804	74,17629022	68,03944539	80,81905263	70,49276544	91,72114577	162,0468255	187,4057556	12495,21055
1998	81,81979704	75,35777962	78,13982577	71,35412301	81,98338831	110,5949514	149,5721392	205,3542536	15117,25465
1999	79,03189181	72,36252013	68,82699026	72,35708577	73,02830027	110,6054076	127,8114049	214,8391761	14806,93449
2000	83,90638539	73,77138489	82,08156171	70,68594178	80,75867662	105,1288673	154,2410466	190,5259078	15234,1614
2001	85,83904348	80,56677801	76,6213204	81,63854069	92,3645855	109,7447949	151,7253303	215,776743	15374,95032
2002	92,08451668	79,62662183	58,10061202	76,83996448	92,1789507	110,2177314	138,1857775	184,9102273	17749,9003
2003	84,41950149	81,22346004	76,71434142	78,09076683	90,33344081	113,3280268	167,5031365	222,2994935	17816,95543
2004	96,10203992	83,87073736	85,29028202	79,37770826	85,5672131	117,206535	151,9179659	189,9941648	17002,6788
2005	99,18821809	77,5318111	80,09060091	82,45395484	86,1466174	121,8613954	142,91794	244,4235031	16185,50565
2006	91,92272743	95,44749554	72,52462235	80,13225145	99,93848683	110,5443046	176,4439946	200,7086262	15455,74755
2007	84,87465181	105,5930977	80,90530049	85,75777771	89,29935145	122,4074972	185,00984	224,7375275	19264,86935
2008	93,94533163	82,26092735	87,05308202	79,60935082	82,91493058	127,5455603	165,5139733	251,7380151	17090,16518
2009	111,3376706	79,54441021	84,09880049	82,6246145	77,28822775	98,95963491	173,2831517	213,5452327	17820,78455
2010	99,16601861	87,30004654	88,39477366	79,77334529	87,28051462	126,9322917	169,5670143	227,5788799	18274,38773
2011	98,7371596	88,85293819	88,26307559	75,20967065	90,53487907	127,0156562	166,9618372	210,6168397	20141,34526

No-tariff Scenario

mean	May price	Jun price	Jul price	Aug price	Sep price	Oct price	Nov price	Dec price	export productionlv
1997	672,668	595,5542	582,276	603,6436	666,0232	926,5692	1221,0662	1642,3546	100581,4881
1998	681,9592	624,7922	599,4027	598,6307	669,3695	941,9029	1240,3703	1670,4877	105076,0136
1999	705,2673	648,5992	620,1007	622,8768	692,8917	962,5922	1295,4282	1693,9911	110187,8493
2000	721,2377	658,9945	626,2997	630,8339	700,4329	981,382	1340,3616	1729,3971	114936,5985
2001	755,2364	672,724	632,7072	643,0798	703,7697	993,1138	1330,7095	1738,9252	116063,431
2002	752,1026	675,3249	644,4012	662,034	732,9649	1028,3852	1346,7412	1784,6248	118822,712
2003	766,9153	684,7251	653,4042	663,759	730,01	1008,9479	1348,7931	1791,9817	120169,6361
2004	775,8172	707,0915	668,408	674,6975	742,8242	1038,462	1374,6567	1792,5941	119311,5598
2005	774,7975	705,4063	683,3811	678,9819	748,8089	1043,8692	1363,1321	1826,0291	121946,0212
2006	806,7603	707,492	689,8297	678,8379	754,6537	1054,1539	1378,7976	1795,9909	119561,096
2007	810,5211	703,7412	671,0296	668,4954	742,5925	1032,5598	1366,9975	1804,8893	122749,0769
2008	797,2015	713,5868	681,3052	674,9542	753,9004	1061,4433	1394,5582	1802,5128	124953,227
2009	806,8776	697,1351	670,1382	683,1668	776,1179	1049,1406	1383,3423	1829,8773	122669,8035
2010	800,8247	701,2105	678,8952	677,4965	747,3067	1028,7787	1385,1066	1814,7211	122927,3527
2011	809,1032	731,3118	678,3199	693,1319	750,9672	1060,5695	1378,0205	1839,8077	127891,3064
standard deviation	May price	Jun price	Jul price	Aug price	Sep price	Oct price	Nov price	Dec price	export productionlv
1997	85,99930669	82,81098223	62,4348009	66,46183009	84,73267949	109,4221281	146,509187	196,1713581	13654,38372
1998	74,53727591	73,8380195	73,06829216	74,57598099	77,39636616	113,0767787	155,1365309	216,8268768	15458,22713
1999	87,06128931	82,1912371	73,82078205	78,25824662	90,37793535	97,22106665	151,7071486	188,747613	16698,08114
2000	85,4107095	93,34694336	64,49482969	77,14969261	88,31918166	114,6433954	174,7293131	200,3117362	17197,21754
2001	94,51996999	81,29110422	74,77675349	78,80023914	80,52011629	107,4939633	176,2226475	187,4118324	17076,23612
2002	85,4005491	77,51494607	73,4776613	83,12099884	93,71370885	136,0809378	155,4571184	202,2124448	17414,2757
2003	85,4482684	74,86522928	63,74486536	83,98410335	93,89626358	123,45461	135,5748313	214,6970386	17950,71632
2004	92,90910271	83,04171482	84,19641235	84,58224348	78,38846387	111,7976924	171,6149047	220,1544565	16367,33505
2005	81,31056302	94,73650864	88,99884619	80,35236755	87,10073946	115,5825053	145,5240318	223,369169	17628,98707
2006	94,33415487	92,29902798	87,4845862	82,76085399	82,15792778	117,963513	157,2722926	229,7314287	16012,91766
2007	94,47358356	80,20842874	88,41477858	72,88080124	85,21714617	121,2110066	165,1643305	194,0036768	15888,00607
2008	87,46297934	85,88000505	90,80692896	87,2753634	84,49784869	129,0089242	185,1254801	215,1227545	17559,44384
2009	106,4955048	73,78817589	86,87173697	78,29971265	87,16360771	117,8296205	191,7766381	232,1653521	17637,70468
2010	106,6758606	80,81853865	78,94248266	86,78646889	105,9947782	114,4520341	159,5819116	228,6895204	15870,60443
2011	96,39376597	93,80858872	81,15541151	83,78490413	95,0334587	119,6628724	169,2563127	229,3879331	18377,17597

Base Scenario

mean	export productionnn	export productionnv	export productionon	export productionov	export productionsn	export productionsv	local productionlv
1997	27943,6994	18167,9624	21767,3166	11851,041	37158,04	16735,895	51782,2686
1998	28818,2139	18661,9215	21936,2422	12054,057	37602,8105	16690,8863	53754,7927
1999	28224,299	18650,1423	22720,4026	12294,945	38394,9995	16805,0493	56311,1751
2000	27999,422	19187,5006	22346,1352	12592,0728	37893,4413	17086,5025	55657,6954
2001	27864,0353	20047,1605	23403,1746	12879,9145	39541,9386	18299,6418	59551,0148
2002	27510,9905	20443,6667	22394,9225	12926,5263	40094,2084	18514,9571	58720,0557
2003	26899,1303	20692,2533	23259,1164	12857,2673	39922,3786	17960,4824	59088,7768
2004	27134,5691	20459,8754	22901,7251	13492,4878	38097,6691	18411,662	60489,7103
2005	26231,6004	20870,5822	22295,6612	13183,3485	38615,7996	18583,7629	60162,8044
2006	26408,1561	20586,639	22528,774	13446,5604	38656,1775	18784,8041	60635,7534
2007	26475,9798	21075,7035	21494,5554	13316,9075	37115,3743	18751,4566	61620,9373
2008	25912,1687	20735,6547	21424,9639	13562,0495	37116,0645	19093,499	61154,502
2009	26788,9709	21127,2868	21131,6671	13751,1837	37201,6247	19246,5771	60045,3204
2010	25714,4886	21015,4936	21974,1621	13887,3864	35220,4976	19186,5177	59476,2106
2011	26040,9381	21205,0682	20802,5018	13786,4272	35593,2981	19752,7071	60262,6421
standard deviation	export productionnn	export productionnv	export productionon	export productionov	export productionsn	export productionsv	local productionlv
1997	3794,062634	2634,114613	3090,16396	1565,427714	5235,114201	2474,921963	12601,20234
1998	4485,81154	2599,233389	3697,389686	1673,87476	5192,180314	1994,691866	12541,05321
1999	3787,55261	2857,801609	3133,921108	1741,150319	5815,999932	2292,462898	13329,8784
2000	4281,577752	2756,883162	3064,881278	1921,612795	5970,819799	2808,256548	10501,50275
2001	3428,696626	2586,355923	2701,494994	1584,929695	5684,443951	2436,451284	13518,49395
2002	3435,555178	2930,538465	3127,141879	1780,430329	5990,728199	2294,514958	12719,42996
2003	3383,550415	2891,210005	3562,145381	1538,402991	6125,239997	2383,868763	13031,59641
2004	3999,21841	3249,161524	3394,42721	1755,119287	4964,190944	2814,521648	12151,73391
2005	3276,138075	3124,951939	3454,436817	1710,230162	5147,012399	2693,332934	13874,4947
2006	4152,889332	2797,125418	2701,3296	2117,966654	4834,354532	2371,857096	14522,56302
2007	3504,774585	2685,150179	3039,171916	1903,196566	4970,450392	2742,569254	11520,99205
2008	3912,343694	3127,099236	3272,39023	1862,883743	5286,14559	2998,613175	13584,44018
2009	4127,683713	3092,193667	3233,434551	1843,435507	4873,512013	2787,901711	12673,8988
2010	3874,952127	3187,280181	2726,624377	1959,721647	4663,674574	2706,219538	13349,17672
2011	4338,934973	3192,517224	3075,928936	1870,750497	5342,718606	2674,785998	13184,83012

FTA Scenario

mean	export productionnn	export productionnv	export productionon	export productionov	export productionsn	export productionsv	local productionlv
1997	28450,5189	17837,9652	21761,3548	11574,374	36202,142	16599,2566	54462,4581
1998	27779,3955	18636,7162	22550,981	12023,0283	37786,3074	17032,7786	53126,7978
1999	28342,3136	18900,5569	22738,0399	12470,1983	37814,959	17815,9352	56213,9957
2000	27216,2713	19372,3313	22697,2864	12081,5899	39175,9205	16799,2716	55849,7157
2001	27324,4709	19957,355	22656,0434	12799,7847	38668,8746	17475,8194	56810,8624
2002	27575,7121	20468,1266	23644,324	12832,7577	38700,0128	17692,4077	57979,96
2003	27201,9374	20283,6738	22945,0643	12794,9784	39267,5159	18052,9563	57498,741
2004	26898,2842	19943,2183	22983,0286	13255,5731	39740,9733	18039,2853	59979,92
2005	26678,2647	20758,8739	22694,4006	13364,9021	38554,1417	18985,4037	59128,6745
2006	26003,5632	20873,0809	22223,3637	13652,9329	37767,527	19036,9446	61817,0902
2007	26490,353	21252,9247	21909,5913	13420,8923	38029,1949	19101,3185	59016,3612
2008	26073,9316	21279,8819	21655,2631	13738,6826	36790,0699	19165,7165	62179,7286
2009	26351,6649	21139,5379	21720,7978	13660,7764	36755,3266	18779,6859	63041,4648
2010	26313,7209	20826,6117	21062,8447	13794,9686	35722,9879	19552,2084	62147,554
2011	25710,4127	21394,1095	21474,1547	13933,3283	35920,1202	19769,2938	62041,4643
standard deviation	export productionnn	export productionnv	export productionon	export productionov	export productionsn	export productionsv	local productionlv
1997	4258,050202	2654,511903	3076,350566	1592,56865	4951,371634	2105,678617	12685,48105
1998	4132,196663	2587,579528	2648,407654	1403,861893	5096,661329	2196,983795	12135,24575
1999	4384,499303	2452,970634	3207,484429	1675,71897	5365,357511	2923,485049	13136,20251
2000	4226,9182	2488,112679	3231,640026	1804,096292	6528,399043	2504,172266	11489,41559
2001	3804,89979	2614,575186	3333,909594	1885,961556	4892,802587	2371,728479	12224,14749
2002	3855,167621	2878,215529	3265,400292	2062,11546	5812,094367	2585,586057	14038,36896
2003	3473,994084	3035,70948	3398,403088	1838,917125	5978,662121	2630,311189	13184,29888
2004	3852,778307	2783,605794	3047,911487	1922,938789	5817,736988	2618,990317	11157,31615
2005	3917,23653	2413,472458	3105,939109	1958,26829	5175,655745	2745,730346	14790,27926
2006	4116,281438	2923,252791	2873,178292	1823,807967	6077,726639	2729,0513	14011,56753
2007	3964,178038	2688,300678	3437,991589	1691,527305	5114,315178	2175,988882	14074,47861
2008	3373,04848	2924,631302	2710,769937	1907,328606	4956,618766	2666,051285	14695,17097
2009	3716,359633	3118,615521	2887,93171	1893,764045	5741,30335	2562,765063	12303,9493
2010	3548,863461	2891,667152	3484,094088	1832,858291	5023,495264	2924,326451	14068,69105
2011	3766,560762	3136,010347	3160,222881	2243,358315	5316,891691	2818,327834	14237,58195

No-tariff Scenario

mean	export productionnn	export productionnv	export productionon	export productionov	export productionsn	export productionsv	local productionlv
1997	28181,3902	17429,5993	21822,5943	11834,1077	36695,3997	16386,4147	51283,344
1998	28488,4288	18111,3484	21832,7601	12091,4303	38094,484	16973,4143	56301,2107
1999	27566,5822	18731,7577	22376,673	12232,5479	38309,6528	17239,1704	54898,1671
2000	27834,481	19562,7921	22905,2543	12460,304	38493,6158	17669,961	55759,0594
2001	28456,765	19830,9135	22969,5935	12456,4283	39549,5789	17719,0474	55880,9832
2002	27349,3769	20803,1971	22842,4241	12819,5386	39585,5133	18306,6182	57072,1982
2003	27355,0402	20166,9773	23516,6254	13491,83	39801,2679	17895,0843	59601,0217
2004	26730,0524	20355,8631	22857,9407	13717,7815	37826,898	18965,3404	59523,2612
2005	26959,6794	20944,4511	22781,2176	13748,6372	38528,1168	19447,1949	60613,6166
2006	27109,4059	20972,4242	22129,1318	14112,3965	37088,459	19169,868	62327,147
2007	27035,4714	21668,974	21740,7547	14138,4749	37775,3654	19588,0927	64273,6029
2008	26091,8702	21576,7094	21648,6493	14317,6058	37296,1697	20335,1248	62654,5436
2009	25953,6449	21440,7813	21181,8671	14528,6522	36666,1962	20606,222	63781,0192
2010	26439,1107	21314,6231	21650,3784	14650,232	36276,4845	20417,6088	64399,996
2011	26449,0504	22283,6382	21338,8055	14981,2939	36438,5958	20637,7006	63581,0117
standard deviation	export productionnn	export productionnv	export productionon	export productionov	export productionsn	export productionsv	local productionlv
1997	3585,15285	2162,221537	3006,371804	1608,155229	5336,695266	2056,595115	11827,76563
1998	4358,133361	2334,71417	3436,259517	1932,186527	5838,699595	2011,625118	11945,21101
1999	4125,41789	2765,929087	3340,362792	1842,597996	5117,155247	2266,703211	12317,12966
2000	3823,409229	3021,575254	3513,87223	1672,198936	5356,517788	2431,64507	12396,28397
2001	4324,112807	2735,870314	3309,218144	1876,66891	5517,290328	2443,978337	12862,82728
2002	3990,969725	3160,34861	3322,395731	1879,976823	5415,91713	2281,435639	14987,11571
2003	3267,514086	2499,807273	3681,65274	1900,669866	5754,180902	2322,666868	13357,13354
2004	3338,587099	2795,769038	3326,992076	1727,222712	5183,583496	2737,542732	14016,65365
2005	4437,826731	3174,291092	3507,758967	1909,328008	5102,358973	2645,240694	14770,75134
2006	3332,840289	3031,492202	3430,260793	1678,741464	5304,773313	2668,090742	14644,46663
2007	3991,937708	3198,879754	3025,93505	2051,886151	5666,852312	2779,179693	11718,86804
2008	3456,978479	3047,224037	2832,126572	2026,43794	5446,447184	2896,965928	14438,57212
2009	3685,552573	2907,501764	2943,897152	2149,837146	4893,999196	3594,366916	13685,72621
2010	3593,06099	3442,328518	3137,187026	2011,933402	5503,717598	2705,222257	13306,24097
2011	3115,258409	3308,842871	3233,666539	2134,047241	5119,107244	2737,570675	14876,24577

Base Scenario

mean	local productionnn	local productionnv	local productionon	local productionov	local productionsn	local productionsv	export turnoverlv	export turnovernn
1997	18985,1458	8804,0233	11508,0196	4773,1717	20058,5513	6656,3423	157334828,3	39796620,93
1998	17878,5115	9113,7863	12158,7011	4954,3778	19362,3099	6819,0941	180366528,9	44920561,65
1999	18699,0483	9279,878	11979,1944	4774,5311	21286,1506	6958,8688	197225535,8	47877971,57
2000	18182,5994	10094,9152	12144,6879	4987,1181	21350,3038	6825,7912	220905618,9	51848531,59
2001	18246,0905	10104,9208	12499,0503	4997,9055	21124,2471	6538,036	246982554,7	57228982,2
2002	17701,3206	10428,6736	12878,532	5289,947	20714,3741	7448,5003	265832633,4	61593368,01
2003	17317,2382	10085,713	12397,6673	5324,9398	20346,4009	7400,5271	291078321,9	65416747,73
2004	17435,6248	10520,0767	12804,0193	5193,2697	21969,7122	7390,3532	324254554,9	71290039,56
2005	17655,6849	10443,2409	11783,6804	5319,5687	21256,094	7468,6929	339039085	73393323,56
2006	17817,9868	10682,3794	11861,6671	5247,0914	21029,6259	7600,5818	360112409	78510805,1
2007	17433,4042	10134,7198	12141,1096	5623,7556	20281,2256	7408,3105	373188053,9	83203369,37
2008	16677,3352	10537,8967	11960,5552	5525,3977	20134,6082	7739,2701	413969222,3	87066456,07
2009	17029,4238	10217,4697	11911,9811	5517,1249	19214,1228	7924,6214	434751686	94432668,86
2010	16502,4446	10685,1221	11304,8591	5587,6024	19575,9243	7622,0371	467853352,8	97296002,36
2011	16319,9732	10435,3756	11444,2396	5616,7418	19133,2807	7800,0464	500237461,7	105182494,8
standard deviation	local productionnn	local productionnv	local productionon	local productionov	local productionsn	local productionsv	export turnoverlv	export turnovernn
1997	3558,614742	2077,304797	2605,147555	1294,033813	4045,253177	1905,824827	25679702,88	7687699,859
1998	3420,20503	1865,999247	2504,655058	1378,207231	4428,484882	1726,326485	26983248,12	9221772,623
1999	3373,416737	2286,149974	2345,662653	1494,856528	3968,922055	1790,626826	32542541,13	8865156,966
2000	3794,230641	2193,884127	2235,95582	1260,334926	4402,750648	1639,382345	35308429,57	11005537,47
2001	3144,851013	2377,607583	2435,61973	1352,990999	4189,885751	2001,955024	41080758,69	11523568,5
2002	3223,399206	2389,547326	2461,320692	1291,274467	4252,472913	1869,246701	41751187,08	11249032,95
2003	2694,951908	2291,893428	2373,233295	1551,086029	4395,491719	1987,92015	50395111,06	11926945,25
2004	3240,240843	2247,837739	2489,927184	1446,145195	4963,003513	2144,094134	55801591,97	13685749,64
2005	3179,056381	2326,439761	2473,328302	1476,53085	4607,860861	1938,579732	61390013,48	14262849,55
2006	3400,050958	2511,944358	2404,340176	1399,221178	3806,375882	1875,43394	47885485,83	17003286
2007	2869,17428	2041,472386	2727,658326	1534,228323	4022,329206	1940,135582	56894253,77	14933572,71
2008	3019,871351	2037,853396	2424,448838	1371,671823	4566,697026	1899,991813	64475599,68	17067587,49
2009	2653,161648	2413,055308	2586,802986	1468,208076	3811,904627	2061,950949	70450787,06	20208868,17
2010	2878,498711	2315,635059	2383,482658	1518,60499	3628,879668	1993,230574	79612023,36	18324336,19
2011	2844,265714	2147,794946	2493,985705	1609,075176	4012,098586	1936,7399	76597432,45	22117230,09

FTA Scenario

mean	local productionnn	local productionnv	local productionon	local productionov	local productionsn	local productionsv	export turnoverlv	export turnovernn
1997	17936,4436	9127,1742	11842,5511	4938,9302	20319,8125	6889,4	155388611	40018004,93
1998	18221,9064	9029,3187	12022,0403	4895,5863	20484,2122	7107,4494	179330701	43746202,08
1999	18525,9393	9639,7134	12310,8655	4904,688	21277,052	7233,0738	200876518,4	49031624,89
2000	17601,5167	9951,6832	11963,3216	4955,1553	21219,7867	7498,4093	228372151	54176265,28
2001	17476,0563	10184,8659	13018,6421	5118,6692	21591,1251	7579,5023	249818481,1	56954238,42
2002	18218,2915	10391,31	12586,7486	5236,6642	21729,9613	7217,3746	273864817,8	63629601,97
2003	17807,3219	10507,6395	12944,484	5297,6214	21850,9353	7201,8206	304929775,4	67145909,65
2004	17631,2201	10425,4702	12377,8446	5091,5733	21037,166	7412,5068	323737402,7	70584520,99
2005	17553,795	10520,0194	12328,9817	5516,1713	20647,791	7352,9223	346920966,1	75142173,64
2006	17243,1771	10551,7777	12406,3401	5404,2049	20527,2859	7537,0737	371972155,9	78452720,01
2007	16773,9183	10377,2684	12177,5467	5702,0723	19775,7711	8116,8787	401241075,2	85643123,93
2008	16962,4084	10137,1658	11971,7737	5211,4629	20143,5733	7508,1897	422325593	89528781,32
2009	17221,7112	10514,7335	11553,1488	5468,2544	20201,1365	8494,9191	443622818,2	96669760,5
2010	16541,4486	10744,7554	11620,7699	5350,9098	19793,1429	7760,4142	473235986,9	100399137,7
2011	16906,9464	10775,5383	10575,6082	5703,7908	19631,8191	7808,3755	511446921,7	103600185,7
standard deviation	local productionnn	local productionnv	local productionon	local productionov	local productionsn	local productionsv	export turnoverlv	export turnovernn
1997	3151,652934	2031,968495	2797,325994	1120,928579	4158,644191	1662,922219	19573333,69	8176995,413
1998	3321,694706	1935,747581	2236,882013	1447,654867	4247,858979	1925,787404	31135281,13	8735826,086
1999	3533,08534	2272,942254	2659,670732	1234,462067	3789,147459	2174,072992	31043317,55	10045745,31
2000	3572,64313	2177,396837	2677,602794	1359,302363	4621,142864	1883,341034	36881822,61	12627083,77
2001	3073,139961	2258,433437	2644,111307	1158,158558	4446,414374	1937,139227	44633097,62	12452227,43
2002	3454,440943	2420,475348	2765,371767	1459,951309	4349,202907	1750,001866	47122435,3	13597429,84
2003	3419,394649	2400,124219	2820,709161	1473,974549	4454,76389	1962,102317	51071618,52	13104644,77
2004	3190,99187	2194,120756	2406,114354	1303,64552	4387,852605	1651,6809	50799321,37	14777119,4
2005	3355,145245	2538,350726	2458,096383	1462,92669	4542,232007	1932,778254	50895343,51	14370347,09
2006	3177,06046	2246,717708	2610,347659	1338,457379	4125,089307	2301,820972	57939305,42	16580296,57
2007	2545,120377	2307,369059	2519,035313	1611,685517	4082,805668	1989,535194	70974299,84	18252646,55
2008	3044,878627	2294,086452	2199,483689	1623,098632	4081,297339	1990,348631	68449397,14	17356855,4
2009	3225,99544	2413,703013	2133,855077	1585,366971	4424,467802	1985,417168	69936120,32	18666642,42
2010	3256,204899	2479,143513	2537,355822	1575,155491	3885,842353	2175,583976	68859048,24	19117301,01
2011	2929,765962	2617,286951	2346,356771	1500,832013	3755,006034	2139,895368	85742018,48	20662327,06

No-tariff Scenario

mean	local productionnn	local productionnv	local productionon	local productionov	local productionsn	local productionsv	export turnoverlv	export turnovernn
1997	18533,9439	9021,6651	11552,533	4891,6453	19532,3234	6837,6181	174728959,6	45836196,1
1998	17809,2854	9336,2173	11484,3194	4729,5843	20620,2534	7093,2319	195163301,6	50892851,56
1999	18646,1802	9317,1867	12489,7725	4949,6035	20072,3554	6817,0073	223389542,7	53423209,19
2000	18231,6777	9556,822	12241,0906	5051,3535	21056,4686	6966,5353	246095838,9	58787287,74
2001	18166,384	9976,6091	12238,1192	5234,6543	21333,1714	7236,3114	266397127	63302211,65
2002	17899,9579	10062,4649	12640,4245	5258,1438	21251,0215	7241,1647	294176661,9	65956379,35
2003	18312,8232	10630,2492	11788,5608	5169,556	21884,5236	7843,6235	315179528	70301563,87
2004	18564,4788	10226,623	12558,3876	5303,5107	21243,5118	7830,3007	340676951,9	75084714,84
2005	18002,1339	10444,9319	12389,48	5535,3679	20221,5547	7679,108	375881594,3	82625853,43
2006	17103,2934	10592,5169	11817,8601	5505,9113	20822,667	8097,6509	387067761,6	86408657,61
2007	17428,5713	10607,3479	12238,3312	6028,1553	21311,7499	8187,7631	411744122	90649493,37
2008	17515,1834	10983,5645	11552,4503	6087,8776	20821,1455	8329,1141	450891718,5	93459032,87
2009	17570,4895	10913,9218	11915,2899	6060,2376	20499,603	7767,835	453357818,3	96683454,6
2010	17934,5928	11225,1285	11558,01	6147,8839	20855,1045	8224,6491	494887047,4	105745295
2011	16990,9227	10926,4304	11671,6593	6177,8172	19270,564	8520,9844	532223274,5	109935639,8
standard deviation	local productionnn	local productionnv	local productionon	local productionov	local productionsn	local productionsv	export turnoverlv	export turnovernn
1997	3947,76177	1987,598931	2416,292963	1152,503808	3994,652848	1508,522004	24596512,21	7663264,07
1998	3356,414447	2058,490738	2446,518315	1526,23064	4159,892564	1942,08222	31453420,26	9560022,159
1999	3337,906388	2109,697887	2718,878701	1319,882729	4047,794263	1862,413263	37257444,86	10319566,16
2000	3003,766126	2307,560539	2473,605909	1388,33189	4377,901293	1869,273192	39464564,03	11207782,74
2001	3314,971931	2232,525436	2806,876929	1450,724687	4635,713523	1749,471008	47946866,12	13576749,76
2002	3176,441204	2251,637283	2627,671527	1381,448827	4623,018161	1698,003011	50342963,18	12387288,57
2003	3262,55781	2138,730039	3117,72975	1323,506844	5209,57836	1856,357064	57687430,73	12334369,46
2004	3273,680914	2255,113935	2589,970333	1320,629509	4503,866287	2254,113861	54389995,13	14272600,85
2005	3346,701058	2260,65454	2566,324889	1411,710506	4499,786547	2155,992626	58622354,04	17640026,08
2006	2888,674935	2289,739531	2480,067462	1355,16089	4474,907952	2165,856474	64781816,48	15533144,77
2007	3042,226809	2312,437113	2601,793237	1646,726779	4023,226745	1985,289434	64293180,31	17619364,92
2008	3146,606556	2405,406076	2398,383471	1605,802816	4099,87617	2166,278137	66985179,65	18192745,4
2009	3157,196075	2524,886504	2322,061266	1587,434845	4650,264122	1944,318898	70254847,17	19205541,12
2010	3431,116957	2562,665901	2360,938886	1622,628502	4143,456275	1938,031429	80485211,87	20621400,99
2011	3523,432022	2481,321191	2252,979238	1579,527297	4200,996975	2025,530952	99440123,04	19046502,55

Base Scenario

mean	export turnovemv	export turnoveron	export turnoverov	export turnoversn	export turnoversv	local turnoverlv	local turnovemn	local turnovemv	local turnoveron
1997	28379604,76	33454253,33	17584546,51	58293624,66	25614131,29	30762960,09	13051759,16	5207973,136	6808553,951
1998	31642057,96	36836119,86	19608414,3	64069584,92	27793320,06	32655661,44	12619151,4	5516788,647	7398644,567
1999	34246039,61	41128602,46	21574125,22	71022927,25	30139848,65	34794464,77	13552336,13	5717434,374	7446236,914
2000	37907047,39	43477420,31	24137268,87	75271962,84	33377570,91	35365150,23	13426458,85	6386589,81	7712767,088
2001	42793461,27	49760639,92	26747505,18	85927668,56	38574351,3	37992804,17	13728928,66	6430050,788	8016252,296
2002	47008733,56	51468096,64	29105007,66	94522201,57	42260334,67	38401890,7	13609909,87	6791958,623	8439788,112
2003	51527663,52	57692571,31	31356335,79	101732426,7	44606731,36	39531116	13652329,5	6714065,626	8326938,589
2004	55339552,27	61854274,05	35689612,4	105266968,1	49197048,17	40606124,1	13849880,16	7019486,262	8641754,691
2005	60661047,72	64025109,28	37905583,49	113824883	53747562,81	40608707,98	14160793,21	7027502,827	8011836,003
2006	63276102,89	68764789,55	40828828,7	120649437,1	57500922,97	41393736,65	14361751,44	7274556,84	8165209,569
2007	67686080,68	68472686,55	42189361,74	121250849,5	59893627,95	41957842,02	14333951,54	6851377,007	8352099,783
2008	71567570,25	73787936,52	46411264,36	130712496,3	66020121,81	42462873,57	13803150,67	7267431,418	8334162,425
2009	77581535,88	76591387,8	50297761,21	137816330,5	71024779,98	41902527,22	14143764,49	7084036,568	8341230,933
2010	81843812,82	84858506,81	53776703,15	140035408	74671088,57	41684214,51	13707656,01	7455268,455	7984321,451
2011	87043289,26	84632879,06	57414288	148468178,2	82221658,35	42173039,63	13692364,82	7267680,335	8049171,814
standard deviation	export turnovemv	export turnoveron	export turnoverov	export turnoversn	export turnoversv	local turnoverlv	local turnovemn	local turnovemv	local turnoveron
1997	5574977,271	5780224,729	3084918,238	10745771,99	4903233,164	6873570,892	2340707,609	1176063,951	1497300,303
1998	5205305,128	7787520,18	3476844,914	11305327,79	4277677,297	6908380,869	2257379,702	1105916,115	1574432,861
1999	7168990,761	8024847,946	3843904,493	15576595,54	5117709,176	7360081,664	2289718,192	1373920,596	1507091,533
2000	7666591,486	7993379,037	5349903,004	16037140,49	7465114,465	6180435,772	2504267,572	1440413,112	1483795,205
2001	7714370,926	9442078,21	4409619,589	17448965,86	6757670,803	7581495,373	2300058,918	1539055,553	1629797,687
2002	8288784,158	9943310,045	4937357,791	19450301,72	6871383,66	7738650,294	2245624,225	1568850,256	1623815,809
2003	8755674,819	10371541,54	4884189,555	20058042,93	8336808,545	8100726,958	2088644,346	1556210,334	1592101,882
2004	9828654,252	11551014,15	6112908,783	18495116,32	8524712,611	7459484,933	2401160,764	1517426,843	1734048,681
2005	11660327,57	12182231,06	6675698,521	23535741,45	9311140,528	8207176,771	2343395,9	1560979,413	1692947,43
2006	10677213,3	11882390,59	7297968,812	22117029,63	8660175,806	8575666,608	2606996,144	1692170,959	1734619,154
2007	12358727,72	12520944,61	7337313,579	22280030,7	10698157,71	7200978,055	2310190,382	1425498,7	1938979,554
2008	12950954,95	14139986,97	7765128,334	24861666,94	13171914,41	8691905,594	2449567,711	1369157,418	1641996,616
2009	14948188,33	14952924,02	8041440,06	25319019,14	14110435,55	8479249,126	2174594,148	1713731,713	1795883,766
2010	15423038,25	12901727,88	9060821,961	26587983,79	12534493,61	8338367,313	2365225,275	1630523,406	1759854,44
2011	15730000,39	15509400,48	10525280,47	27487730,09	13921203,91	8335529,429	2311003,203	1553190,413	1687438,644

FTA Scenario

mean	export turnovemv	export turnoveron	export turnoverov	export turnoversn	export turnoversv	local turnoverlv	local turnovemn	local turnovemv	local turnoveron
1997	27601163,9	33357592,08	16792139,71	56487099,73	24857632,82	31886931,01	12274817,78	5336170,349	6943310,923
1998	31758922,17	38234421,14	19546627,13	65102157,76	28531347,71	32120311,33	12834139,2	5437829,072	7288111,063
1999	34513552,59	41342057,42	21581621,18	70382599,9	31584313,86	34750507,37	13424508,62	5930709,327	7602546,45
2000	40568280,11	47509621,63	23987226,2	83756683,87	34118983,42	35403067,26	13077029,45	6277016,485	7609929,833
2001	43976212,71	49355819,88	26697523,82	86027629,9	37318206,96	36438003,37	13180926,96	6535448,531	8369095,997
2002	49145931,76	56429180,95	29366772,29	94270305,29	41356202,54	37752815,59	13972321,95	6725763,349	8244821,646
2003	52638179,23	59254512,56	32093260,93	103242451,9	46052145,31	37993412,82	13840049,41	6925143,983	8573600,599
2004	54876202,53	62707671,53	35715023,48	110103235,5	49265544,81	40846987,71	14114948,14	7055469,263	8434865,52
2005	60238054,12	65778379,54	38045773,73	114421365,7	54779453,15	40073278,35	14127916,88	7093697,895	8399334,87
2006	65979423,33	69613117,67	42314146,56	120040778,9	59465380,07	42156155,31	13888318,29	7145017,834	8494334,494
2007	70830484,36	72960284,47	43854151,09	129069189,1	63087409,09	40752623,17	13799070,21	7159304,955	8482509,848
2008	75378612,87	76619999,71	47698158,39	132635911,6	66962942,63	42883048,52	13952926,84	6975246,922	8314013,001
2009	78375683,18	80586569,91	49916146,81	139576608,8	68972570	43776961,1	14194856,76	7255695,185	8078355,37
2010	82043208,76	82352958,87	53557414,71	142892482,8	76548005,03	42947792,8	13732348,43	7385625,985	8097815,695
2011	87551316,71	87661918,42	56483029,21	150287905,8	80675552,14	43031798,86	13954800,3	7457116,17	7420547,396
standard deviation	export turnovemv	export turnoveron	export turnoverov	export turnoversn	export turnoversv	local turnoverlv	local turnovemn	local turnovemv	local turnoveron
1997	4944492,37	6284775,525	2958118,285	10606479,23	4200380,116	6682834,797	1916471,107	1210082,914	1714218,554
1998	5141693,442	6387698,223	3442641,77	10611217,81	5339280,681	6742839,887	2172423,524	1174877,866	1411449,956
1999	6286332,663	7726342,07	3888868,577	14276314,15	6142058,088	7578029,83	2486578,475	1411286,674	1603505,278
2000	6890358,874	9590502,367	4558160,41	18979795,17	5991740,427	6583799,223	2382002,528	1369794,483	1736164,148
2001	8833105,033	9360840,188	5089564,82	16093454,09	6464719,111	6958765,668	2186481,391	1560911,013	1730053,91
2002	10386176,81	11497629	5948563,272	19033885,25	8503886,076	8575161,52	2509176,384	1529537,947	1842222,985
2003	9213195,44	10814571,38	5946943,087	18796860,65	8166412,427	7690742,197	2471706,219	1588922,468	1836662,29
2004	10096109,26	12881259,8	5676183,239	20552736,02	8663438,106	7032458,219	2311145,243	1514339,569	1557457,216
2005	9516761,169	12663243,91	7089485,836	22535068,46	10600961	9495923,227	2545517,441	1732376,87	1674023,614
2006	14222551,37	14640469,24	7462845,706	23887700,88	10150536,47	8904816,216	2273030,654	1482859,422	1797842,431
2007	11835909,29	15223407,2	7170878,618	23641012,51	10103571,01	8114622,663	2049265,708	1633020,412	1747082,134
2008	13676286,25	13862862,51	8810927,837	23093713,49	10831886,19	9087030,898	2416057,006	1638404,598	1541125,535
2009	14656711,07	14866781,15	9012576,091	26483418,74	10993177,82	7649832,875	2493203,378	1662081,846	1518858,904
2010	15458270,96	16891996,63	9573590,368	27803142,49	13933599,35	8719708,944	2553867,458	1692443,072	1745350,086
2011	14821955,02	16146866,53	10413895,79	27853332,7	13795524,79	8270455,712	2294292,343	1760052,042	1702418,763

No-tariff Scenario

mean	export turnovemv	export turnoveron	export turnoverov	export turnoversn	export turnoversv	local turnoverlv	local turnovemn	local turnovemv	local turnoveron
1997	30528800,11	37310813,67	21188458,16	63835819,97	29221077,03	30331151,15	12649862,58	5325044,176	6819692,557
1998	33935522,11	40351527,23	23007494,87	71836434,07	32303839,08	33950510,62	12539822,46	5608504,719	6927100,267
1999	38172361,16	44552276,69	25712572,87	78089040,62	36054087,18	34279659,26	13542169,32	5784839,345	7806870,005
2000	42095191,08	49022367,25	27720820,49	84000738,85	39156737,36	35321234,85	13539689,36	6030531,804	7767599,203
2001	45719139,17	51890086,62	29930277,21	91170721,9	42220610,15	35988415,84	13796087,4	6394696,355	7916534,416
2002	51663293,44	55774465,29	32913572,32	98649973,67	46613744,3	37415189,13	13766394,94	6599606,294	8319445,238
2003	53151480,28	61145852,63	36475094,61	105787079,4	48068469,62	39306565,82	14290319,17	7005428,404	7828161,712
2004	58454290,63	64939292,76	40565374,33	109912781,9	55837880,54	40127679,18	14734351,62	6872896,001	8530437,196
2005	65207456,88	70823288,79	43766486,26	122593560,8	61666632,56	41088704,98	14312951,91	7092463,658	8461014,072
2006	68028319,26	70922515,45	46871084,62	122208392,7	63460626,38	42705672,88	13974732,96	7230482,416	8200949,249
2007	73116495,95	72931172,64	48789167,81	130702617,3	67383893,14	43569755,14	14093440,13	7126826,326	8397532,332
2008	78417707,21	77905263,39	53309272,8	136912125,1	75295022,58	42841676,14	14336962,68	7467438,725	7973823,68
2009	81511545,21	79790811,71	56762109,33	140291558,3	79997704,55	43686324,2	14376036,12	7434861,678	8202602,494
2010	85833194,01	86962991,42	60876597,17	149306355,3	84539330,33	43716084,69	14570058,09	7575927,048	7925949,651
2011	92282468,3	89016391,65	63947360,55	155014999,8	87613877,86	43889723,72	14110234,17	7507957,4	8146592,447
standard deviation	export turnovemv	export turnoveron	export turnoverov	export turnoversn	export turnoversv	local turnoverlv	local turnovemn	local turnovemv	local turnoveron
1997	4566613,52	6545753,901	3686219,273	11323011,3	4430681,658	6214574,54	2486637,852	1155681,099	1494147,279
1998	5620882,258	8304970,573	4223522,937	14719714,43	4886356,147	6562355,578	2206964,913	1258095,783	1444477,19
1999	6999232,515	8043117,23	4684624,404	13840975,68	6171534,806	6941800,941	2381802,084	1278934,851	1720777,144
2000	7326692,287	9989733,643	4875403,855	15450784,36	7151931,281	7001359,986	2230669,23	1489383,264	1575117,842
2001	7705533,494	9835461,305	5294487,259	17715037,87	7471464,657	7610661,42	2355546,259	1454591,556	1766558,662
2002	9381486,854	9724549,257	6159341,346	16268455,17	7036578,195	8850737,735	2386186,786	1532657,472	1816971,36
2003	9160769,905	12171598,03	6445154,404	19969107,3	7260849,03	7664609,738	2425053,012	1485361,65	2093250,189
2004	10515198,14	13268012,42	7313593,865	21388751,57	10408396,48	8344701,554	2524765,278	1528949,675	1835605,147
2005	13386507,18	14669011,67	8021666,056	23916880,8	10735229,61	8703979,519	2356090,731	1634164,697	1804304,607
2006	12588100,88	13408792,2	7450792,705	23804083,9	11554288,8	8963551,125	2228103,053	1571651,54	1800891,825
2007	13633201,34	12273377,96	8535626,389	27252083,35	11856854,16	7248522,232	2349000,238	1491591,122	1922700,517
2008	14201015,37	13658654,9	9469061,34	23230218,39	13044341,08	8806976,676	2686314,133	1595288,03	1668627,836
2009	13203701,41	14931219,71	10572617,75	21684445,94	15407112,45	8463401,804	2438824,531	1700893,375	1584150,39
2010	16290012,02	17580092,43	10963450,2	30862688,25	15382121,11	7903592,725	2695248,052	1682106,956	1660949,284
2011	14032026,56	18973472,08	11151744,83	28937463,97	14147324,69	9078119,098	2814563,438	1717007,22	1597785,759

Base Scenario

mean	local turnoverov	local turnoversn	local turnoversv	total costlv	total costnn	total costnv	total coston	total costov	total costsn	total costsv
1997	3454281,424	12385864,3	4406853,922	104413026,9	32850161,57	18393534,98	25671436,44	12272686,19	41706136,12	16384369,09
1998	3651678,222	12234445,84	4573885,857	115534937,2	35149900,63	20073061,97	27655704,12	13250464,61	44366949,95	17449617,99
1999	3572938,062	13754333,86	4773031,265	124762969,2	37030314,49	21429246,12	29844997,52	14193058,22	48382622,21	18697707,47
2000	3824294,101	14122941,18	4765030,133	136006658,3	38834714,59	23438780,14	31404222,86	15406633,27	50867256,01	20006221,43
2001	3844808,386	14126829,22	4595025,213	146806717,5	40548307,47	25321683,34	33922798,91	16450715,88	54505719,35	21888852,11
2002	4190843,346	14150145,3	5382371,174	154875977,9	42233462,26	27193468,29	35072896,92	17593094,61	57756854,28	23734143,13
2003	4264880,639	14286126,2	5440960,854	163847507,4	43525445,29	28668372,27	37224624,83	18450455,01	60166216,04	24452057,86
2004	4189228,653	15446474,9	5450984,475	174887007,6	45827590,25	30052884,45	38906465,89	19934053,18	62182076,22	26147221
2005	4328402,879	15120970,63	5565811,952	180094737,9	47000342,61	31775239,3	39322794,56	20637575,84	64891795,83	27571196,67
2006	4314963,801	15103000,85	5722879,009	188549046	49029027,51	32927600,65	41105804,75	21745542,37	67327204,3	29031595,72
2007	4594781,662	14584917,12	5514594,471	196846281,8	51082109,63	34707652,14	41940106,76	22872193,74	68215475,91	30244749,29
2008	4616030,076	14726644,56	5898730,593	208404362,6	52158874,32	35926675,22	43229915,43	24009714,8	70619794,26	32049697,65
2009	4608376,917	14076390,48	6060043,692	214297754,5	55167495,45	37609850,71	44425471,26	25187885,48	72729949,4	33622072,53
2010	4729811,527	14388039,68	5887996,711	223438792,6	55599780,99	39083987,4	46459989,32	26363920,76	73123451,87	34644300,14
2011	4711776,412	14136614,87	5977436,374	235351304,7	58146767,31	40855365,76	46974941,55	27386452,27	76103405,33	36928511,33
standard deviation	local turnoverov	local turnoversn	local turnoversv	total costlv	total costnn	total costnv	total coston	total costov	total costsn	total costsv
1997	902091,8894	2484876,289	1289749,781	9933141,183	2603545,472	1698207,016	2234294,89	1042747,711	3613934,73	1457055,097
1998	1031702,733	2644126,822	1161698,133	9226801,491	3109768,343	1808128,662	2622356,216	1141550,464	3430097,232	1466271,246
1999	1074220,821	2463262,956	1249065,196	10846762,66	2874278,84	2007901,95	2469544,598	1242221,287	4328322,979	1714229,482
2000	934573,6022	2881535,092	1083819,821	11943223,22	3401494,394	2290839,578	2621458,715	1491085,577	4330156,046	2188833,064
2001	1059421,386	2772160,144	1431509,345	13227127,5	3180536,573	2232913,288	2474441,088	1442804,444	4527771,076	2026182,185
2002	1032101,882	2777635,354	1385299,67	13344004,11	3302715,673	2272024,004	2853385,449	1598605,149	4967511,125	1872394,169
2003	1206025,405	3097282,09	1460074,813	15773032,04	3102457,638	2627345,33	3236551,078	1490019,465	5067282,699	2029438,394
2004	1139571,274	3274210,563	1599929,531	14776628,64	3829293,15	2958851,965	3309431,45	1642322,433	4990321,204	2596389,642
2005	1175841,628	3351187,83	1485953,907	15050448,93	3269152,229	2695846,672	3111563,839	1499656,064	4743819,893	2420110,808
2006	1138649,384	2715905,949	1427160,269	15902237,76	4246259,643	2628549,974	2959198,274	1977446,606	4593885,447	2385598,196
2007	1252259,257	2764272,271	1424136,042	17250019,02	3920005,499	2932597,988	3491610,247	2057767,916	5604042,098	2640953,844
2008	1146598,855	3356398,84	1445185,787	18722233,12	4221271,3	3422908,396	3680377,812	2153123,724	5953522,656	3250249,822
2009	1154424,847	2677268,734	1566308,194	18451589,33	4924179,285	3203579,331	3704148,752	2107532,389	6032344,052	3125053,953
2010	1299301,513	2506693,375	1559161,946	19207693,92	4410290,236	3515664,483	3646414,16	2472978,84	5862024,563	3349209,167
2011	1323755,142	3000752,087	1469036,35	18863934,55	5565409,504	3829383,937	4058022,625	2368665,43	6207655,349	2836588,389

FTA Scenario

mean	local turnoverov	local turnoversn	local turnoversv	total costlv	total costnn	total costnv	total coston	total costov	total costsn	total costsv
1997	3518231,91	12374415,31	4469732,236	105048866,8	32970829,01	18303231,58	25862484,94	12182512,51	41310470,23	16420441,15
1998	3572650,723	12949668,4	4746733,606	114011678,9	34373022,91	19927954,24	27890795,62	13123078,12	44632656,28	17671024,02
1999	3665799,319	13763105,8	4936201,423	126488521,1	37043244,07	21692180,5	30017877,56	14378628,49	47958841,44	19519562,05
2000	3792716,152	14044046,55	5220365,79	133265687,8	38006785,63	23464811,69	31505608,48	14942655,97	51663235,78	20011102,6
2001	3978566,19	14496925,93	5376613,374	144072888	39857651,2	25247665,08	33574518,48	16417489,57	54051655	21641303,05
2002	4099270,26	14860240,39	5148144,38	154550212,5	42563191,15	27308270,48	36145401,06	17525284,37	57250977,58	23018160,78
2003	4243544,43	15152982,1	5249619,67	163185347,3	43797746,22	28358330,69	37162258,5	18290468,43	60101604,31	24335875,2
2004	4162666,495	15028264,51	5545051,487	172925111,5	45505341,16	29462979,62	38619215,12	19572292,54	63008703,77	25723751,91
2005	4499293,329	14703751,62	5475103,009	183059532,7	47411978,35	31752654,11	40123690,64	20948446,87	64652824,14	27917437,09
2006	4457207,862	14664553,92	5656577,499	191093553,1	48670856,54	33301399,89	41335994,5	22132280,8	66481713,07	29356081,69
2007	4730731,039	14382623	6151879,986	200475735,1	50952133,28	35116713	42559079,37	23083852,67	69043838,55	31078463,14
2008	4340246,471	14614293,52	5710049,49	208158939,5	52493333,9	36399201,33	43597716,75	23979790,5	70421499,94	32005579,05
2009	4538017,512	14757385,5	6463987,488	217649196,2	54900772,18	37908450,11	45035787,53	25102620,38	73014351,37	33513118,54
2010	4452283,338	14460061,82	5905494,462	226594349,1	56585298,32	39099327,67	45835802,21	26123045,67	74146738,48	35204055,41
2011	4755991,082	14366671,84	5960799,501	240629755,1	58209885,09	41384970,56	47256163,21	27670351,77	77023550,94	37025499,56
standard deviation	local turnoverov	local turnoversn	local turnoversv	total costlv	total costnn	total costnv	total coston	total costov	total costsn	total costsv
1997	793586,1093	2420110,624	1061539,809	7819869,966	2943956,85	1605331,067	2174883,037	1070053,391	3854714,334	1362367,118
1998	1034250,007	2763289,629	1292299,798	10146752,05	2854206,189	1697569,202	2059602,881	883698,1932	3396428,994	1445409,969
1999	903793,5557	2493333,92	1475000,661	9803964,438	3109992,637	1712478,097	2518754,349	1295538,529	3777733,362	2044300,7
2000	1066236,23	2888661,603	1272669,117	11578525,23	3600001,689	1970271,351	2741624,54	1402223,266	4733097,232	1926213,893
2001	900544,3196	3061536,434	1391820,401	11721873,67	3161176,512	2085889,747	2754391,069	1569365,402	3977775,79	1774677,368
2002	1173441,116	3029052,992	1227185,221	12959301,22	3255912,833	2477488,749	3064034,249	1654570,547	5032659,579	2233740,037
2003	1196277,479	3176103,739	1416574,11	14997782,01	3180827,028	2455489,35	3096790,005	1611937,512	5391210,685	2191169,269
2004	1072935,269	3261557,846	1266653,583	15849949,35	3681102,457	2602743,032	3181027,106	1834748,396	5811507,52	2406930,779
2005	1200997,444	3180599,169	1440206,138	15368731,1	3437965,777	2398059,658	3249216,9	1808382,234	5535574,002	2624284,126
2006	1116258,426	2805406,545	1713504,047	15145006,31	4215160,573	2937992,601	3281509,617	1912982,153	6048292,617	2428280,939
2007	1315634,805	2857174,266	1472105,948	19989078,92	3949682,64	2895840,631	3670445,777	1805223,319	5450012,248	2230555,407
2008	1323984,452	2861564,448	1528037,554	18400397,09	4089875,029	3289870,913	3206959,513	2016999,916	5779104,884	2879776,77
2009	1282825,612	3200470,763	1530404,66	21403244,9	4014757,06	3449067,136	3813051,314	2391192,661	6013226,351	2827510,02
2010	1310099,272	2796150,912	1677576,61	19221420,66	3997902,202	3374731,92	3904786,326	2237436,997	6182956,438	3177437,474
2011	1239392,203	2645770,679	1652987,374	23452391,3	4950040,87	3852808,443	4058772,869	2841732,158	6059790,993	3433666,378

No-tariff Scenario

mean	local turnoverov	local turnoversn	local turnoversv	total costlv	total costnn	total costnv	total coston	total costov	total costsn	total costsv
1997	3535286,332	11977972,46	4496193,252	103897616,1	33016286,76	18059567,36	25825252,94	12357279,29	41401531,61	16300427,45
1998	3448466,987	12959420,07	4718241,384	114958484,5	34966304,75	19777772,47	27322001,41	13247451,87	45171072,97	17787091,75
1999	3727273,302	13080816,78	4692896,757	126217656,4	36745254,32	21572211,02	29977984,23	14344120,86	48121790,11	19088054,42
2000	3871003,736	13950318,2	4880258,933	138360263,5	39013885,07	23707828,43	32105999,43	15516609,02	51623356,75	20724342,08
2001	4050401,842	14397833,76	5119291,857	145908795,8	41187148,14	25182830,42	33548741,61	16332781,14	54809190,34	21863177,43
2002	4174092,709	14575828,14	5268033,826	157833128,9	42580073,21	27609883,26	35635481,17	17729600,87	58032581,05	23776078,51
2003	4124819,198	15159219,37	5705239,862	168069185,8	44757877,01	28704154,73	37471032,06	19230650,04	61322105,58	24966820,96
2004	4299367,227	15028861,36	5780518,694	174749239,3	46107003,89	29972524,25	38826659,88	20400014,9	61733603,53	27040820,37
2005	4523525,007	14405232,68	5727531,718	185979095	48208536,49	32066741,62	40370564,16	21601350,21	64603104,95	28810338,42
2006	4514898,11	15082607,85	6088161,686	192795039,4	50091824,4	33617667,04	41039611,07	22962169,93	66309586,24	30111869,88
2007	4877913,64	15274099,86	6066609,642	205657078,2	52335549,41	35877949,95	42584698,05	24417697,31	70009674,61	32020111,64
2008	4998480,819	15010444,38	6243748,782	215533542,2	53338193,18	37370222,65	43498304,12	25636980,19	71739652,36	34187503,93
2009	4979777,675	14771368,02	5840101,187	222297683,9	55264424,51	38701689,09	44873314,75	26945544,8	73497977,72	35617370,72
2010	5021589,011	14966401,46	6115717,397	231604768,7	58005277,57	40259414,73	46725316,56	28264053,94	75885999,21	37149154,7
2011	5100040,56	14107670,11	6436279,941	246689699,9	59914615,75	42892079,11	48240403,38	29868719,79	77952326,85	39153699,46
standard deviation	local turnoverov	local turnoversn	local turnoversv	total costlv	total costnn	total costnv	total coston	total costov	total costsn	total costsv
1997	851649,6005	2424035,491	983210,3106	9007316,202	2700104,31	1535033,257	2143004,969	1201384,453	3743114,143	1392323,33
1998	1116819,693	2457252,023	1280993,391	10614700,95	3371757,316	1688383,982	2359913,344	1301442,248	3536024,61	1373926,148
1999	1022312,841	2669875,62	1300873,577	11443137,94	2737644,467	1922925,613	2767658,801	1253671,465	4046771,384	1580922,215
2000	1045874,266	2972065,751	1332065,844	12414900,25	2899930,883	2236776,81	3004844,005	1278893,086	4410974,317	1762008,9
2001	1108397,397	2941200,88	1250924,205	13016999,16	3562275,412	2141178,768	2596177,925	1323526,57	4502833,562	1766426,637
2002	1089090,876	3154785,35	1280276,773	13614797,48	3517210,65	2468721,478	3241592,455	1700256,516	4618493,533	1911076,241
2003	1087536,682	3503617,952	1407904,811	15241766,8	2995053,645	2250714,35	3312303,273	1669095,168	5096665,409	2084579,32
2004	1101010,68	3068964,055	1616863,057	15056727,51	3162086,881	2417510,741	3366100,871	1593154,375	4732475,521	2357631,118
2005	1183008,526	3240314,217	1587519,81	15419495,92	4277036,39	3122861,065	3347604,501	2014903,43	5193452,749	2375919,325
2006	1094867,225	3243260,447	1626946,601	14815928,65	3523124,682	2952697,521	3756068,373	1728671,848	5388680,819	2373245,553
2007	1269540,517	2980587,968	1461767,437	16073613,47	4047493,569	3000293,562	3577215,514	2111763,763	6114600,285	2861437,655
2008	1331654,047	2806204,243	1570588,303	18386559,53	4043100,755	3158282,791	3211300,125	2251325,522	5908154,327	3035912,772
2009	1259378,053	3167054,63	1419485,266	18361379,85	4607328,382	3106643,192	3947663,835	2539914,492	5725887,691	3858065,83
2010	1396288,36	2947476,861	1423392,191	17777981,03	4430901,057	3984394,483	3699984,636	2652334,193	6555487,199	3286105,42
2011	1277547,761	3166861,613	1548122,476	21664164,19	4373285,333	3917691,643	3983614,976	2510262,242	6280045,903	3048368,426

Base Scenario

mean	junsep tar	ex ann	ex jan1	ex feb	ex mar	ex apr	ex may	ex jun	ex jul	ex aug
1997	3,7	5,7748	5,62	5,5998	5,6156	5,676	5,7166	5,7736	5,813	5,8416
1998	3,57	6,1656	5,9725	6,0182	6,0508	6,0743	6,1051	6,1522	6,176	6,2128
1999	3,43	6,5781	6,3921	6,4227	6,4628	6,5088	6,5345	6,554	6,592	6,6156
2000	3,3	7,0512	6,8125	6,853	6,9172	6,9515	6,9833	7,0205	7,0667	7,1195
2001	3,17	7,4882	7,2981	7,3399	7,377	7,3871	7,4349	7,4692	7,4976	7,5483
2002	3,03	8,0008	7,7673	7,8056	7,8635	7,9051	7,9277	7,9932	8,0445	8,0335
2003	2,9	8,4473	8,248	8,2664	8,3017	8,3447	8,379	8,425	8,4696	8,5359
2004	2,77	8,9557	8,6807	8,7202	8,7915	8,8243	8,898	8,9418	8,9861	9,0208
2005	2,63	9,533	9,3039	9,3636	9,3983	9,4422	9,484	9,5323	9,5634	9,5976
2006	2,5	9,9775	9,7861	9,7965	9,8085	9,8488	9,9202	9,9766	9,9979	10,0562
2007	2,37	10,4027	10,2017	10,224	10,2711	10,3119	10,3805	10,4305	10,398	10,4261
2008	2,23	10,9772	10,7011	10,7559	10,8223	10,8668	10,9379	11,0009	10,9711	11,0625
2009	2,1	11,5418	11,2902	11,3474	11,4042	11,4381	11,5016	11,5578	11,5481	11,6085
2010	1,97	12,0878	11,7778	11,8607	11,9095	11,9964	12,0068	12,0603	12,0909	12,1365
2011	1,83	12,8224	12,5296	12,6106	12,6482	12,6947	12,7337	12,7772	12,8237	12,901
standard deviation	junsep tar	ex ann	ex jan1	ex feb	ex mar	ex apr	ex may	ex jun	ex jul	ex aug
1997	0	0,183354738	0	0,130843265	0,154300486	0,188488726	0,222334073	0,240060492	0,252386608	0,292912
1998	0	0,345002377	0,335298002	0,348767487	0,364449393	0,365555071	0,365684276	0,389475493	0,397698378	0,378576492
1999	0	0,474926721	0,464947943	0,486618649	0,490713929	0,511676226	0,518562195	0,526307895	0,51420424	0,516343529
2000	0	0,466498189	0,541095879	0,521784438	0,506079203	0,498448342	0,484891854	0,493352562	0,478669103	0,473642006
2001	0	0,545313451	0,5616043	0,555104486	0,565779993	0,58279378	0,595391459	0,572935738	0,601430162	0,584616207
2002	0	0,541944056	0,608172434	0,598363301	0,588870741	0,588393567	0,569169316	0,61462164	0,591880689	0,596619435
2003	0	0,524720602	0,584388569	0,546517191	0,554846024	0,550520581	0,5654706	0,575307744	0,576922733	0,581197204
2004	0	0,551420448	0,578337713	0,600338205	0,583887618	0,593554134	0,585967576	0,610701859	0,62368084	0,596566308
2005	0	0,571329152	0,635351706	0,635602895	0,560264322	0,57351823	0,603029021	0,607621354	0,610013475	0,619654936
2006	0	0,635945556	0,711170718	0,701148166	0,711661963	0,704346903	0,748915189	0,731821317	0,731962151	0,67930962
2007	0	0,659567821	0,672647092	0,672278216	0,681035321	0,733307159	0,730909536	0,688039788	0,705797421	0,729435254
2008	0	0,792869573	0,825354342	0,822548594	0,853059031	0,877561257	0,894667866	0,845957558	0,787305398	0,815106588
2009	0	0,798025538	0,888917296	0,859966999	0,867054992	0,861058297	0,875582914	0,859259658	0,855261007	0,846350253
2010	0	0,831834815	0,871845835	0,918622071	0,878632318	0,876564339	0,900192068	0,914207258	0,926206343	0,9167741
2011	0	0,83817077	0,901314507	0,878449566	0,859806234	0,889095557	0,939098137	0,860302365	0,909961159	0,908645696

FTA Scenario

mean	junsep tar	ex ann	ex jan1	ex feb	ex mar	ex apr	ex may	ex jun	ex jul	ex aug
1997	3,7	5,7252	5,62	5,6244	5,6579	5,6656	5,6753	5,6807	5,7387	5,7597
1998	3,57	6,1212	5,9234	5,961	5,9992	6,0323	6,0586	6,0754	6,1163	6,1621
1999	3,43	6,5778	6,3762	6,4149	6,467	6,5069	6,5624	6,5926	6,6158	6,6408
2000	0	7,0548	6,8104	6,8347	6,9124	6,9493	7,003	7,0382	7,0906	7,137
2001	0	7,5015	7,2897	7,3262	7,3602	7,3745	7,433	7,4734	7,4975	7,5721
2002	0	7,9974	7,7728	7,8424	7,899	7,901	7,9388	7,9966	8,028	8,0543
2003	0	8,4742	8,2317	8,2469	8,3312	8,3437	8,391	8,4355	8,5103	8,5385
2004	0	9,0075	8,7832	8,8235	8,3341	8,8862	8,9426	8,9918	9,0493	9,0856
2005	0	9,43	9,2132	9,2592	9,2972	9,3313	9,3903	9,42	9,4526	9,4647
2006	0	9,9969	9,7061	9,7427	9,81	9,8962	9,901	9,9449	10,04	10,1049
2007	0	10,6027	10,345	10,3975	10,4331	10,4842	10,5113	10,5516	10,619	10,6965
2008	0	11,0729	10,8595	10,9125	10,9368	11,0081	11,0274	11,0658	11,1094	11,1474
2009	0	11,5439	11,2483	11,3071	11,3992	11,4709	11,4939	11,5166	11,5717	11,6068
2010	0	12,1299	11,8496	11,8901	11,9295	12,005	12,0479	12,0899	12,1584	12,1772
2011	0	12,7111	12,4931	12,5029	12,5758	12,6101	12,6591	12,6925	12,7347	12,7788
standard deviation	junsep tar	ex ann	ex jan1	ex feb	ex mar	ex apr	ex may	ex jun	ex jul	ex aug
1997	0	0,174438986	0	0,124083198	0,133576158	0,175677659	0,18790133	0,236386357	0,261054228	0,267497495
1998	0	0,375463127	0,366475702	0,374559742	0,406813584	0,399702027	0,399194238	0,406758946	0,399593931	0,393360636
1999	0	0,374014919	0,429294258	0,432468484	0,439104771	0,420553671	0,418203587	0,387346408	0,408979657	0,424301025
2000	0	0,467186216	0,475505878	0,454300462	0,460103944	0,486728374	0,508726842	0,519810312	0,519091167	0,507878923
2001	0	0,549165503	0,550218966	0,561755783	0,578095113	0,564480956	0,580118091	0,597113423	0,605434348	0,637738653
2002	0	0,525476203	0,597381084	0,596223314	0,591287578	0,558992844	0,579769402	0,574571527	0,565027433	0,550134993
2003	0	0,52758351	0,590477866	0,606439931	0,583387144	0,597253137	0,58249206	0,570982268	0,555225098	0,570570548
2004	0	0,555700234	0,59600651	0,60285052	0,589593241	0,629950442	0,635757218	0,627305954	0,606717817	0,598861119
2005	0	0,62719375	0,605306336	0,656940911	0,662809294	0,666000983	0,665973656	0,679136216	0,69585145	0,708404482
2006	0	0,693304688	0,706038094	0,676237909	0,729913694	0,759118937	0,748949264	0,756561293	0,779144403	0,792887754
2007	0	0,752999143	0,73971143	0,810668089	0,795419003	0,778846814	0,783985529	0,775945514	0,838026849	0,807585754
2008	0	0,747576478	0,821797268	0,789721945	0,804159039	0,84661053	0,811770436	0,783173263	0,78813174	0,790958431
2009	0	0,774343457	0,838002452	0,84731611	0,818787738	0,832013335	0,833818799	0,821223745	0,83257799	0,846185417
2010	0	0,720865445	0,800326084	0,808453456	0,781511836	0,810203061	0,767596632	0,771457705	0,783342479	0,807842906
2011	0	0,792431568	0,842927868	0,861767132	0,867467786	0,869532627	0,889412272	0,923937633	0,863196913	0,867113926

No-tariff Scenario

mean	junsep tar	ex ann	ex jan1	ex feb	ex mar	ex apr	ex may	ex jun	ex jul	ex aug
1997	0	5,7674	5,62	5,6215	5,6679	5,7089	5,7417	5,7645	5,7786	5,8064
1998	0	6,1681	5,95	6,0116	6,0344	6,0666	6,1159	6,148	6,1994	6,2583
1999	0	6,634	6,4199	6,459	6,5047	6,5505	6,5659	6,614	6,671	6,694
2000	0	7,1091	6,8996	6,9379	6,9844	7,0423	7,0719	7,0893	7,1384	7,1621
2001	0	7,562	7,3447	7,3751	7,4148	7,4643	7,5316	7,5646	7,5998	7,6448
2002	0	7,9661	7,767	7,7792	7,8182	7,8649	7,8899	7,9276	7,9976	8,0521
2003	0	8,4308	8,2394	8,2869	8,2975	8,3558	8,3901	8,4133	8,4369	8,4777
2004	0	8,9761	8,6743	8,7183	8,7751	8,8535	8,8944	8,9583	9,0417	9,0897
2005	0	9,4805	9,2749	9,3175	9,3509	9,4001	9,4426	9,4694	9,5004	9,5426
2006	0	9,9428	9,7385	9,7668	9,8174	9,8457	9,8588	9,9183	9,9582	10,0221
2007	0	10,4352	10,1681	10,2109	10,2635	10,2869	10,3426	10,3995	10,4606	10,5274
2008	0	11,0551	10,806	10,836	10,8924	10,9574	11,0014	11,0366	11,0497	11,1335
2009	0	11,6096	11,3456	11,3892	11,4409	11,5024	11,5618	11,5855	11,6588	11,7019
2010	0	12,2236	11,9304	11,9676	12,0376	12,0809	12,162	12,2505	12,2978	12,3124
2011	0	12,7625	12,5056	12,5245	12,5797	12,6239	12,6649	12,7439	12,8164	12,8325
standard deviation	junsep tar	ex ann	ex jan1	ex feb	ex mar	ex apr	ex may	ex jun	ex jul	ex aug
1997	0	0,19389492	0	0,136428553	0,175620585	0,230299349	0,230911477	0,249637237	0,268007537	0,292001781
1998	0	0,338179523	0,329590655	0,332218964	0,346878423	0,352911377	0,356334379	0,389584394	0,40677468	0,386279834
1999	0	0,441429496	0,401401283	0,423432403	0,446306089	0,468459977	0,467848469	0,478898737	0,497287643	0,498834642
2000	0	0,490575366	0,530063996	0,532862637	0,556029352	0,55336038	0,558090844	0,54276377	0,529829633	0,509068355
2001	0	0,550474341	0,547535305	0,569419871	0,578305248	0,597670904	0,587589517	0,597525598	0,577309241	0,587772881
2002	0	0,587179521	0,605021487	0,59523387	0,615980031	0,59218324	0,617256017	0,611392051	0,614774951	0,637097002
2003	0	0,613934329	0,680309959	0,694564173	0,675006704	0,632738777	0,6561547	0,644164661	0,656937889	0,67540633
2004	0	0,604648485	0,610208579	0,635496743	0,628903005	0,641129277	0,631232635	0,642182303	0,676479201	0,651560366
2005	0	0,642450582	0,677525638	0,688464051	0,703302346	0,677224475	0,704076161	0,718601169	0,715955194	0,688831794
2006	0	0,645589777	0,68476328	0,650030584	0,632568763	0,645511046	0,662347764	0,689624615	0,686098215	0,705164229
2007	0	0,78910263	0,778151264	0,795107659	0,830130791	0,793577589	0,809990889	0,818160589	0,843400047	0,867524778
2008	0	0,767818331	0,845432434	0,822119213	0,825909341	0,851242175	0,823888366	0,841574976	0,840399256	0,830619498
2009	0	0,720317874	0,840275336	0,831252886	0,818718627	0,816743085	0,788075352	0,759939965	0,782355776	0,766453776
2010	0	0,816102347	0,806481147	0,816727764	0,858035104	0,883879058	0,883964931	0,874374491	0,869685667	0,867049157
2011	0	0,864097651	0,984602783	0,997144297	0,98074304	0,949885146	0,936250495	0,965524619	0,979853581	0,91512226

Base Scenario

mean	ex sep	ex oct	ex nov	ex dec	annual ppi	annual CPI	CPI jan	CPI feb	CPI mar	CPI apr
1997	5,8622	5,8908	5,9361	5,9564	153,1913	198,4055	193,1	193,0068	194,1359	195,6138
1998	6,2433	6,2705	6,3355	6,3742	163,811	212,1628	205,7452	206,9525	208,121	209,1299
1999	6,6648	6,6974	6,7155	6,7755	173,7141	226,0077	219,6989	220,6578	221,8066	223,0395
2000	7,1559	7,1971	7,2541	7,2856	183,9631	239,8948	233,7101	234,7737	235,9401	236,9631
2001	7,5635	7,6134	7,6275	7,7062	192,9233	253,6365	247,2368	248,422	249,679	250,7924
2002	8,1065	8,1636	8,1887	8,2098	203,3874	267,4319	261,1954	262,3207	263,5266	264,5894
2003	8,5412	8,5857	8,6088	8,6599	213,2443	281,2591	274,953	275,9871	277,2112	278,3951
2004	9,0737	9,1045	9,1846	9,241	223,7037	295,116	288,7743	289,8959	291,052	291,9434
2005	9,6422	9,6501	9,6945	9,725	233,5175	308,9542	302,4842	303,8902	304,9954	306,3066
2006	10,0868	10,1158	10,1339	10,1971	242,8673	322,8446	316,6193	317,5946	318,8006	319,6705
2007	10,4795	10,4886	10,5948	10,6232	253,6532	336,5495	330,1444	331,4626	332,5054	333,6834
2008	11,104	11,1343	11,1522	11,2257	263,678	350,3741	344,0182	345,1012	346,321	347,6477
2009	11,6524	11,6827	11,7119	11,7568	273,3348	364,2484	357,781	359,1437	360,0657	361,3126
2010	12,2008	12,2449	12,3374	12,4291	282,654	378,0508	371,629	373,2231	373,872	375,4728
2011	12,9749	12,9858	13,0807	13,1075	293,855	391,8413	385,354	386,8698	387,8165	389,0975
standard deviation	ex sep	ex oct	ex nov	ex dec	annual ppi	annual CPI	CPI jan	CPI feb	CPI mar	CPI apr
1997	0,296076274	0,301465355	0,299489215	0,328905822	6,35973233	0,446737899	0	1,609707352	1,473170116	1,569355779
1998	0,414009795	0,405093508	0,435218049	0,467369618	4,689112176	0,444261365	1,537106034	1,651212509	1,512859875	1,531276262
1999	0,513181216	0,508593394	0,529919569	0,52894305	6,05566926	0,408065816	1,454376083	1,54309467	1,318524342	1,614371317
2000	0,493017434	0,505308411	0,520202067	0,553619581	6,545940833	0,443078955	1,525890884	1,619670741	1,50935847	1,443933998
2001	0,587406801	0,574479277	0,591304279	0,624134248	6,545220096	0,43466165	1,421591981	1,653463033	1,51611642	1,630526982
2002	0,576280097	0,566717778	0,552757913	0,56235928	5,845548669	0,462345531	1,488144092	1,532917646	1,571615869	1,682712584
2003	0,570498519	0,565664662	0,55604007	0,571962403	5,479917747	0,472163309	1,424953683	1,434431103	1,56611384	1,541728572
2004	0,613238379	0,613325974	0,632353414	0,65286216	5,8158617	0,473491288	1,606832446	1,759360165	1,715533736	1,537972635
2005	0,664875297	0,681298018	0,655324919	0,679347481	5,484445528	0,403740461	1,505587048	1,462743983	1,614069032	1,46738558
2006	0,666418607	0,65491859	0,650005992	0,634099827	5,510004148	0,438117382	1,493236924	1,528315687	1,54104693	1,680186522
2007	0,712917071	0,766591182	0,769338001	0,779717744	6,028338557	0,456899059	1,403961766	1,638061427	1,40310336	1,511394866
2008	0,856607261	0,860004948	0,853795737	0,859715366	5,944232331	0,446204202	1,219481349	1,516428884	1,600207174	1,521140924
2009	0,837164404	0,816807021	0,813521598	0,813229217	5,982914253	0,452463744	1,398149134	1,497854903	1,545912193	1,480152438
2010	0,893844147	0,886979701	0,878211387	0,879705741	6,653252586	0,434162827	1,512564379	1,633352194	1,419899292	1,51545312
2011	0,923499318	0,949533759	0,964406818	0,97234806	6,080310272	0,43668589	1,292465087	1,594986508	1,706683553	1,514920047

FTA Scenario

mean	ex sep	ex oct	ex nov	ex dec	annual ppi	annual CPI	CPI jan	CPI feb	CPI mar	CPI apr
1997	5,7793	5,7957	5,8256	5,8793	153,5111	198,4508	193,1	193,5015	194,1535	195,531
1998	6,2123	6,266	6,3135	6,3356	163,0564	212,1277	205,9765	206,7214	208,0858	209,1086
1999	6,6599	6,671	6,6885	6,7331	173,5745	226,0106	219,5944	220,8906	221,9173	223,0502
2000	7,1723	7,2124	7,2247	7,2766	183,4865	239,7988	233,4338	234,3454	235,9589	236,8897
2001	7,6112	7,6533	7,7039	7,7275	192,3511	253,6079	247,2917	248,5083	249,5828	250,644
2002	8,088	8,1143	8,1422	8,1923	203,9271	267,53	261,1238	262,3575	263,6724	264,3031
2003	8,5812	8,643	8,6798	8,7576	212,1989	281,3039	274,8723	275,9102	277,5056	278,3133
2004	9,1425	9,1618	9,1919	9,2028	222,4973	295,1377	288,839	290,3109	291,0706	292,451
2005	9,5101	9,5533	9,6087	9,6603	233,4001	308,9433	302,4927	303,8973	304,6653	306,0377
2006	10,1442	10,1405	10,2351	10,3002	243,5977	322,7927	316,4465	317,8189	318,671	319,8882
2007	10,7345	10,7823	10,815	10,8588	253,8387	336,5929	330,4658	331,4918	332,7228	333,6301
2008	11,1684	11,195	11,2052	11,2382	263,0651	350,3923	344,107	345,2882	346,4104	347,5291
2009	11,6663	11,7002	11,7639	11,7819	273,1765	364,1707	357,7382	358,919	360,3198	361,412
2010	12,286	12,3281	12,3985	12,4248	282,9398	377,9944	371,819	372,8799	374,0642	375,2134
2011	12,7805	12,8541	12,9272	12,9314	293,7179	391,8099	385,5831	386,5221	387,8327	388,6821
standard deviation	ex sep	ex oct	ex nov	ex dec	annual ppi	annual CPI	CPI jan	CPI feb	CPI mar	CPI apr
1997	0,261473727	0,294490255	0,302494033	0,35408828	6,144693466	0,418054255	0	1,770576389	1,490462596	1,360859655
1998	0,410513958	0,441961537	0,432528323	0,438041824	5,65042574	0,435010011	1,435482062	1,650450254	1,297830636	1,701587506
1999	0,415358869	0,419793997	0,443189294	0,42586546	5,818128801	0,425635572	1,625785985	1,226359507	1,677576141	1,548714293
2000	0,535299645	0,533396888	0,539493197	0,557214896	6,213043598	0,421939048	1,549572702	1,567089927	1,760100506	1,670026021
2001	0,602915052	0,602851648	0,621119787	0,591502113	5,413583637	0,387552048	1,466547002	1,340009743	1,670856714	1,525821746
2002	0,554490757	0,576325004	0,55912893	0,56355808	6,364494685	0,491359339	1,508434805	1,55429944	1,570882631	1,575879878
2003	0,576998153	0,555365645	0,569805195	0,590525393	5,348061872	0,45974419	1,490921094	1,344794393	1,519107843	1,502482649
2004	0,606877871	0,603543503	0,598778248	0,60398192	6,557034521	0,48226726	1,522268373	1,400355023	1,764997915	1,498645722
2005	0,701570374	0,690360855	0,699244814	0,702507587	5,460778423	0,40260416	1,439755434	1,498400384	1,558980086	1,472484876
2006	0,786364012	0,777549195	0,739631656	0,720533108	6,448919887	0,437526811	1,372952567	1,298817843	1,524889176	1,441561917
2007	0,836159524	0,845192114	0,843375954	0,835977607	6,309280728	0,451511451	1,566422791	1,471077415	1,582423508	1,602704274
2008	0,818190345	0,843840625	0,82772638	0,810056023	5,52305993	0,381774423	1,508660001	1,643082092	1,575892078	1,438541689
2009	0,831664181	0,866367105	0,848210935	0,800313307	7,108429696	0,420640595	1,472889256	1,366155555	1,569825455	1,420765287
2010	0,845323607	0,835334298	0,820312593	0,85772196	5,43194937	0,404564754	1,555622383	1,509944035	1,748413098	1,564314587
2011	0,840651384	0,847956479	0,830404817	0,811344588	7,194408008	0,412622091	1,579971959	1,639225607	1,466913668	1,552194121

No-tariff Scenario

mean	ex sep	ex oct	ex nov	ex dec	annual ppi	annual CPI	CPI jan	CPI feb	CPI mar	CPI apr
1997	5,8343	5,8525	5,882	5,9279	153,7383	198,4909	193,1	193,2599	194,5443	195,4032
1998	6,2654	6,3047	6,3097	6,3556	163,3821	212,1029	205,7891	207,0983	208,1711	209,2085
1999	6,7349	6,75	6,7982	6,8452	173,8481	226,0292	219,6796	220,863	221,9912	223,2254
2000	7,1783	7,2328	7,2689	7,3025	184,4996	239,8476	233,5467	234,5041	235,7868	236,8012
2001	7,6652	7,6815	7,7305	7,725	192,6561	253,6329	247,4401	248,2856	249,6782	250,4819
2002	8,0814	8,1142	8,1239	8,1825	204,1727	267,4488	261,3406	262,2337	263,4682	264,7789
2003	8,5426	8,5361	8,5709	8,6268	214,22	281,2616	275,0303	276,2724	277,1495	278,3911
2004	9,13	9,1208	9,2026	9,2543	223,1841	295,1414	288,8407	289,631	291,079	292,123
2005	9,5547	9,6022	9,6399	9,6679	233,1799	308,8665	302,5324	303,7051	304,861	305,9092
2006	10,0529	10,0972	10,1083	10,1297	243,0934	322,8009	316,3839	317,5783	318,6921	320,066
2007	10,5699	10,6065	10,6771	10,7152	253,7972	336,5289	330,1836	331,2074	332,6838	333,5735
2008	11,1726	11,2017	11,2532	11,3151	263,3796	350,4098	344,1813	345,0809	346,4308	347,6337
2009	11,7312	11,7432	11,8057	11,8471	273,1956	364,2205	357,8426	359,1612	360,4564	361,2313
2010	12,3687	12,3848	12,4194	12,4802	283,3002	377,9866	371,6943	372,5707	374,1217	375,0791
2011	12,8901	12,9423	12,9912	13,0349	293,9461	391,858	385,4988	386,6144	387,9653	388,8754
standard deviation	ex sep	ex oct	ex nov	ex dec	annual ppi	annual CPI	CPI jan	CPI feb	CPI mar	CPI apr
1997	0,296409362	0,294331021	0,309903211	0,321839385	5,74020471	0,397036762	0	1,458772426	1,329720463	1,620931757
1998	0,411388916	0,404236206	0,422249819	0,405310548	6,521786917	0,475182691	1,547066317	1,487885785	1,581827358	1,440677879
1999	0,51195995	0,50414482	0,520106489	0,525683327	6,344773864	0,503862442	1,747031723	1,469522712	1,436177761	1,814418596
2000	0,499009128	0,525294356	0,511172955	0,531402625	6,643738544	0,411643341	1,646577696	1,473827734	1,669928669	1,486734865
2001	0,604662683	0,599537113	0,611060349	0,609456315	5,685507171	0,381689127	1,433334919	1,538398726	1,458504289	1,437548396
2002	0,654007676	0,658538047	0,65821713	0,692755909	5,769649531	0,420245833	1,488648259	1,599370285	1,552468602	1,503546404
2003	0,657575273	0,661619067	0,637732068	0,609934226	5,458061744	0,463209931	1,664316349	1,704924116	1,5074398	1,405904616
2004	0,672803092	0,673699755	0,667683488	0,648945691	6,097060947	0,40666453	1,612484577	1,273283551	1,451173663	1,33772157
2005	0,689264035	0,715441933	0,685627443	0,690689938	5,892873878	0,396755277	1,411474491	1,530110777	1,459032213	1,582118869
2006	0,715338095	0,726199258	0,749840056	0,780135187	5,817887283	0,517078514	1,640088348	1,619913612	1,41966707	1,597536854
2007	0,880125554	0,887605064	0,887446105	0,840988086	5,839874499	0,443323573	1,769093282	1,340083296	1,647532567	1,664759067
2008	0,833260607	0,79652	0,836389718	0,81693512	5,66217501	0,434027603	1,475648776	1,503121482	1,709701541	1,638519853
2009	0,80826268	0,79562916	0,817030299	0,763280152	5,965043054	0,452478453	1,46247162	1,380099475	1,407733299	1,613860375
2010	0,881398497	0,8927323	0,938514592	0,942988844	6,987327383	0,439677655	1,440417478	1,42818294	1,543908712	1,555168219
2011	0,894123588	0,896869952	0,878618552	0,879481091	5,947285582	0,463616221	1,490354508	1,571778178	1,556304247	1,636381775

Base Scenario

mean	CPI may	CPI jun	CPI jul	CPI aug	CPI sep	CPI oct	CPI nov	CPI dec	CPI gyr	CPI g01old
1997	196,6621	197,8082	198,8618	200,0398	201,1689	202,11	203,6592	204,6986	121,382	120,4
1998	210,4562	211,78	212,6729	214,0031	215,0819	216,106	217,5555	218,3547	123,2724	122,4562
1999	224,3305	225,4674	226,6506	227,9467	223,9867	230,0563	230,9934	232,4601	124,9352	124,1527
2000	238,0809	239,2505	240,5652	241,7127	242,7178	243,6499	245,2469	246,1276	126,3429	125,6404
2001	252,1476	252,9778	254,0411	255,5568	256,321	257,9581	258,6861	259,8185	127,8296	127,1649
2002	265,257	266,9726	268,0105	268,9604	270,4408	271,7004	272,3606	273,8472	128,9804	128,4704
2003	279,304	280,9072	281,7867	283,0567	284,0878	285,2793	286,384	287,7522	130,1698	129,7027
2004	293,5338	294,528	295,6607	296,8428	298,2675	299,138	300,206	301,5462	131,1921	130,7231
2005	307,3029	308,3079	309,3698	310,6112	311,9508	312,939	313,8486	315,4419	132,1714	131,7223
2006	321,1169	322,6479	323,4593	324,7237	325,6214	326,8005	328,0089	329,0695	133,0307	132,6723
2007	334,6559	336,0626	337,3661	338,2474	339,3975	340,3707	341,8968	342,8037	133,7984	133,4473
2008	348,9609	349,8542	350,8758	351,7762	353,2753	354,3572	355,4742	356,8293	134,4087	134,163
2009	362,5474	363,7166	364,8399	366,0277	367,1327	368,2424	369,4398	370,7323	134,9318	134,7056
2010	376,1602	377,5568	378,4092	379,5416	381,1816	381,9313	383,0364	384,5887	135,3836	135,1319
2011	389,9863	391,157	392,4011	393,6812	394,9586	395,8662	396,9763	397,9266	135,7779	135,5888
standard deviation	CPI may	CPI jun	CPI jul	CPI aug	CPI sep	CPI oct	CPI nov	CPI dec	CPI gyr	CPI g01old
1997	1,481921924	1,601972771	1,439616185	1,557431848	1,476386057	1,706447186	1,553616864	1,51038407	0,449986666	0
1998	1,571308232	1,521788422	1,52426067	1,415381712	1,631215924	1,706521608	1,616936223	1,620062625	1,014791722	0,875010606
1999	1,569391841	1,331290066	1,354358018	1,584032231	1,495363538	1,414110077	1,454086118	1,439348113	1,278704407	1,238784771
2000	1,608973645	1,629268778	1,47216404	1,502260866	1,599598437	1,587458658	1,504825369	1,519492757	1,515630756	1,468339143
2001	1,546741814	1,557380865	1,554572543	1,561570927	1,48781148	1,532550616	1,608313959	1,568187728	1,594120397	1,647360613
2002	1,649301367	1,450541706	1,389693761	1,572666474	1,549268653	1,518958143	1,566174205	1,495023799	1,625462962	1,744087681
2003	1,439105278	1,662779649	1,746816564	1,479926387	1,720379946	1,458663947	1,297765772	1,382989935	1,604094124	1,658648157
2004	1,678110116	1,671671618	1,347718261	1,639238287	1,684260891	1,380187668	1,6897414	1,629784513	1,658349357	1,637413018
2005	1,66453735	1,500372817	1,51774173	1,544210012	1,30382643	1,551273348	1,61822373	1,487659702	1,681309026	1,698097085
2006	1,541643081	1,481926648	1,632911054	1,641922443	1,4982283	1,746639273	1,384965628	1,491734142	1,686245092	1,741148963
2007	1,505127965	1,374668779	1,431075746	1,3935348	1,589358597	1,416996299	1,648335451	1,323075701	1,661106089	1,714128265
2008	1,502555886	1,269331462	1,616022388	1,483559085	1,36363901	1,592573439	1,546254947	1,536575579	1,809959477	1,804075109
2009	1,502422457	1,548753835	1,619649033	1,45695014	1,802644089	1,606346239	1,367953201	1,531019827	1,784950072	1,889692737
2010	1,495458445	1,650040533	1,464324882	1,476180016	1,646478523	1,487289921	1,457459104	1,457928431	1,797708831	1,795520367
2011	1,606111238	1,499726975	1,484321323	1,759237494	1,637771669	1,484106991	1,565926981	1,599677605	1,830076662	1,837263879

FTA Scenario

mean	CPI may	CPI jun	CPI jul	CPI aug	CPI sep	CPI oct	CPI nov	CPI dec	CPI gyr	CPI g01old
1997	196,5632	197,3853	199,1464	200,1125	201,4311	202,3344	203,3929	204,7643	121,283	120,4
1998	210,5326	211,3585	212,8523	213,9125	215,1044	216,0757	217,286	218,5189	123,1041	122,3023
1999	224,2612	225,4291	226,6569	227,9283	228,9561	230,001	230,9696	232,4726	124,729	124,0613
2000	238,1248	239,3702	240,402	241,6579	242,7117	243,7652	244,7875	246,1417	126,0843	125,4851
2001	252,0765	253,1161	253,9632	255,2313	256,5481	257,4671	258,9327	259,937	127,4457	126,8328
2002	265,7941	267,1499	267,9762	269,4395	270,2832	271,6282	272,732	273,8994	128,6791	128,1435
2003	279,6778	280,634	281,9504	283,0029	284,4405	285,474	286,2946	287,5703	129,7736	129,3178
2004	293,3987	294,427	295,7395	296,4616	298,054	299,1384	300,3363	301,4279	130,7392	130,2646
2005	307,3664	308,6853	309,5233	310,4523	311,8655	313,0482	314,1247	315,1633	131,7022	131,3177
2006	321,1457	322,0942	323,3344	324,5451	325,786	326,5869	327,8329	329,3589	132,5087	132,1922
2007	334,9655	335,9621	337,1355	338,4472	339,2949	340,4749	341,7735	342,7501	133,2188	132,907
2008	348,4542	349,8441	351,09	352,212	353,2121	354,4145	355,4141	356,7388	133,9094	133,5837
2009	362,3578	363,4104	364,6181	365,8754	367,1437	368,3896	369,246	370,6183	134,6184	134,3236
2010	376,1874	377,4467	378,5891	379,7059	380,669	381,9251	383,0675	384,3656	135,0759	134,8782
2011	390,2245	391,2007	392,4801	393,5817	394,4844	396,0462	396,9546	398,1263	135,5936	135,3726
standard deviation	CPI may	CPI jun	CPI jul	CPI aug	CPI sep	CPI oct	CPI nov	CPI dec	CPI gyr	CPI g01old
1997	1,681121578	1,493644171	1,441890093	1,63838663	1,659577594	1,549065731	1,415406157	1,594482521	0,472634108	0
1998	1,576410238	1,371095456	1,45223473	1,469394008	1,41985726	1,500876581	1,566030012	1,58759623	0,899524424	0,854776994
1999	1,652761495	1,457706483	1,599591007	1,422059812	1,414947981	1,386159082	1,401889382	1,564555285	1,182498626	1,101003774
2000	1,506914384	1,466085932	1,644588702	1,638142421	1,530757365	1,487613848	1,680406722	1,497866519	1,352454994	1,344194551
2001	1,515885467	1,699664023	1,704793172	1,613427194	1,423054247	1,605872532	1,624478289	1,470135026	1,404511484	1,367686426
2002	1,688060482	1,516848374	1,493774936	1,552587115	1,363166079	1,695919444	1,563950766	1,435861289	1,417574051	1,46987508
2003	1,311952423	1,630729898	1,496929471	1,717064527	1,584909698	1,4995526	1,78016315	1,466470903	1,491257536	1,460958986
2004	1,590399733	1,470311872	1,587358419	1,430981286	1,607821508	1,735878867	1,401683741	1,748208966	1,683060712	1,66923241
2005	1,382434461	1,468149485	1,409323281	1,564892875	1,635143648	1,563236549	1,791632471	1,660356019	1,727114113	1,695120559
2006	1,621008485	1,439695926	1,459498763	1,45507697	1,296786798	1,620750872	1,621018381	1,618773545	1,882726563	1,891907281
2007	1,540252171	1,642421563	1,370066695	1,444333812	1,57270054	1,630713031	1,344647444	1,44529616	1,953973531	1,916784547
2008	1,495699288	1,427083806	1,424132719	1,564481384	1,450758626	1,580223639	1,344956576	1,398497251	1,967992795	2,03636522
2009	1,465237578	1,579190248	1,462502441	1,527130918	1,555677123	1,641618665	1,62236494	1,464889794	1,982020545	2,002291947
2010	1,641397344	1,362645262	1,406411103	1,615573641	1,353245358	1,602342969	1,819957898	1,389662779	2,056639052	2,024351442
2011	1,660089983	1,494926256	1,412775633	1,540392194	1,710531683	1,669022337	1,260900805	1,477779182	2,149401089	2,157410309

No-tariff Scenario

mean	CPI may	CPI jun	CPI jul	CPI aug	CPI sep	CPI oct	CPI nov	CPI dec	CPI gyr	CPI g01old
1997	196,6505	197,8532	198,865	200,0498	201,4646	202,3267	203,4624	204,9114	121,2395	120,4
1998	210,3926	211,3802	212,5542	214,0001	214,6139	216,3045	217,2851	218,436	123,0203	122,1871
1999	224,1765	225,3401	226,5782	227,815	229,1539	229,9807	231,1663	232,3796	124,7351	123,9861
2000	238,0576	239,3786	240,7621	241,6769	242,5633	243,9865	245,0911	246,0187	126,1862	125,5555
2001	251,9254	253,0343	254,2938	255,5545	256,5417	257,5505	259,0145	259,7929	127,6134	126,9926
2002	265,6275	267,0724	267,9863	269,0929	270,0995	271,4901	272,4238	273,7732	128,7787	128,2682
2003	279,4933	280,6956	281,6725	282,9085	284,3342	285,1885	286,3239	287,681	129,8287	129,3701
2004	293,4241	294,7321	295,5567	297,1288	298,1305	299,1282	300,4385	301,4829	130,9405	130,4262
2005	307,1876	308,3072	309,4355	310,4716	311,5708	312,9416	314,3327	315,1398	131,9183	131,4773
2006	320,846	322,3107	323,3455	324,4582	325,7385	326,9183	328,0355	329,2321	132,7097	132,3726
2007	334,7635	335,8954	337,2304	338,2485	339,4012	340,5852	341,8912	342,6865	133,4786	133,0822
2008	348,9799	349,8682	350,7962	352,2786	353,2314	354,3237	355,3803	356,7329	134,2666	133,8961
2009	362,5409	363,7209	364,8866	365,9338	366,9423	368,1709	369,3614	370,3999	135,0298	134,719
2010	376,1535	377,4237	378,7559	379,7034	381,1142	382,1401	383,0094	384,0772	135,5062	135,3171
2011	390,0067	391,1016	392,3745	393,5969	394,8446	395,99	397,2009	398,2303	135,9303	135,8039
standard deviation	CPI may	CPI jun	CPI jul	CPI aug	CPI sep	CPI oct	CPI nov	CPI dec	CPI gyr	CPI g01old
1997	1,638463533	1,4195745	1,43211068	1,3512964	1,528340551	1,467414771	1,690142077	1,601431247	0,499362343	0
1998	1,400771659	1,322037806	1,382089129	1,562484877	1,299704501	1,560016266	1,524830151	1,502874579	1,016668535	0,899461278
1999	1,646215281	1,69145647	1,472604074	1,427939424	1,621490607	1,573821626	1,456240128	1,647529617	1,401749974	1,283431256
2000	1,507665463	1,329044032	1,440774302	1,606228934	1,305224161	1,402739017	1,606413331	1,649788868	1,569639946	1,577500792
2001	1,682926867	1,518532354	1,270800362	1,549860236	1,527611243	1,671929649	1,41279466	1,575562944	1,642414211	1,613803966
2002	1,559582877	1,339245399	1,450941525	1,386420063	1,401204749	1,493936742	1,616828241	1,508092093	1,63059931	1,669404313
2003	1,567001631	1,424532429	1,534412836	1,522100769	1,529466038	1,54993895	1,390798975	1,499888329	1,535348596	1,608414434
2004	1,699083338	1,597772384	1,487091157	1,487805955	1,520887488	1,428222238	1,483422647	1,629066171	1,513071958	1,558000501
2005	1,409890861	1,4556834	1,573022171	1,405926541	1,450891919	1,654636951	1,515246419	1,497010341	1,577601379	1,558700006
2006	1,688059241	1,65292423	1,53606079	1,408571887	1,433235064	1,671971923	1,513082532	1,603531288	1,696709436	1,751867358
2007	1,435293959	1,736360804	1,535947213	1,653087641	1,732853877	1,468955057	1,535635556	1,52170324	1,737867095	1,740495665
2008	1,431364031	1,472254992	1,431045618	1,732981835	1,399680692	1,56440318	1,492322656	1,338821344	1,729032226	1,800666485
2009	1,453979432	1,47938034	1,509003128	1,55838492	1,521291461	1,250767041	1,617873926	1,669819448	1,749482769	1,782301041
2010	1,324808303	1,343293456	1,458255873	1,357623085	1,469947741	1,531393153	1,392612523	1,281634176	1,780228513	1,774387948
2011	1,776172883	1,6234708	1,73550533	1,472177092	1,484106074	1,706456563	1,639668927	1,402276332	1,888913156	1,829151659

Base Scenario

mean	CPI g02	CPI g03	CPI g04	CPI g05	CPI g06	CPI g07	CPI g08	CPI g09	CPI g10	CPI g11
1997	120,5628	120,771	120,9523	121,1064	121,2981	121,4905	121,63	121,8296	122,0274	122,1799
1998	122,5711	122,7498	122,8974	123,0564	123,237	123,401	123,5086	123,6519	123,7923	123,9102
1999	124,3283	124,503	124,6707	124,8225	124,903	125,041	125,2016	125,2781	125,3452	125,4287
2000	125,7631	125,8932	126,0744	126,1948	126,2879	126,4009	126,5678	126,6699	126,7584	126,8786
2001	127,296	127,4222	127,5929	127,7133	127,8373	127,9292	128,0291	128,1172	128,2078	128,2874
2002	128,5304	128,5743	128,6187	128,7306	123,8623	128,9982	129,1573	129,2745	129,4278	129,5191
2003	129,7842	129,8359	129,9284	130,0438	130,1239	130,2001	130,2938	130,4293	130,4772	130,5798
2004	130,8485	130,9497	131,0082	131,0806	131,1407	131,2154	131,3113	131,41	131,4685	131,504
2005	131,8112	131,8677	131,9845	132,0917	132,1534	132,2164	132,2801	132,343	132,4575	132,5257
2006	132,774	132,8186	132,9176	132,9204	133,0071	133,0353	133,0704	133,1835	133,2636	133,3339
2007	133,5477	133,6071	133,6623	133,7032	133,7484	133,8516	133,8745	133,9225	133,9983	134,075
2008	134,2086	134,2648	134,309	134,3514	134,3766	134,4591	134,461	134,4889	134,5491	134,6261
2009	134,7517	134,8323	134,8827	134,914	134,9588	134,9712	135,0005	135,0152	135,0341	135,0367
2010	135,2212	135,2452	135,2601	135,3738	135,3845	135,4291	135,4525	135,5003	135,5042	135,5549
2011	135,6399	135,661	135,6942	135,7664	135,7825	135,7908	135,8413	135,8735	135,8842	135,8999
standard deviation	CPI g02	CPI g03	CPI g04	CPI g05	CPI g06	CPI g07	CPI g08	CPI g09	CPI g10	CPI g11
1997	0,241851525	0,307120498	0,406329558	0,494177134	0,555499226	0,56936346	0,660413507	0,724394809	0,741717763	0,772297216
1998	0,909841629	0,958972346	0,988694715	1,032501351	1,09806967	1,132297222	1,116805283	1,158181933	1,181182336	1,197110672
1999	1,262382711	1,249477091	1,265991513	1,259195279	1,28306547	1,318344796	1,35853209	1,419215061	1,412546976	1,423418178
2000	1,500418405	1,522903726	1,478954577	1,508555919	1,559809793	1,589307456	1,594127084	1,606760402	1,624784737	1,603245471
2001	1,594786506	1,608796805	1,618681127	1,6225998	1,62339327	1,630885453	1,645504844	1,611980198	1,635421401	1,686624214
2002	1,71024438	1,683133539	1,696022792	1,656817926	1,650925713	1,638321934	1,603337054	1,594490122	1,620600864	1,658330543
2003	1,63226602	1,63114199	1,655526937	1,669761528	1,674350623	1,628188868	1,640143152	1,634035651	1,626313057	1,636471802
2004	1,659107215	1,675884516	1,69854725	1,694002255	1,716223328	1,708225641	1,719204267	1,723921112	1,726437589	1,723719235
2005	1,712586512	1,697700713	1,716501893	1,749438799	1,705912202	1,707966932	1,735072618	1,710959672	1,729705394	1,723408979
2006	1,690876104	1,675894997	1,696713364	1,745946689	1,703830564	1,706750981	1,748187587	1,781810526	1,757241884	1,724242381
2007	1,673565568	1,644509225	1,659158736	1,651189196	1,651017698	1,668601043	1,703884606	1,726153165	1,751895576	1,762573403
2008	1,824997545	1,827557102	1,83340912	1,840671084	1,808957833	1,809869109	1,841549619	1,866458087	1,874989117	1,906606354
2009	1,840656435	1,807448951	1,854617942	1,847386803	1,850844283	1,834677236	1,786946768	1,816595431	1,824143687	1,807968504
2010	1,802310894	1,823773275	1,806633607	1,784403979	1,842186948	1,856847379	1,866739069	1,896073023	1,846774583	1,849104375
2011	1,872036055	1,874255319	1,878257799	1,904278089	1,904317397	1,910244843	1,877053358	1,868983882	1,874862224	1,793435527

FTA Scenario

mean	CPI g02	CPI g03	CPI g04	CPI g05	CPI g06	CPI g07	CPI g08	CPI g09	CPI g10	CPI g11
1997	120,5684	120,75	120,8671	121,0096	121,1688	121,3305	121,5217	121,6972	121,8759	122,0483
1998	122,4213	122,5764	122,7328	122,867	123,0126	123,1872	123,343	123,5025	123,6206	123,751
1999	124,2296	124,3492	124,3984	124,5227	124,6367	124,8058	124,9324	125,0351	125,1225	125,2704
2000	125,5617	125,6721	125,7551	125,9107	126,0383	126,1595	126,2715	126,3835	126,4777	126,569
2001	126,9621	127,0725	127,2074	127,3162	127,4208	127,5285	127,5917	127,6804	127,8232	127,9126
2002	128,2458	128,3491	128,4548	128,5699	128,6213	128,7447	128,8515	128,8756	128,9853	129,1008
2003	129,4442	129,5125	129,5637	129,6614	129,7526	129,8098	129,8929	129,9671	130,041	130,1204
2004	130,3155	130,406	130,4942	130,5998	130,687	130,7795	130,9015	130,9987	131,0843	131,1398
2005	131,4022	131,47	131,532	131,5758	131,6317	131,7172	131,8314	131,8913	131,9451	132,0026
2006	132,257	132,305	132,362	132,4301	132,501	132,5403	132,5697	132,6272	132,7203	132,775
2007	132,9623	133,0377	133,0413	133,1097	133,205	133,2736	133,3463	133,4013	133,4082	133,4481
2008	133,6416	133,6749	133,7596	133,8394	133,9061	133,9483	133,9712	134,039	134,0997	134,1889
2009	134,427	134,4547	134,5092	134,593	134,6411	134,6778	134,706	134,6966	134,7505	134,8138
2010	134,9244	134,9289	134,951	135,0355	135,0468	135,0872	135,1338	135,1688	135,1971	135,2517
2011	135,388	135,4718	135,5415	135,5743	135,5399	135,6093	135,6792	135,701	135,7384	135,7378
standard deviation	CPI g02	CPI g03	CPI g04	CPI g05	CPI g06	CPI g07	CPI g08	CPI g09	CPI g10	CPI g11
1997	0,2601681	0,363705925	0,440951913	0,506770007	0,559552107	0,60293843	0,670866686	0,732682851	0,742753115	0,792094761
1998	0,883848013	0,856099901	0,911098326	0,944706833	0,956903987	0,982949724	1,00213522	1,005473396	1,048848721	1,057719717
1999	1,137873385	1,208011324	1,208054403	1,252072566	1,27773867	1,242731813	1,274629452	1,263438558	1,293525705	1,28559552
2000	1,374856396	1,401369541	1,411061654	1,399142777	1,383439232	1,390161411	1,390425385	1,391502336	1,446822626	1,423305659
2001	1,368272849	1,4156125	1,421708564	1,454600825	1,442923893	1,46685744	1,468706952	1,473709551	1,46953658	1,502793812
2002	1,472907451	1,464401649	1,45706656	1,453378474	1,435786652	1,441330257	1,461119006	1,448087235	1,453924658	1,486595897
2003	1,468133632	1,443603391	1,459220103	1,489205842	1,558322345	1,580429043	1,579579245	1,58705595	1,607561818	1,632930446
2004	1,690377103	1,692956585	1,710166764	1,74287692	1,738473181	1,704742429	1,74593664	1,76130046	1,736128598	1,711350917
2005	1,688365825	1,696644925	1,711942756	1,741148575	1,778132197	1,761578315	1,764990096	1,809863893	1,828674107	1,882978821
2006	1,925845009	1,907462975	1,892442337	1,876774624	1,933520882	1,924016868	1,914152269	1,901659843	1,891223654	1,94322078
2007	1,950910482	1,9538382	1,939557504	1,96835335	1,959969643	1,956679596	1,976498244	2,032461392	2,061277458	2,042089467
2008	2,010399324	1,961339081	2,000108957	2,004154595	1,986699723	2,014815155	2,021736026	2,01835106	2,01152005	2,027656231
2009	1,986067219	1,968495596	1,988991041	2,022043274	2,047983347	2,069391012	2,03675919	2,04640818	2,018549665	2,02143552
2010	2,026098872	2,032110674	2,030889214	2,005197434	2,079219026	2,106556944	2,128890688	2,130708934	2,139406598	2,176091935
2011	2,156138678	2,165661275	2,21996143	2,233256033	2,202526048	2,18937674	2,205651686	2,192566305	2,17715903	2,151784181

No-tariff Scenario

mean	CPI g02	CPI g03	CPI g04	CPI g05	CPI g06	CPI g07	CPI g08	CPI g09	CPI g10	CPI g11
1997	120,5463	120,6933	120,8764	121,0073	121,1843	121,2892	121,4669	121,6375	121,7874	121,9245
1998	122,3262	122,4832	122,6625	122,7769	122,9552	123,1178	123,2655	123,4083	123,5276	123,6848
1999	124,1544	124,2538	124,4	124,5265	124,6821	124,7922	124,9251	125,0773	125,2119	125,344
2000	125,66	125,7545	125,8536	125,9693	126,1044	126,2188	126,3617	126,5183	126,648	126,7601
2001	127,129	127,2494	127,3768	127,4507	127,5772	127,6839	127,7824	127,8853	127,9735	128,0797
2002	128,3736	128,4579	128,5621	128,6301	128,7291	128,8274	128,878	129,014	129,1138	129,1953
2003	129,4274	129,4803	129,5996	129,6667	129,7779	129,9192	129,9728	130,0185	130,096	130,2427
2004	130,5343	130,6502	130,6905	130,8105	130,8962	130,9686	131,1048	131,201	131,2889	131,3217
2005	131,549	131,6608	131,7528	131,817	131,9215	132,018	132,0608	132,0884	132,1816	132,2246
2006	132,4176	132,5077	132,5858	132,644	132,6699	132,7652	132,8128	132,8567	132,9219	132,9388
2007	133,1471	133,2152	133,2991	133,3899	133,4485	133,5419	133,5891	133,6106	133,742	133,8105
2008	133,9707	134,056	134,1037	134,1849	134,2185	134,2479	134,3227	134,401	134,5131	134,6121
2009	134,7907	134,8581	134,9281	134,993	134,9889	135,0407	135,1095	135,177	135,22	135,2497
2010	135,3548	135,417	135,424	135,4362	135,4752	135,5149	135,5128	135,5725	135,6352	135,6804
2011	135,776	135,7963	135,83	135,8611	135,8994	135,9422	136,0009	136,0375	136,0576	136,0614
standard deviation	CPI g02	CPI g03	CPI g04	CPI g05	CPI g06	CPI g07	CPI g08	CPI g09	CPI g10	CPI g11
1997	0,246388535	0,391921051	0,497540993	0,533218257	0,606848012	0,631700372	0,692728944	0,735259648	0,774310816	0,806530068
1998	0,947759231	0,980735316	1,016446137	1,043625119	1,075096721	1,138498643	1,154093909	1,136988175	1,145259027	1,187437139
1999	1,309035003	1,324975305	1,389291186	1,404980694	1,467502842	1,475832362	1,516268113	1,528083018	1,543887104	1,546295573
2000	1,550441872	1,548940525	1,566883863	1,584726636	1,59783123	1,636523315	1,651570195	1,675651548	1,662089649	1,688219473
2001	1,636673761	1,66133911	1,709649017	1,698185652	1,708233637	1,704619544	1,706291956	1,692673894	1,683056372	1,675669093
2002	1,694394004	1,675201657	1,69103536	1,719702006	1,695855003	1,680695463	1,680152374	1,651740294	1,626066284	1,628288952
2003	1,635137071	1,623178028	1,610305511	1,58793895	1,565571011	1,546240395	1,581752244	1,590497014	1,552391703	1,534915538
2004	1,554557979	1,505498575	1,514840833	1,532199318	1,561262809	1,581920997	1,596629876	1,55720356	1,58300404	1,582269923
2005	1,547734796	1,560977694	1,616169595	1,590825886	1,59096598	1,611648845	1,647182856	1,653441695	1,653201573	1,692504901
2006	1,785207618	1,7746041	1,772647839	1,739623522	1,716204822	1,70364872	1,698673059	1,706903076	1,721494522	1,756342951
2007	1,717816556	1,75254471	1,759059462	1,760392283	1,759394427	1,783504244	1,810573995	1,795172872	1,785969205	1,810414524
2008	1,809765872	1,778501617	1,733199732	1,74007557	1,771651983	1,775193113	1,758263265	1,74075587	1,738807462	1,774214359
2009	1,811353226	1,847404501	1,780205435	1,782457012	1,785886276	1,772729114	1,80436547	1,764113658	1,766201008	1,787315
2010	1,759292176	1,777566033	1,818023652	1,81157378	1,8[illegible]9441387	1,839146267	1,823850367	1,827991452	1,865257344	1,839544465
2011	1,841172453	1,859028593	1,894509963	1,906879071	1,912347678	1,926912857	1,940746297	1,997466583	1,986705373	2,020789954

Base Scenario

mean	CPI g12	Consumer surplus	pop ann
1997	122,3349	19795537,76	41138082,32
1998	124,0424	20998209,95	41924345,47
1999	125,5504	22799158,78	42714933,24
2000	126,9804	23512924,79	43509869,42
2001	128,3599	25180777,77	44309177,92
2002	129,6023	25759871,38	45112882,79
2003	130,635	26032695,66	45921008,21
2004	131,6486	27614062,93	46733578,49
2005	132,603	27910285,79	47550618,09
2006	133,3709	28647378,21	48372151,58
2007	134,1396	29269111,47	49198203,69
2008	134,6501	29443123,11	50028799,26
2009	135,0812	29539031,03	50863963,29
2010	135,5469	29759835,69	51703720,9
2011	135,9199	30317558,01	52548097,36
standard deviation	CPI g12	Consumer surplus	pop ann
1997	0,799113878	3080936,27	0
1998	1,193677611	3269236,79	0
1999	1,439952027	3655933,709	0
2000	1,641124566	3012866,578	0
2001	1,709317697	3510647,517	0
2002	1,655613394	3362434,062	0
2003	1,641684196	3271105,169	0
2004	1,697830981	3434311,803	0
2005	1,718615431	3816546,873	0
2006	1,721361145	3978584,886	0
2007	1,788215826	3257386,233	0
2008	1,888967175	3819338,013	0
2009	1,749557247	3561874,584	0
2010	1,855201711	3944166,104	0
2011	1,789814792	3750733,494	0

FTA Scenario

mean	CPI g12	Consumer surplus	pop ann
1997	122,1526	20586465,65	41138082,32
1998	123,9411	21198927,86	41924345,47
1999	125,3787	22959667,48	42714933,24
2000	126,7306	23477395,6	43509869,42
2001	128,0032	24827574,61	44309177,92
2002	129,2102	25861080,16	45112882,79
2003	130,1981	26467712,07	45921008,21
2004	131,2024	26998542,83	46733578,49
2005	132,1076	27642002,43	47550618,09
2006	132,824	28828456,26	48372151,58
2007	133,4817	28485217,3	49198203,69
2008	134,2621	29623303,48	50028799,26
2009	134,8259	30655592,13	50863963,29
2010	135,3068	30664117,35	51703720,9
2011	135,7687	30998644,24	52548097,36
standard deviation	CPI g12	Consumer surplus	pop ann
1997	0,834185375	3048464,537	0
1998	1,064966568	2895914,658	0
1999	1,293784105	3107520,944	0
2000	1,392155753	3404694,924	0
2001	1,510293932	3398360,086	0
2002	1,501854174	3368166,417	0
2003	1,631231863	3617915,195	0
2004	1,738914098	3228416,168	0
2005	1,852424962	3859156,928	0
2006	1,94708346	3940638,171	0
2007	2,054682971	4215042,872	0
2008	2,010755726	3815312,64	0
2009	2,021266482	3926960,955	0
2010	2,18477316	4261334,268	0
2011	2,129419008	4505605,522	0

No-tariff Scenario

mean	CPI g12	Consumer surplus	pop ann
1997	122,0657	19761674,28	41138082,32
1998	123,8484	21715650,03	41924345,47
1999	125,4677	22268689,34	42714933,24
2000	126,837	23436778,4	43509869,42
2001	128,189	24410917,34	44309177,92
2002	129,2704	25348550,47	45112882,79
2003	130,3672	26891857,93	45921008,21
2004	131,4013	27398029,59	46733578,49
2005	132,2647	28031018,53	47550618,09
2006	133,0257	28860409,3	48372151,58
2007	133,8665	30558387,65	49198203,69
2008	134,672	30578453,22	50028799,26
2009	135,2808	31298068,1	50863963,29
2010	135,7391	32377608,56	51703720,9
2011	136,0981	31906021,47	52548097,36
standard deviation	CPI g12	Consumer surplus	pop ann
1997	0,839521596	3038432,67	0
1998	1,217577694	3149563,65	0
1999	1,572161477	3185711,568	0
2000	1,638586891	3238841,562	0
2001	1,661619391	3496010,14	0
2002	1,61423971	3693476,599	0
2003	1,529251503	3852477,646	0
2004	1,521831564	3995901,945	0
2005	1,70496009	4053636,443	0
2006	1,713110186	3931763,708	0
2007	1,75972576	3538087,28	0
2008	1,778059617	4253045,614	0
2009	1,767567639	4286685,268	0
2010	1,834931113	4161821,099	0
2011	2,007255186	4169788,085	0