AN ANALYSIS OF TRADE RELATED ISSUES CONCERNING THE GLOBAL KIWIFRUIT INDUSTRY – WITH A FOCUS ON THE EU, CHINA AND NEW ZEALAND

Caroline M. Saunders, Ellen A. E. Anker-Kofoed and William Kaye-Blake

Agribusiness and Economics Research Unit, P O Box 84,
Lincoln University, Lincoln 7647, New Zealand

Introduction

The New Zealand kiwifruit industry will have to face several trade related issues over the next years as the global industry is confronted with strategic and structural challenges. These changes include different requirements on the production methods and growth in production overseas. New Zealand is currently the third largest global producer of kiwifruit and thus plays an important role on the international market. Exports of kiwifruit are also of significant horticultural value for New Zealand. Therefore, the objective of this paper is to quantify and analyse the possible effects that these changes might have on the kiwifruit industry especially in New Zealand.

The paper will focus on trade related issues concerning the global kiwifruit industry through a trade modelling approach. A new kiwifruit trade model has been developed, using new industry specific countries and varieties based on the Lincoln Trade and Environment Model (LTEM). It is a partial equilibrium trade model, which can simulate effects that various domestic agriculture and border policy changes would have on price, supply, demand and net trade.

Next section provides a background of the industry and its issues, followed by a section on theory and methodology used in this research. Thereafter, the research scenarios are presented, followed by the modelling results thereof, finished by conclusive comments of the outcome.

Background

From starting out as an insignificant source of returns/investment in the early 1970's the New Zealand kiwifruit industry expanded to become a highly important agricultural sector and the sixth largest export earner in 1991 and subsequently the most valuable horticultural exporter in 2005 (720 million NZ$) (HortResearch 2005). The kiwifruit industry in New Zealand was the earliest and among the most proactive players to position itself on the global market. The country is consequently the second largest exporter and third largest producer of kiwifruit today. Marketing and exports are carried out by the single desk seller Zespri Ltd, which is argued to be a significant advantage to New Zealand, being able to pool resources and marketing efforts.

Two thirds of total world production of kiwifruit enters the global market and relatively few main players constitute the international trade in kiwifruit. The OECD member countries accounted for almost 85 percent of world imports of kiwifruit in 2004 (Belrose Inc 2006) and world exports are currently dominated by Italy (35 percent), New Zealand (32 percent) and Chile (15 percent) (HortResearch 2005).

The world's three largest producers have until recently been represented by Italy, New Zealand and Chile. China has overtaken Chile and New Zealand as the largest producer, but the original three countries are currently still the three largest exporters and account for more than 80 percent of total global exports. The trend in global exports, therefore, is heavily influenced by the production levels in the top producing countries. Since China has a relatively large domestic market to supply, the country's future prospective on the export market is unknown, but certainly has a large potential (Belrose Inc 2006).

Out of the producing and exporting countries in the EU, Italy has always been, and remains, the largest kiwifruit producing nation with the most influence on the world market. The EU also constitutes the largest consuming market.

Italy is the leading supplier of kiwifruit in the international market. The marketing strategy of the country differs widely from the one in New Zealand and is performed by numerous organisations of different structures and sizes. Since there are no trade barriers within the European Union, Italy's domestic market effectively consists of 460 million European citizens. This can be seen as an immediate advantage, but Italy has also encountered some difficulties in applying a specific discipline over exported volumes and quality. This is a concern that the centralised New Zealand system has a better control over. To increase its competitiveness Italy has recently invested in improving every stage of the supply chain through introducing the latest technology, strong brands, new

varieties and forming alliances with suppliers in other countries such as France and Chile (Belrose Inc 2006).

The New Zealand kiwifruit industry had to confront a severe crisis in 1990-1992 when Italian retailers threatened to take the entire industry to court. It was argued that New Zealand kiwifruit contained pesticide levels exceeding local standards, while New Zealand claimed that they in fact were well within the requirements for European regulations. Since Italy belonged to one of New Zealand's most important export markets with annual fruit imports of three million trays, for the value of NZ$ 30 million, the decision had a severe impact on the New Zealand industry. The kiwifruit industry formed a partnership with HortResearch aiming to develop an integrated pest management (IPM) programme, called KiwiGreen, to reduce the use of chemicals through careful and comprehensive inspections (Growing Futures n.d.).

China has increased kiwifruit production more than tenfold over the past decade. In 1998 the total production of kiwifruit from China reached 118 500 metric tonnes and grew to 165 000 metric tonnes in 1999 and is estimated to reach 400 000 metric tonnes per year by 2006. If productivity approaches the level of other countries, Chinese annual production could potentially reach 700 000 metric tonnes per year (Huang and Ferguson 2001). Currently, almost all domestically produced kiwifruit is sold within the country and between one fifth and one third is being processed. Exports presently account for only two percent of production, a number that may change as existing orchards mature. China is facing a few challenges mainly concerning quality issues and the need for unified coordination of marketing and production. The country also needs to be prepared for a potential overproduction within the next few years and consequently improve present storage and transport facilities. Another issue concerns planting more commercially demanded varieties. At present, the Chinese kiwifruit industry produces varieties that are not as desirable to neither Chinese nor international consumers (Huang and Ferguson 2001). Even though the Hayward variety has not been extensively planted in China, the country is still the world's fourth largest producer of the variety, which could have a significant impact on world trade as more Hayward orchards are being planted (Huang and Ferguson 2002). In 2003-2005 official statistics positioned China as the second largest producing country in the world. The industry concentrates on supplying the domestic market first of all and then on export markets. Only small volumes have been exported to Asian markets and some trial shipments have been sent to European and North American markets (Belrose Inc 2006).

International trade in kiwifruit is currently distorted by several measures. One of the most commonly exercised policies falls under the classification of a Sanitary and Phytosanitary (SPS) measure, established by the WTO. This is an agreement recognising what measures a government can execute in order to protect domestic animal and plant health and food safety (World Trade Organisation 2005). These are the most efficient measures in order to prevent substandard kiwifruit from entering currently health aware and environmentally and safety concerned markets and is the reason for several trade disputes (Voss 2005).

Import tariffs belong to the main trade restriction currently facing the international kiwifruit industry. These differ slightly between countries where China has imposed the highest tariff (20 percent) (New Zealand Ministry of Foreign Affairs 2006) and Japan the lowest (seven percent) (USDA Foreign Agricultural Service 2000). Other countries with import tariffs on kiwifruit include the EU (eight percent) (European Commission 2006) and the U.S (nine percent) (Ministry of Agriculture and Forestry n.d.).

Theory of partial equilibrium modelling

In order to investigate the trade-related issues concerning the kiwifruit industry internationally, a trade-modelling approach has been taken. General equilibrium theory aims to explain supply, demand and prices by examining the economy as a whole taking into account all interrelated segments and industry sectors as well as the flow of income and expenditure (van Tongeren, van Meijl et al. 2000). Because the economy as a whole constitutes of many different actors, factors and commodities a partial equilibrium approach is therefore commonly and more widely applied. In this analysis attention is directed at a smaller number of variables directly affecting a market, or a group of related markets, while influences of other factors are generally ignored. Even if the basic assumption of excluding irrelevant markets causes practical limitations to applied PE modelling, it also contributes to its basic advantage. An analysis based on a PE approach can therefore be seen as a technique that simplifies an economy in general equilibrium (Simpson 1975) and allows for the examination of commercial policy issues to be sectoral specific, relatively rapid and transparent (Francois and Hall 1997).

In the economic literature, many different partial equilibrium models, specific to different purposes, can be found. Examples are the FAPRI model with a focus on the United States, the AGLINK model used by governments of OECD member countries, SWOPSIM developed by the USDA specifically for the Uruguay Round, GAPSI emphasising the EU, VOMM developed by the World Bank and WFM developed by the FAO.

Literature Review

Since trade related issues in the kiwifruit industry have been rarely modelled so far, studies carried out in related industries have been reviewed together with the trade modelling literature in order to establish a relevant framework for future examination and analysis in this study. Parallels from trade in kiwifruit can be

drawn to other valuable sources of horticultural export revenue for New Zealand and other countries, since other horticultural industries are concerned with similar trends and strategic challenges both currently and ahead.

The approach taken in this research is novel in two ways. Firstly, a model specific to the kiwifruit sector is developed to simulate various trade conditions. Secondly, the study considers key aspects of the kiwifruit industry and links these to international trade in the sector.

Protective trade restrictions such as sanitary and phytosanitary measures are increasingly affecting the current trade in kiwifruit. A global expansion of kiwifruit production constitutes another issue that is likely to have a significant impact on future trade patterns. This section will further explain the effects of these trade related issues based on previous studies carried out in the kiwifruit industry and studies using relevant trade modelling methodology in related industries.

Kiwifruit literature

Saunders and Cagatay (n.d.) investigate the short to medium term impact of commercially releasing GM food and food production in New Zealand. The impact of different levels of GM-food on producers, consumers and trade in New Zealand is simulated through scenarios using the GEMO, a trade model developed based on the Lincoln Trade and Environment Model (LTEM) framework. The results of the analysis illustrate the impact of GM introduction on New Zealand producer returns. A 20 percent preference for GM-food, for example, simulates an increase in producer returns by 20 percent for kiwifruit.

Hanawa Peterson and Schertz Willett (2000) analysed the U.S. kiwifruit industry and its determinants of supply, demand and the price received by growers, through the use of a dynamic industry model. The study provides a quantitative description of the U.S. kiwifruit industry and a framework for decision making in production and marketing of fresh horticultural products. The study was the first economic analysis of the U.S. kiwifruit industry and is divided into a production sector component and a demand sector.

The model framework is based on an annual component representing the production process and a monthly component expressing the marketing process. Profitability between sectors is compared and the model simulates relevant information for growers of whether to stay in production of kiwifruit, alter to another crop (peach) or convert to non-farm uses. The study shows that early plantings of kiwifruit are quite speculative and as the orchard matures expected profitability and potential performance are increasingly significant parameters in the decision-making of future production and aim for increased returns (Hanawa Peterson and Schertz Willett 2000).

Even if the model utilised in this research is not trade focused it mentions imports as one of the main factors affecting the production of US kiwifruit, which emphasises the significance of international trade on domestic markets. Since the LTEM is a synthetic model, some assumptions in this research by Hanawa Peterson and Schertz Willett (2000) have been used and compared when constructing the new kiwifruit model based on the LTEM.

The article by Fournier and Hassan (2003) investigates the pricing factors throughout the kiwifruit channel and stresses that the type of margin (constant or proportional) at one stage strongly influences demand price elasticity and hence upstream turnover. Demand price elasticity is calculated for each of the three stages of the supply chain. The demand function $Q=Cp^{\varepsilon}$ is established, where ε is the demand price elasticity at the level considered. The results of the estimations illustrate the highest elasticity on retail level (-1.71), a positive elasticity at shipping level (-1.26) and a steady elasticity on production level (-0.81).

Again, this research focusing on the kiwifruit industry is based on production and does not include other countries or varieties.

Trade modelling literature

A study by Bakshi (2003) examines the impacts on demand, supply, imports and prices when Mexican avocados are allowed into the U.S. through the alleviation of U.S. SPS barriers. Results, through the use of a partial equilibrium trade model, show that Mexican imports increase significantly (as expected) when the U.S. market opens up. Imports from New Zealand and Chile as well as domestic supply fall when Mexican avocados enter the market. Consumption and total supply increase. The price of Mexican avocados increases whereas the prices of Californian, Chilean and New Zealand avocados decrease. As a result when the price on Mexican avocados increases, consumption subsequently falls. From the areas where Mexican access is granted domestic, New Zealand and Chilean avocados are generally redistributed. The supply of avocados with domestic or non-Mexican origin rises in the areas where Mexican avocados have no access, since the price of avocados falls across the entire country and the total supply, foreign and domestic, is displaced from approved Mexican access regions to other parts of the country. The result of this study demonstrates an increase of total supplies of avocado in the U.S. by 12 percent when Mexican avocados are imported. This consequently causes the price of domestic avocados to fall by 12.5 percent.

The report of (Calvin and Krissoff 2005) explains the trade relationship of Japan and global apple exporters. New Zealand used to export apples to Japan during five

years (1993-1998) under a phytosanitary protocol, but found that the costs exceeded the benefits with the protocol. The report recognises a phytosanitary technical barrier as a measure that alters the relative price between the domestic market and the rest of the world and hence creates a price wedge between potential traders. The analysis concludes that exporters will enjoy increased opportunities due to the adjustment of the Japanese phytosanitary protocol, whereas the analysis implies that domestic production would decrease by approximately 11 percent. Japanese consumers, on the other hand, would gain from lower prices and greater availability of varieties (Calvin and Krissoff 2005).

The research report of (Arthur 2006) examines the Australian sanitary and phytosanitary measure, which restricts apple imports from New Zealand and what economic impact a liberalisation would have on Australian net social welfare in terms of changed economic surplus. The import ban was introduced in the 1920's in order to prevent the disease fireblight to enter the Australian production system via imports from New Zealand. The import barrier restricts market supply and competition and thereby raises the domestic price of the commodity, affecting consumers negatively yet benefiting producers. The potential liberalisation of the Australian-New Zealand apple market was assessed through a Markov Chain Analysis. From a net social welfare approach the conclusion was given that if the Australian apple market is liberalised, regardless of the severity and the impact of a disease entry, it is to prefer in terms of maximised social welfare, compared to the current situation.

Research carried out by the Economic Research Service USDA (n.d.) investigates three different ways of analysing the effect of a technical barrier to trade through trade modelling. One of them constitutes a demand-shift element, which should be used if a trade regulation has been introduced to improve information to the consumer. Such information can be related to factors such as country of origin and quality and allows for the regulation to have a beneficial impact on producers or consumers. The demand-shift model implies a shift of the demand curve from an initial assumption of limited information to a situation where information targeted at consumers increases. Consumers, being better informed, are better off demand for imported products either increase or decrease (shifts the demand curve outwards or inwards).

This section examined some of the present literature relevant to this research and how similar studies have been carried out in the past. It explains how they contribute to this study and also provides an understanding of the gaps in the literature where this research will be of significant value.

None of these focus on the kiwifruit industry specifically. In order to investigate and answer the research questions of this paper, a modified and industry-specific version of a PE framework (Lincoln Trade and Environment Model - LTEM) will be used.

Since the LTEM is a synthetic model, some assumptions in the research by Hanawa Peterson and Schertz Willett (2000) have been used and compared when constructing the new kiwifruit model based on the LTEM. Elasticities in the study Fournier and Hassan (2003) were used when developing the new kiwifruit model based on the LTEM.

Methodology

The framework of the Lincoln Trade and Environment Model (LTEM) will be utilised yet modified to include industry-specific countries, commodities, elasticities, prices and policies.

The research will utilise the LTEM, which is a partial equilibrium model capable of separating conventional production systems from organic and IPM productions. The model has been modified and developed to be industry specific in order to assess potential scenarios. Different scenarios containing different proportions of organic and conventional production for New Zealand as well as for overseas main players can be simulated.

The original LTEM is a multi-country, multi-commodity PE model focusing on the agricultural sector. The new kiwifruit industry-specific model includes Australia, Belgium, Chile, China, EU15 (Old), EU10 (New), France, Germany, Greece, Italy, Japan, New Zealand, Spain, United Kingdom and the United States. The EU is divided into two different markets; the EU 15 (old) and the EU10 (new). See also table A1 in appendix.

The kiwifruit sector will be separated into three different commodities (See table A2 in appendix). The most commercially accepted/popular variety Hayward is referred to as Kiwi Green (KW). The Golden kiwifruit, which Zespri holds the property rights to, is referred to as Kiwi Gold (KG) and finally the organic sector is defined as Kiwi Organic (KO). The commodities included in the model are treated as homogeneous with respect to the country of origin and destination and to the physical characteristics of the product. Therefore, commodities are perfect substitutes for consumers in international markets. Based on these assumptions, the LTEM is a non-spatial model, emphasising the net trade of commodities in each country. The model examines implications of trade and trade policy changes in different markets and quantifies price, supply, demand and net trade effects. The policy impacts until 2013 are derived in a comparative static fashion based on the base year of 2003.

The parameters of the supply and demand equations for the LTEM model are adopted from the literature, which categorises the model as 'synthetic'. Interdependencies between primary and processed products and/or

between substitute/complementary products are reflected by cross-price elasticities.

Generally, the LTEM framework contains six behavioural equations and one economic identity for each commodity under each country. The behavioural equations are domestic supply, demand, stocks, domestic producer and consumer price functions and a trade price equation. The economic identity is the net trade equation, which equals excess supply or demand in the domestic economy.

The model essentially simulates the commodity based world market by clearing price on the domestic quantities and prices in each country. Excess domestic supply or demand spills over onto the world market to determine world prices. It is further assumed that the world market-clearing price is determined at the level of equilibrium where total world excess demand equals total world excess supply of each commodity in the world market. The LTEM therefore solves for the world price so that net trade equals zero. The LTEM evolves from SWOPSIM (Roningen, Dixit et al. 1991) which was used to conduct analyses during the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) negotiations. The LTEM is built similarly using a spreadsheet-based framework with Microsoft Excel software.

The new kiwifruit model was constructed as to include the different industry-specific countries and varieties, allowing for consumers to be able to substitute between the different varieties of kiwifruit for each other. This further assumes that price sensitivity varies by country and across the three varieties and assumptions and calculations of elasticities (own-price, supply, income and cross-price) had to be made (see appendix A4). Each country in the model has an individual demand and supply (possibly zero) for each kiwifruit variety. Total net trade is calculated to be zero based on the assumption that world supply equals world demand and world exports equal world imports. Countries are either net importers or net exporters, making up the difference between consumption and production through trade.

Data and elasticities

The framework of the Lincoln Trade and Environment Model (LTEM) will be utilised in this research. The original LTEM, with its data, equations and assumptions, constitutes the framework of the new kiwifruit model. Additional industry-specific data is mainly sourced from the FAO, OECD, annual World Kiwifruit Reviews and ZESPRI. Elasticities are sourced from the articles by Hanawa Peterson and Schertz Willett (2000) and Fournier and Hassan (2003). In the case of insufficient data on elasticities for specific countries, basic assumptions regarding whether the country belongs to a producing/non producing country or a developed/developing economy were made and similar elasticities were applied. See table A4 in appendix for further details. Lack of data constitutes a concern in this research. Where data has been insufficient, assumptions were made based on present literature and thorough calculations. Data for gold and green organic kiwifruit has been particularly difficult to allocate.

Research Scenarios

Scenarios will be selected and simulated according to potential future scenarios facing the global trade in general and the domestic New Zealand industry in particular. Possible scenarios constitute the most central and probable situations potentially influencing the New Zealand trade in kiwifruit.

Reference Scenario

The reference scenario, to which all other scenarios are compared, is set according to actual conditions in 2003. Scenarios will be compared with this base case. The reference scenario represents the situation with factual production, consumption and traded quantities at trading conditions (tariffs and prices) in 2003.

EU consumption drop, reducing New Zealand imports through a SPS policy.

The European Union, if taken as a whole, is the largest consumer of kiwifruit in the world. According to FAO consumption data for 2004, the European Union alone accounts for 64 percent of world kiwifruit consumption (FAOSTAT 2006; FAOSTAT 2006).

This scenario will illustrate a large drop in EU consumption, here viewed as a SPS policy. The scenario targets NZ imports and is modelled through a shift in EU consumption, assuming that all EU countries are affected by the import restriction, but still accepting trade within the EU and with other countries. The expected result of this scenario, according to theory, would suggest that the import restriction to the European market, due to an introduction of a SPS measure, reduces the imported quantity. Producers in the importing country are better off, since the SPS policy restricts imports and thereby protects domestic producers from international competition. Consumers in the importing country are worse off, due to fewer products at a higher price. Producers in the exporting country suffer from reduced exports and hence lower returns. New Zealand producers are hence negatively affected by a potential EU introduction of an SPS policy.

Chinese production doubles by 2013.

If China, being considered as a major producing and exporting country, contributes to an increased supply of kiwifruit on the world market, theory suggests that

world prices of kiwifruit will be reduced due to a significant increase of supply on the world market. This scenario is modelled through increasing Chinese production twofold from 2003 to 2013. If New Zealand kiwifruit is considered homogenous with Chinese kiwifruit, and compete for the same market share, a Chinese expansion will have a negative impact on New Zealand producers in terms of lower returns.

Introduction of a tax on NZ production.

A tax, which could be viewed as a carbon tax, is an example of a pollution tax, highlights the issue of negative externalities and has an environmental purpose to reduce carbon dioxide emissions and thereby decelerate global warming. To put a price on greenhouse gas emissions also constitutes an essential part of the Kyoto Protocol (Cullen and Hodgson 2005). This scenario introduces a 20 percent tax on NZ kiwifruit production and will be modelled through a shift in factor productivity of New Zealand production from 1 to 0.8. No demand changes will be included in this scenario. Results are likely to illustrate higher production costs leading to reduced exports and lower producer returns.

Trade liberalisation through the elimination of all import tariffs.

This scenario will be examined through changing all the trade restricting variables in all countries in the model from current import tariffs to zero. With all import barriers eliminated worldwide, more commodities can be traded. Theoretically, with more supply on the world market a reduction of prices will occur. Consumers are consequently better off with more commodities on the market at a lower price. Producers, on the other hand, would suffer from lower producer returns, depending upon their tariff level.

Results and discussion

This research is based on methodology utilising three different versions of the same commodity included in a new trade model with industry-specific countries, statistics and assumptions. The result on mainly New Zealand producer returns of the four different scenarios are given below.

EU consumption drop, reducing NZ imports through a SPS policy.

This scenario illustrates a large reduction in EU demand for NZ kiwifruit. Consumptions shocks can reflect a variety of factors such as an import ban, food safety scare or consumer reaction to the food miles debate. The shift in EU consumption is in this case viewed as an introduction of a SPS measure targeting NZ exports, which represent 60 percent of total NZ exports in 2003. See also table A5 in appendix.

By 2013, the effects of this dramatic reduction in European Union consumption of New Zealand kiwifruit, result in a 28 percent reduction in producer returns for green kiwifruit and 11 and 21 percent reductions in producer returns for gold and organic green kiwifruit respectively. New Zealand kiwifruit exports in 2013 will have fallen by 13 percent, three percent, and 17 percent respectively for green, gold and organic green kiwifruit.

Chinese production doubles by 2013.

This scenario illustrates the effects of a Chinese production expansion, doubling the country's kiwifruit output by 2013, compared to the 2003 base year. The effects of increased availability of Chinese kiwifruit are simulated to reduce both New Zealand producer returns and exported quantities, all according to theory. New Zealand grower returns for green, gold and green organic kiwifruit are consequently reduced by 16 percent, 19 percent and nine percent respectively. New Zealand kiwifruit export quantities in 2013 will have fallen by seven percent, six percent, and five percent respectively for green, gold and organic green kiwifruit. See also table A6 in appendix.

Introduction of a tax on New Zealand production.

In this scenario, a tax of 20 percent was added to production costs in New Zealand. No changes in demand were included and the tax was only introduced in New Zealand. By 2013, the effects of the tax added to New Zealand kiwifruit production result in a 17 percent reduction in producer returns for green kiwifruit and 17 and 19 percent reductions in producer returns for gold and organic green kiwifruit respectively. New Zealand kiwifruit exports in 2013 will have fallen by 21 percent, 19 percent, and 23 percent respectively for green, gold and organic green kiwifruit. See also table A7 in appendix.

Trade liberalisation through the elimination of all import tariffs.

By removing all tariffs in all countries by 2013, a trade liberalisation scenario was modelled. This was expected to reduce prices and consequently increase consumption but reduce producer returns in countries with high tariffs. New Zealand grower returns increase for green, gold and green organic kiwifruit by 14 percent, 19 percent and 14 percent respectively. World market prices rise significantly for green, gold and green organic by ten percent, 13 percent and 10 percent respectively. This gives New Zealand an incentive to increase production by four percent for green, five percent for gold and four percent fro green organic.

New Zealand export quantities for green, gold, and green organic kiwifruit increase similarly by five percent, five percent and eight percent respectively. See also table A8 in appendix.

In China, where the relatively high tariff (20 percent) is dropped, domestic price falls and consumption increases by eight percent for green, 11 percent for gold and 26 percent for green organic. China stays a net importer and increases imports as well.

Europe drops its relatively low tariff (8 percent) and as a result of complete trade liberalisation domestic EU price rises for both consumers and producers. Producer returns actually increase by two percent, which indicates that EU producers are better off if the world kiwifruit market were to be completely liberalised.

The rise of EU prices can be explained through the increase in Chinese imports. The consumption drop in the EU compared to the consumption increase in China reflects that most increase in production worldwide is swallowed by China. The difference in population between the EU and China by 2013 is calculated by the model to be as much as 70 million, indicating that it is not unlikely that Chinese demand for kiwifruit will increase to the extreme of affecting EU prices.

Conclusion

Four cases illustrating potential scenarios that may face the global kiwifruit industry in the near future have been modelled and analysed throughout this paper. Results illustrate interesting effects on countries included in the new kiwifruit model and New Zealand in particular. Consequences of the potential scenarios on New Zealand producer returns were estimated in order to quantify changes executed by the model.

A potential EU import ban on New Zealand kiwifruit, due to an introduction of a SPS measure clearly reduces total exports from New Zealand and lower producer returns. New Zealand producers are hence negatively affected by a potential EU introduction of an SPS policy. Italy has utilised this measure before, and with the increasing use of non-tariff trade barriers worldwide, it is therefore not unlikely that this scenario could take place in the nearest future.

China is currently expanding its kiwifruit production at a significant pace. A scenario where total production is doubled by 2013 is probably the most realistic of all scenarios carried out in this research. However, this may potentially be a slight understatement of the likely expansion in Chinese kiwifruit production. The effects of increased availability of Chinese kiwifruit are clearly affecting New Zealand producer returns and exported quantities negatively.

A tax was assumed to be introduced and added to New Zealand production costs. The assumption of this scenario is applicable to other industries as well and this research illustrates how the kiwifruit industry in particular would be negatively affected by the introduction of a tax.

A trade liberalisation scenario was modelled through the removal of all tariffs in all countries by 2013. World market prices rise significantly for all varieties giving New Zealand an incentive to increase production and exports. China increases its imports and consumption significantly, which could possibly explain the rise in EU prices. The scenario, interestingly enough, illustrates that EU producers are better off, through higher producer returns, if the world kiwifruit market were to be completely liberalised.

The result of this scenario also illustrates the importance of using a trade model, including several interacting actors and factors. A simple partial equilibrium supply and demand diagram of any of the European kiwifruit consuming countries would illustrate increased demand and imports if tariffs were to be removed completely. The calculations and simulations by the model clearly show the importance and influence of other countries.

The approach taken in this research is novel in two ways. Firstly, a model specific to the kiwifruit sector was developed to simulate various trade conditions. Secondly, the study considers key aspects of the kiwifruit industry and links these to international trade in the sector. The realistic scenarios developed in this research provide an understanding of the potential threats and opportunities facing the industry. This study identifies the possible impacts on producer returns and thus may provide decision-makers with important insights for future investment and policy.

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JEL Classification

F14 Country and Industry Studies of Trade

Q17 Agriculture in International Trade

Key Words

International trade, kiwifruit, LTEM, New Zealand, organic, China

Appendices

Table A1: Countries included in the model

ID	***Country***	**ID**	***Country***
AU	Australia	GR	Greece
BE	Belgium	IT	Italy
CI	China	JP	Japan
CL	Chile	NZ	New Zealand
EO	EU Old (15)	SP	Spain
EN	EU New (10)	UK	United Kingdom
FR	France	US	United States
GM	Germany	RW	Rest of World

Table A2: Kiwifruit variety coverage of the model

ID	***Variety***
KW	Kiwifruit green
KG	Kiwifruit gold
KO	Kiwifruit green organic

Table A3: Scenarios

Reference Scenario	**Scenario 1 (EU consumption drop)**	**Scenario 2 (Chinese expansion)**	**Scenario 3 (tax)**	**Scenario 4 (trade lib)**
Actual conditions in 2003	No trade EU-NZ	Chinese production doubles by 2013	20% tax on NZ production	All tariffs eliminated by 2013

Table A4: Elasticties used in the model

Country/Region	Elasticity	KW	KG	KO
AU	demand	-1.70	-3.40	-3.40
	income	0.18	0.18	0.18
	supply	0.30	0.30	0.30
BE, GM	demand	-1.67	-3.34	-3.34
	income	0.22	0.22	0.22
	supply	0.10	0.10	0.10
CI, RW	demand	-1.70	-3.40	-3.40
	income	0.49	0.49	0.49
	supply	0.40	0.40	0.40
CL	demand	-1.70	-3.40	-3.40
	income	0.49	0.49	0.49
	supply	0.40	0.40	0.40
EN,EN,GR	demand	-1.70	-3.40	-3.40
	income	0.30	0.30	0.30
	supply	0.40	0.40	0.40
FR	demand	-1.83	-3.66	-3.66
	income	0.18	0.18	0.18
	supply	0.40	0.40	0.40
IT	demand	-2.40	-4.80	-4.80
	income	0.38	0.38	0.38
	supply	0.40	0.40	0.40
JP	demand	-1.70	-3.40	-3.40
	income	0.37	0.37	0.37
	supply	0.40	0.40	0.40
NZ	demand	-1.70	-3.40	-3.40
	income	0.18	0.18	0.18
	supply	0.40	0.40	0.40
SP	demand	-1.88	-3.76	-3.76
	income	0.94	0.94	0.94
	supply	0.40	0.40	0.40
UK	demand	-1.91	-3.83	-3.83
	income	0.87	0.87	0.87
	supply	0.10	0.10	0.10
US	demand	-1.70	-3.40	-3.40
	income	0.29	0.29	0.29
	supply	0.40	0.40	0.40

Table A5: Scenario 1 – EU consumption drop through a SPS policy

	2013											
	Producer Price			Producer Returns			Quantity Produced			Quantity Consumed		
Country	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic
AU	21%	8%	16%	-26%		-20%	7%		5%	31%	8%	53%
BE	21%	8%	16%							-48%	-89%	-39%
CI	21%	8%	16%	-28%	-11%	-21%	-9%	-3%	-7%	31%	8%	53%
CL	21%	8%	16%	-28%		-21%	-9%		-7%	31%		14%
EO	21%	8%	16%	-28%		-21%	-9%		-7%	-48%	-89%	-39%
EN	21%	8%	16%	-28%		-21%	-9%		-7%	-48%	-89%	-39%
FR	21%	8%	16%	-28%		-21%	-9%		-7%	-48%	-89%	-36%
GM	21%	8%	16%							-48%	-89%	-39%
GR	21%	8%	16%	-28%		-21%	-9%		-7%	-48%	-89%	-39%
IT	21%	8%	16%	-28%		-21%	-9%		-7%	-38%	-88%	-22%
JP	21%	8%	16%	-28%		-21%	-9%		-7%	31%	8%	53%
NZ	21%	8%	16%	-28%	-11%	-21%	-9%	-3%	-7%	31%	8%	53%
SP	21%	8%	16%	-28%		-21%	-9%		-7%	-68%	-89%	-36%
UK	21%	8%	16%							-45%	-89%	-34%
US	21%	8%	16%	-28%		-21%	-9%		-7%	70%	8%	136%
RW	21%	8%	16%	-28%		-21%	-9%		-7%	50%	8%	-7%

Table A6: Scenario 2 – Chinese production doubles by 2013.

	2013											
	Producer Price			Producer Returns			Quantity Produced			Quantity Consumed		
Country	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic
AU	-12%	-14%	-6%	-15%		-8%	-4%		-2%	12%	49%	9%
BE	-12%	-14%	-6%							11%	48%	8%
CI	-12%	-14%	-6%	67%	63%	83%	90%	89%	95%	12%	49%	9%
CL	-12%	-14%	-6%	-16%		-9%	-5%		-3%	12%		-3%
EO	-12%	-14%	-6%	-16%		-9%	-5%		-3%	12%	49%	9%
EN	-12%	-14%	-6%	-16%		-9%	-5%		-3%	12%	49%	9%
FR	-12%	-14%	-6%	-16%		-9%	-5%		-3%	14%	55%	10%
GM	-12%	-14%	-6%	-16%		-9%	-5%		-3%	11%	48%	8%
GR	-12%	-14%	-6%	-16%		-9%	-5%		-3%	12%	49%	9%
IT	-12%	-14%	-6%	-16%		-9%	-5%		-3%	22%	83%	19%
JP	-12%	-14%	-6%	-16%		-9%	-5%		-3%	12%	49%	9%
NZ	-12%	-14%	-6%	-16%	-19%	-9%	-5%		-3%	12%	49%	9%
SP	-12%	-14%	-6%	-16%		-9%	-5%		-3%	15%	57%	11%
UK	-12%	-14%	-6%				-5%		-3%	15%	59%	12%
US	-12%	-14%	-6%	-16%		-9%	-5%		-3%	12%	49%	9%
RW	-12%	-14%	-6%	-16%		-9%	-5%		-3%	12%	49%	9%

Table A7: Scenario 3 – Introduction of a tax on NZ production

	Producer Price			Producer Returns			Quantity Produced			Quantity Consumed		
Country	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic
NZ	3%	3%	1%	-17%	-17%	-19%	-19%	-19%	-20%	-3%	-7%	-1%

Table A8: Scenario 4 – Trade liberalisation

	Producer Price			Producer Returns			Quantity Produced			Quantity Consumed		
Country	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic	Green	Gold	Organic
AU	10%	13%	10%	13%		13%	3%		3%	-5%	-28%	-19%
BE	2%	5%	2%							0%	-13%	-2%
CI	**-9%**	**-6%**	**-9%**	**-12%**	**-8%**	**-12%**	**-4%**	**-2%**	**-4%**	**8%**	**11%**	**26%**
CL	10%	13%	10%	14%		14%	4%		4%	-5%		-5%
EO	2%	5%	2%	2%		2%	1%		1%	0%	-14%	-2%
EN	2%	5%	2%	2%		2%	1%		1%	0%	-14%	-2%
FR	2%	5%	2%	2%		2%	1%		1%	0%	-15%	-2%
GM	2%	5%	2%							0%	-13%	-2%
GR	2%	5%	2%	2%		2%	1%		1%	0%	-14%	-2%
IT	2%	5%	2%	2%		2%	1%		1%	-1%	-19%	-4%
JP	3%	6%	2%	4%		4%	1%		1%	0%	-16%	-4%
NZ	**10%**	**13%**	**10%**	**14%**	**19%**	**14%**	**4%**	**5%**	**4%**	**-5%**	**-28%**	**-19%**
SP	2%	5%	2%	2%		2%	1%		1%	0%	-15%	-3%
UK	2%	5%	2%							0%	-15%	-3%
US	1%	4%	1%	1%		1%	0%		0%	1%	-12%	0%
RW	10%	13%	10%	14%		14%	4%		4%	-5%	-28%	