RESPONSE TO NEW ZEALAND'S AGRICULTURAL SECTOR FROM ECONOMIC GROWTH AND FREE TRADE WITH CHINA

A Computable General Equilibrium Analysis

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Abstract

China's growth performance over the last three decades has stood at a phenomenal nine percent per annum and shows little sign of abating despite challenging market conditions in recent times. With ever increasing demand and limited land availability this is set to have an increasing impact on New Zealand which has a comparative advantage in land-intensive agricultural products. Already this is observable in recent trade statistics. Using GTAP (global trade analysis project), a computable general equilibrium model, this research estimates the future effects of Chinese growth to New Zealand's agricultural sectors and its economy in general. Almost all primary industries in New Zealand can expect to benefit from China's growth, most notably wool and forestry. Modest gains in gross domestic product and economic welfare also benefit the country on the whole. Chinese growth also complements the well documented gains of the recently signed free trade agreement between the two nations.

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INTRODUCTION

Over the last thirty years China has emerged from being an inward-oriented socialist country to a thriving open market and driven economy. Wide-ranging economic reforms progressively implemented since 1978 have covered agricultural decollectivisation, opening up to international trade, encouraging foreign investment, and reduced state control, all of which provided encouragement to increase productivity and maximise profits. Ultimately China has achieved exceptional economic growth for an unprecedented length of time; thirty-two years and counting, with an average growth rate of nine percent per year, exceeding the performances of the growth miracles achieved by the Asian Tigers. Consequently this has seen per-capita incomes double roughly every decade. Such performance, given the large size of China, has attracted universal attention from academics to policy makers to economic agents wishing to examine the causes, effects, and potentialities of this phenomenal growth which has seen China quickly become the second largest economy in the world.

With economic growth comes the expectation of consumption growth across all sectors of the economy, including agricultural products. Problematic for China however is the lack of arable land with which to increase production in order to match the increasing demands for agricultural products. Despite limitations China has until recently kept up with these demands with exceptional productivity growth in this sector. However since 2002 trends have begun to emerge of high growth in agricultural imports to China. Assuming this trend continues there is great potential for agricultural economies outside of China to benefit from this.

With approximately half of all merchandise exports being derived from agriculture New Zealand stands to gain from the increased demands coming from China. New Zealand being a land abundant country has a comparative advantage in land-intensive products such as dairy and wool, both of which are expected to benefit from China's growth. Furthermore, New Zealand reaps added benefits by being the first developed country to negotiate and successfully implement a free trade

agreement (FTA) with the world's most populous nation. This will grant tariff-free access to China for most of New Zealand's major agricultural products by 2019 and therefore increasing the competiveness of its agricultural exports to China.

1.1. Research Questions

Given the strong income growth that China has experienced over the last thirty years and the likelihood that it will continue into the future, there is an expectation that consumption and production patterns have and will continue to evolve. One expected consequence of higher income is an increased demand for food and diet diversification. Changes in food consumption has been noticeable particularly in urban China with consumers spending more on food and varying their diets, consuming less traditional foods and more Western foods such as dairy products, red meat, seafood, breads, and various horticultural products. Of particular interest is whether China can keep pace with these increasing and changing demands through further agricultural productivity growth and transforming its limited land resources towards alternative crops as required. Alternatively, how heavily will China rely on international markets to meet this demand? Due to China's large economy consisting of 1.3 billion people, any trade in agricultural products has potentially huge implications for the New Zealand economy. Ultimately, the main question to be answered is how does China's economic growth, together with its increasing demands in various agricultural products affect New Zealand, a land abundant agricultural economy. And lastly how might the recently signed FTA with China complement any benefits stemming from Chinese-based growth?

Explicitly stated the four main research questions that this paper addresses are:

1. How is agricultural consumption in China likely to evolve with sustained economic growth?

2. How reliant will China be on imports to satisfy increased demand for agricultural products?

3. What impact will China's growth have on key New Zealand agricultural export industries and its economy in general?

4. How does the New Zealand agricultural sector fare upon the implementation of the FTA with China?

1.2. Hypothesis

Given the strong economic growth in China and the expectation that this will continue into the foreseeable future it is expected that an increasing number of Chinese consumers will spend more on food as well as diversifying their diets. Following the trends of the other 'Asian Miracles', one might expect that this diversification would head towards a more Western-type carbohydrate and high energy fuelled diet. This would include such products as red meats, dairy products, seafood, and a wider range of fruit and vegetables. With New Zealand having a comparative advantage in land-intensive agricultural products, combined with stronger demand resulting from income growth in China and its large population, it is anticipated that there will be strong implications for major New Zealand agricultural industries, most notably in dairy, sheep and beef, fishing, and potentially wine. On the other hand, due to the large population and relatively limited land availability, China has a comparative advantage in labour-intensive agricultural products which limits the potential in these industries in this category for New Zealand, most notably the fruit industry (excluding kiwifruit). However, given the seasonal variation from being in opposing hemispheres and a reputation for quality produce, this may also work to the advantage of New Zealand for these horticultural products. It is important to consider more than just bilateral trade between New Zealand and China, but to also consider the effects on New Zealand's agricultural trade with the rest of the world; some trade-off is to be expected and must be evaluated to determine overall welfare.

In 2008 New Zealand and China signed an FTA which is expected to magnify the benefits seen in the agricultural sector of New Zealand over time as trade barriers are progressively reduced or eliminated by China. Between 2008 and 2010 much of the developed world had experienced a global recession, meanwhile China has had persistent healthy growth which is expected to help stem the impact of the downturn

on the New Zealand economy due to continued growth in demand for agricultural exports. In summary the key hypotheses to be validated in this research are:

1. Consumers in China would diversify their diets towards high-energy foods as high economic growth continues.

2. Limited land availability would restrict China's ability to increase production sufficiently enough to meet demand for agricultural products and thus providing scope for greater imports.

3. New Zealand's primary sector with its comparative advantage in land-intensive agricultural production would benefit from China's economic growth.

4. The hypothesised benefits to New Zealand agriculture from China's economic growth would be augmented by a NZ-China FTA.

1.3. Methodology

The modelling tool employed in this research is the GTAP (Global Trade Analysis Project) computable general equilibrium (CGE) model. This is used to quantify the effect of China's economic growth and trade relations on the New Zealand economy. More details of the methodology are discussed in chapter 6.6.

1.4. Thesis Outline

Chapter Two reviews the literature on the theories of economic growth and international trade, two important areas of this research, and then discusses the empirical evidence of a relationship between them. Chapter Three examines the Chinese economy starting with an overview of her economic growth performance, especially since 1978. This is followed by an analysis of consumption and production trends since 1978 with the focus being on food and agricultural products which is then linked to trade trends. Chapter Four then analyses the New Zealand economy focussing on agricultural trade and trade reforms of the 1980's. Chapter Five then focuses on agricultural trade between the two nations and a discussion on the impact of recent developments, such as the FTA. Chapter Six introduces general

equilibrium theory, the CGE and GTAP models. A literature review, this time of empirical studies using GTAP for economic growth or trade policy analysis is done here along with discussion on data sources and methodology used in this research. Chapter Seven interprets and discusses the results of the GTAP output. Finally, Chapter Eight concludes by summarising the research, providing policy implications, and ideas for further research.

Chapter Two
GROWTH AND TRADE THEORY

Economic growth and international trade are among the most important components of the national economy and consequently they attract a lot of attention for government and the general public as well as researchers. Economic growth generally raises the national standard of living and therefore should be a major priority for any government. International trade is also advantageous as it allows countries to consume at levels of utility that exceed the limits of production capacity and thus improving welfare.

The purpose of this chapter is to overview the theories and empirical literature on these two subjects and the relationship between them. The first section looks at the theoretical history of economic growth. Next is an overview of international trade and how nations can gain through exploiting one another's comparative advantage. The third section takes a look at the empirical evidence of a positive correlation between international trade and economic growth. The fourth section investigates the common view that protectionism hinders and liberalisation helps economic growth. Finally a summary concludes the chapter.

2.1. Overview of Economic Growth

An objective of most governments is to improve economic growth for its nation given the positive consequences, namely higher incomes, reduced poverty, and more consumption. Growth rates have varied markedly throughout the world over the last fifty years ranging the from growth disaster in Madagascar, which saw their per-capita GDP shrink by one percent per year since 1960, to the high performing Asian Tigers with an average per-capita annual growth rate of over five percent (Jones, 2002).[1] Most recently, China has maintained an astounding per-capita growth rate of almost nine percent since 1978 and is consequently a subject of much interest. It is therefore worthwhile briefly discussing the main theories of economic growth in

[1] The four Asian Tigers are Hong Kong, Singapore, South Korea, and Taiwan.

order to gain an understanding as to why some countries experience healthy growth while others languish behind.

Early Classical theorists lay some of the foundations for the study of economic growth. Adam Smith hypothesised that growth could be improved through specialisation and recognised the potential of increase returns to scale in manufacturing. David Ricardo's theory of comparative advantage provided scope for improved wealth through trading with other countries. Thomas Malthus had a pessimistic outlook on the sustainability of economic (and population) growth given the finite limitations of resources available, namely agricultural land for food production (Thirlwall, 2002). Early cynical views of the sustainability of growth neglect or understate the potential of productivity growth which is considered in later growth models.

Robert Solow (1956) and Trevor Swan (1956) pioneered the modelling of long term economic growth with what is now known as the exogenous or neoclassical growth model. In its original form national income (Y) is a function of physical capital (K), labour (L) and a technological multiplier (A_t) so that:

$$Y = A_t \cdot F(K, L) \qquad (2.1)$$

Therefore growth can be derived from any increase in capital, labour, or technology. Drawing on Romer's (2006) interpretation of the Solow growth model the technology variable is effectively a measure of labour productivity and therefore is treated with labour stocks so that:

$$Y_t = F(K_t, A_t \cdot L_t) \qquad (2.2)$$

thus output at time *t* is determined by capital stocks and effective labour. Changes in capital stocks are determined by investment which is determined by the level of savings available which is a function of initial output, and also depreciation which is a function of initial capital:

$$\Delta K_t = s \cdot Y_t - \delta \cdot K_t \qquad (2.3)$$

where s is the savings rate and δ is the rate of depreciation. In addition to this labour growth and productivity growth are functions of themselves so that:

$$\Delta L_t = n \cdot L_t \qquad (2.4)$$

$$\Delta A_t = g \cdot A_t \qquad (2.5)$$

both labour growth (n), and productivity growth (g) are assumed to be exogenous, that is they are not explained within the model. The Solow-Swan model analyses economic growth in terms of capital growth per unit of effective labour, that is both sides of equation (2.3) is divided by $A \cdot L$ and also discounts for the effects of labour and technological growth as shown in equation (2.6). For simplicity capital per effective labour is denoted by the lower case *k*, and after rearranging and simplifying equation (2.7) is derived, the most important in the neoclassical model.

$$\frac{\Delta K_t}{A_t \cdot L_t} = \frac{s \cdot Y_t - \delta \cdot K_t}{A_t \cdot L_t} - n \cdot \frac{K_t}{A_t \cdot L_t} - g \cdot \frac{K_t}{A_t \cdot L_t} \qquad (2.6)$$

$$\Delta k_t = s \cdot f(k_t) - (n + g + \delta) \cdot k_t \qquad (2.7)$$

This equation specifies that changes in per effective worker capital stocks are determined by the difference between the two parts, namely an investment component and what Romer (2006) describes as the amount of investment required to maintain the per effective worker capital stocks. The point at which the two parts are equal ($\Delta k_t = 0$) is known as the steady-state solution, the point at which the economy follows a balanced growth path determined only by the exogenous technical change. However if capital stocks is such that they are not equal it is suggested that it will converge towards this steady state solution and the larger the difference between them the greater the speed of convergence. Convergence is therefore the fundamental cause of differences between the growth rates between countries in the neoclassical growth model, holding technological growth constant. The concept of convergence is the most lasting contribution of the neoclassical growth and has been a hot topic for economic researchers to econometrically test the validity of this.[2] Researchers not content with having technological change defined outside of the neoclassical growth models have attempted to endogenise this. These endogenous growth model however are very diverse and fall outside the scope of this research.

[2] For further information on convergence see Baumol (1986), Mankiw, Romer and Weil (1992) or Barro and Sala-i-Martin (1992)

The growth miracles of the Asian Tigers in the second half of last century and now in China over the last thirty years is explained by Jones in a neoclassical context, that is these economies shifted to new wealthier steady-state points which require faster growth. This can be caused by, among other things, positive economic reforms, infrastructure development, investment stimulation, and stable governance (Jones, 2002). All of these traits have been evidenced in China while achieving their goals of rapid growth.

2.2. Overview of International Trade Theory

International trade, the second of two important concepts in this research, is briefly outlined in this section before discussing the literature that integrates the two concepts.

2.2.1. Mercantilist Trade Theory

Mercantilism, a collection of early economic thoughts that date back to the sixteenth century, viewed international trade as a means of stockpiling precious metals to obtain national wealth. Trade was treated as a zero-sum game where there would be winners and losers and as such an important goal of an economy would be to maximise its trade balance at the expense of other nations. This was done by maximising inflows of gold and silver through exports and minimising outflows from imports. Naturally, under such a system, the government would implement trade policies to promote and protect the nation's accumulation of wealth or bullion which was associated with national supremacy (Salvatore, 2004). Common strategies utilised to promote exports included subsidization, tax exemptions, and wage limits on labourers, an important factor of production. Strategies to limit imports included government control of trading routes, prohibition on individual exports of precious metals, and protectionist trade barriers such as tariffs, quotas, and embargoes (Appleyard, Field, and Cobb, 2006). Despite the well documented gains that are derived from international trade these Mercantilist views of promoting exports and discouraging imports are still evident today under the guises of industry protection, employment rates, self-sufficiency, and trade balance concerns, commonly referred to as neo-mercantilism (Pugel, 2003; Appleyard, *et al.*, 2006).

2.2.2. Classical Trade Theory

David Hume questioned the validity of accumulating national wealth as a means of improving the welfare of the country, his belief was that with an increased money supply would have inflationary consequences and thus prices and wages would increase to negate its trade competitiveness (Appleyard, *et al.*, 2006). This theory is known as the *price-specie-flow mechanism* and implicitly implies that prices increase rather than the alternative of increased output which is assumed to be at optimal levels based on full employment (ibid).[3] Adam Smith was also against the excessive government intervention resulting from the Mercantilist goal to accumulate wealth which served only to inhibit real growth for the general populace. He argues that it is not currency accumulation that determines a nations welfare but rather its productive capacity. As such, focus should be directed at improving productivity and one method would be to specialise in producing and exporting commodities in which the nation has an absolute advantage, conversely products which are more efficiently produced elsewhere should be imported. Smith was a staunch proponent of free trade which aligns with his *invisible hand* theory (Van Marrewijk, 2002).

A third wave of attack against mercantilist views on trade came from David Ricardo with his 1817 publication *The Principles of Political Economy and Taxation*. Following on from Smith's notion of absolute advantage the question was posed as to how scope for trade could exist even if one country was more efficient in producing everything. Using a simple 2x2x1 model[4] and several simplifying assumptions[5] Ricardo finds that both countries can be better off by specialising in and exporting those commodities which are relatively cost efficient. His example showed that while Portugal could produce both cloth and wine more efficiently than England (an absolute advantage in both goods) they produce a higher ratio of wine to

[3] The quantity theory of money is defined as $M_S \cdot V = P \cdot Y$; where M_S is the money supply, V is the velocity, P is the general price level, and Y is total output. Assuming that velocity and output are fixed then an increase in the money supply must lead to an increase in the price level.

[4] 2x2x1 refers to two countries (England and Portugal), two tradable commodities (cloth and wine), and one input (labour).

[5] The ten assumptions as taken from Applefield, Field, and Cobb (2006) are: fixed resource endowments in each country, perfect mobility of factors of production between sectors, perfect immobility of factors between countries, value based solely on quantity of labour, fixed technology, constant returns to scale, full employment, perfect competition, no government intervention, and no transportation costs.

cloth than England who in turn produces a higher ratio of cloth to wine, these differences in ratios between the two countries provide a basis for trade and is the logic behind *comparative advantage*, an extremely important development in international trade theory. International trade under the classical model was viewed as a positive-sum game where all nations can win.

The Ricardian model has been expanded to relax some of the restrictive assumptions to bring it more in line with the real world. The first expansion involves expressing trade in monetary terms instead of labour units; here the process is the same and comparative advantage is based on the country which can produce each good relatively cheaply. A second extension involves analysing more than two commodities and here each country should specialise in those goods which relative production costs are lower than relative wages. Closely related is an extension which evaluates more than two countries and the main implication is that countries will export those commodities which can be produced more efficiently than the international terms of trade. A fourth extension includes the impact of including transportation costs; these increase the costs of trade and consequently erode some, and possibly all, of the gains from comparative advantages and thus acts as a natural trade barrier.

2.2.3. Neoclassical trade theory

Neoclassical economists make use of microeconomic theory to illustrate the potential gains from trade. Making use of a production possibilities frontier (PPF) with increasing opportunity costs, a terms of trade line, and indifference curves it is shown that a country can consume beyond their productive capacity with international trade and thus demonstrating positive welfare effects.[6] One useful result of the neoclassical model is that due to increasing opportunity costs of production there is incomplete specialisation because at some point on the PPF the relative cost of producing the specialised product will increase beyond that of the unspecialised product. This explains why nations can still produce commodities in which they

[6] For a graphical analysis and interpretation see any recent undergraduate international economics textbook, for example Chapter 6 of Appleyard, Field, and Cobb (2006) or Chapter 3 of Salvatore (2004)

have a comparative disadvantage (Salvatore, 2004). Bertil Ohlin (1933) considers the role that factors of production plays in determining comparative advantages of a nation. The basic premise is that the inputs which are relatively abundant form the basis as to which commodities have a comparative advantage and therefore should be exported given various assumptions hold;[7] this is known as the Heckscher-Ohlin theorem.[8]

2.3. Trade-Growth Nexus

There is a general consensus among economists that there is a correlation between economic growth and international trade growth; however questions arise as to the direction of causation of this relationship or whether it is 'bi-directional' (Lewer, 2003, p. 366). Early views on the positive correlation between trade and growth are based on static gains such as those derived from Ricardo's comparative advantage and Ohlin's Factor price equalisation theorem as discussed in the previous section. This section extends on the previous two sections and overviews the copious amount of literature on the potential link between international trade and economic growth.

Economic growth is the expansion of the productive capacity of a nation which can come from two sources – an increase in resource endowments or an improvement in productivity or technology (Salvatore, 2004). This growth in a two-dimensional setting is represented by an outward shift in the PPF which is accompanied by an outward movement in the terms of trade line and the utility function. Consequently with economic growth consumption will increase as well as production and therefore having an impact on imports and exports respectively. The shift in trade resulting from the increase in productive capacity in this model depends on the relative increase in the commodities produced, consumer preferences, and terms of trade effects. The first, changes in the relative shares of commodity production, is explained by the fact that economic growth affects each sector differently and growth

[7] The assumptions of the H-O model are: 2x2x2 model (countries, commodities, and factors of production), identical technology in both countries, constant returns to scale, different factor intensities, identical tastes and preferences in both countries, perfect competition, perfect mobility of factors between sectors, perfect immobility of factors between countries, no transportation costs, and no government intervention (Appleyard*, et al.*, 2006).

[8] Eli Heckscher is recognised as a partner in this theorem due to the influence of his earlier work on the model (Van Marrewijk, 2002)

may be biased towards either exportable or importable products.[9] Secondly, consumption preferences also tend to change disproportionately as a result of increased incomes (less on essentials and more on luxuries) which may also be biased towards exports or imports.[10] The third determinant, the terms of trade effect, depends on the impact on relative world prices resulting from the increased trading activity within the nation, Johnson (1958) summarises the impact of a country's terms of trade as depending on "the extent to which its particular ranges of exports and imports were substitutable for the exports and imports of other countries in world consumption" (p. 93) and these effects will also flow through to other trading nations.[11] Typically, according to theory, an increase in economic growth does increase international trade within the nation, the degree to which depends on the composition of that growth. Also economic and trade growth generally improves the welfare of the nation having the ability to consume more however an expected deterioration in terms of trade erodes some of these gains.[12]

There has been a vast amount of empirical studies attempting to prove the link between growth and trade over the last forty years. The earliest of these studies focussed on the impact of exports on economic growth and found a positive correlation (Emery, 1967; Michalopoulos and Jay, 1973; Michaely, 1977). Balassa (1978) having found similar results went further by using a cross-country regression to estimate GDP using domestic capital, foreign capital, labour, and exports as explanatory variables. He found all variables were positive including a coefficient of 0.04 – 0.05 for exports and concludes that "export growth favorably affects the rate of economic growth over and over the contributions of domestic and foreign capital and labor" (p. 188) and uses this as an argument in favour of export promoting

[9] Economic growth that is biased toward exportable (importable) products is said to be pro-trade (anti-trade) in that there is expected to be a more (less) than proportionate increase in trade (Salvatore, 2004).

[10] Growth induced consumption changes that is biased towards imports (exports) is said to be pro-trade (anti-trade) in that there is expected to be a more (less) than proportionate increase in trade (ibid.).

[11] For small countries these terms of trade effects are likely to be negligible.

[12] There is a possibility of the terms of trade deterioration being large enough to override the welfare gains of economic growth, a theoretical concept which Bhagwati (1958) classified as immiserising growth, however there is little evidence of such occurrence happening in the real world (Salvatore, 2004)

policies. Balassa's findings have been subsequently backed up by Ram (1985, 1987) finding that export growth is also important for developing countries.

Frankel and Romer (1999) address the issue of endogeneity of the trade-growth connection with the use of geographical instrument variables (IV) for trade.[13] The IVs used for trade are population and area (based on size of domestic trade) and a weighted average of distance to other international markets; these variables were justified as being correlated with trade but not per-capita income. Their results reaffirmed the relationship between trade growth and economic growth bolstering "the case for the importance of trade and trade promoting policy" (p. 395). Feyrer (2009), using a time-series application, also finds a positive trade-growth relationship although on a smaller scale to that of Frankel and Romer (1999).

In surveying the a large amount of empirical literature on the trade-growth nexus Lewer and Van den Berg (2003) consistently found a positive relationship despite the various data and methodologies used by researchers. On average they conclude that a one percentage point increase in trade growth increases economic growth by 0.22 percentage points.

Taking a different approach Baier and Bergstrand (2001) analyse the possible causes of trade growth, here income growth accounts for approximately 68 percent of trade growth while trade liberalisation (24%) and lower transport costs (8%) also play an important role. This backs up Krugman's (1995) assertion that the performance of trade growth since 1960, which has outstripped GDP growth, is largely attributable to political factors – such as trade liberalisation through GATT and preferential trade agreements and movement away from import substitution and towards export promotion.

2.4. Trade Protectionism and Liberalisation

Given that the theory and empirical evidence suggests that trade and national income is positively correlated it would be easy to assume that it would be in every country's

[13] Instrument variables are correlated with another explanatory variable (in this case trade) and consequently affect the dependent variable through this explanatory variable; their purpose is to reduce any endogeneity.

best interest to maximise trade by reducing barriers to trade such as tariffs, import quotas, and voluntary export restraints. However despite the apparent advantages of trade liberalisation protectionism is still evident throughout the world, with the agriculture and textile industries typically targeted. This section will firstly examine the justification for protectionist trade policies and their consequences, followed by a brief overview of the empirical literature on trade policy. Then the efforts towards multilateral liberalisation through the World Trade Organisation (WTO, formerly GATT) and its slow progress which has subsequently led to an explosion of preferential trade agreements over the last two decades.

2.4.1. Causes and Consequences of Protectionism

There are several reasons why a government may impose trade barriers against other nations including simply increasing government revenues through import tariffs and export taxes, promoting development of a comparative advantage in an infant industry, attempting to improve macroeconomic indicators, retaliatory action against the protectionism of other nations, and as a negotiating tool for preferential trade agreements. [14] During the mid-twentieth century the perceived benefits of protectionism was a popular line of research for economists with much literature debating the notion of an optimal level of protectionism or tariff for a nation. Charles Bickerdike instigated the notion of an optimum tariff and was further developed by Lerner (1936) and Johnson (1951, 1954). While there is merit in the possibility of using protectionism to as a means to improve a nation's welfare it typically neglects the power of retaliatory actions from countries not wishing to see their own trade advantages eroded.[15] Caetano and Caleiro (2010) view the perceived advantages of trade protectionism in a game theory setting (with two regions). In isolation each nation may indeed benefit from implementing trade protection and thus creating a Nash equilibrium where both are actually worse off than they would be under free trade; emphasising the need for cooperation to raise the welfare of all parties involved and hence the importance of the WTO.

[14] This list is by no means exhaustive and further examples are described by Appleyard etal. (2006)

[15] One possibly valid justification for a tariff is to account for any negative externality associated with an import, however even then consumption taxes may be less distortionary, see for example Markusen (1975)

One popular stance against trade liberalisation among some public spectators is the negative impact on unskilled employment and wages, especially in developed countries, including New Zealand. The argument is that increased competition from low-wage developing countries, like China, will drive down wages or increase unemployment. One example Behravesh (2009) uses against this negative view on free trade is that there has been strong growth and employment in the US despite fears by many Americans against the NAFTA[16] and globalisation in general, similar views are echoed by Sachs and Shatz (1996) with regard to the lack of evidence with regard to deteriorating wages follow increased trade with developing nations.

Regardless of the many reasons government and industries may have for implementing trade protectionism economists generally agree that the distortions often result in welfare losses.

2.4.2. Move towards Liberalisation

Despite the continued widespread existence of protectionism there have been distinct moves towards trade liberalisation over recent years. The first minor step towards multilateral trade reductions began with the signing of GATT in 1947, although in its early days very few countries were involved and tariff concessions minimal, consequently it was little more than an open regional trade agreement, however this set the foundations for significant multilateral negotiations, albeit approximately fifty decades later. The Tokyo round (1973-79) saw the number of members reaching one hundred and represented ninety percent of world trading activity, and while tariffs concessions were estimated at US$300 billion, this round allowed nations to enter into preferential trading arrangements without passing the benefits onto other GATT members upon meeting certain criterions (Hoekman and Kostecki, 1996), as outlined in Article XXIV of the GATT guidelines. The Uruguay round (1986-94) took over seven years to negotiate largely due to two factors; the first due to the desire for the Cairns Group[17] to include fairer concessions to the agricultural sector which had been largely neglected in previous rounds, and the second was the establishment of

[16] North American free trade agreement

[17] The Cairns Group is a coalition of agricultural dominated countries of which New Zealand is a member.

the WTO as an independent organisation with greater powers to settle trade disputes and undertake trade policy reviews of each country (ibid). The Doha round, the first under the WTO, began in 2001 and after almost ten years there is still little sign of a settlement. Once again agricultural is the centre of disputes with disagreements over the level and pace of liberalisation.

Given the allowance of preferential trade arrangements following the Tokyo round and the slow and now stagnant progress of multilateral negotiations within the WTO many countries are turning to regional trade negotiations, making it the most utilised tool for liberalisation. According to the WTO there are currently approximately 200 regional trade agreements in force and has been steadily increasing since the implementation of Article XXIV as part of GATT's Uruguay round (Freund, 2010).[18] The motivation for agricultural nations, such as New Zealand, to enter regional negotiations is plain to see given the well documented gains it stands to make from the liberalisation of agricultural trade in other countries and the slow nature of achieving this under the WTO.

With the rise in regional trade agreements some academics have questioned the impact this may have overall world trade liberalisation. Krugman (1991a) opens the debate suggesting that it is a naive view assuming "that since free trade is better than protection ... preferential trading agreements are ... a step in the right direction" (p. 10) arguing instead that the nature of such agreements can lead to increased protectionism against those not a part of the agreement, the logic behind this is the increased economic power of the combined region having more scope to increase protectionism against outsiders for the benefit of its members. In a subsequent paper Krugman (1991b) acknowledges that while in theory regional trade agreements can be more distortionary on world trade in practice there is little evidence of this occurring. Bhagwati (1992) believes that regionalism impedes multilateral negotiations as the resulting distortions should be the antithesis of global trade liberalisation however recognises that it is expanding and here to stay and advises a cautionary approach. Others suggest that regionalism is complementary to multilateralism, for example Baldwin (1997) points to the positive impacts derived

[18] Regional Trade Agreements - www.wto.org/english/tratop_e/region_e/region_e.htm - accessed 2 June 2011

from pressures for inclusion for non-members to enter into preferential trade agreements which could gradually merge willing participants towards global liberalisation. With tens years having past without resolution in the latest round of multilateral negotiation it appears that preferential trade agreements are a valid intermediate solution.

2.4.3. A Positive Openness-Growth Relationship?

As mentioned previously there is a general acceptance among economists of a positive correlation between international trade and economic growth. A different but related question posed then is whether there is such a relationship between trade liberalisation and economic growth; there has been a vast amount of econometric studies, however with mixed results. Feder (1983), using export share to national income as a measure of openness, and Balassa (1985), using a trade orientation measure, were among the first to use cross-country econometric models within a neoclassical growth framework to analyse any correlation between trade policy and economic growth; both concluding that there is a statistically significant positive relationship. Others (Kavoussi, 1984; Kormendi and Meguire, 1985; Ram, 1985, 1987; Rana, 1988) also find similar results using slight modifications and additions to the models presented by Feder and Balassa. Edwards (1993) was sceptical of these earlier models and the assumption of export related measurements as being adequate proxies for openness and thus they neglected imports, as well as endogeneity, measurement, and omitted variable bias. Levine and Renelt (1992) expanded on the regression model by including up to fifteen explanatory variables for per capita growth including investment and education. Consequently they find that export-share is not a robust determinant of growth while investment-share is this most significant variable (resulting in capital stock and technological growth) while they justify the use of an export-share proxy for trade stating that exports and imports are closely related.

Dollar (1992) measures the openness of a nation in terms of the distortion between domestic and international prices, this is based on a theory that price levels will be generally higher in more protected economies. According to his definition the most open quartile of developing countries experienced 2.9 percent annual growth while

the least open quartile suffered a 1.3 percent annual contraction over the period 1976 to 1985. Running a cross-country regression including openness and investment concludes that both are strongly correlated with economic growth among developing countries. Rodriguez and Rodrik (2001) having expanded Dollar's model to include regional dummy variables and an education proxy reject the significance of any openness-growth relationship.

Sachs and Warner (1995) utilise a dummy variable index as a measure of openness. A closed economy is defined as one with high tariffs, many non-tariff barriers, a high black market exchange rate, a socialist economic system, or a state monopoly on major exports (p. 22). They find that an open economy, one that has none of the former attributes, experiences improved annual economic growth of 2.2 percentage points above that of closed economies. However according to Rodriguez and Rodrik (2001) after having reran their regressions but with splitting the dummy variable into separate policy variables, it is the state monopoly and black market exchange rate that are the major determinants of the model, the least related to a closed economy. Direct measures, tariffs and NTB elements however are statistically insignificant.

Winters (2004) outlines three significant problems with the cross-country econometric approach to analysing the effects openness has on economic growth. First is the definition of openness and how it can be accurately measured. Secondly is the issue of the direction of causation of any correlation. Thirdly is the issue of accounting for the indirect effects trade has on growth through variables such as corruption, inflation, investment policy, institutional framework, and education. However despite the different measures and methodologies the majority of empirical studies point to a positive relationship.

2.5. Summary

This chapter has presented the important theoretical foundations of economic growth and international trade both of which are important concepts in examining the future direction of New Zealand and China trade relations. It is generally accepted by economists that there is a positive correlation between trade and growth although the direction of causation is debatable and possibly works both ways; regardless the

implication is that if China's phenomenal economic growth continues into the future trade volumes will increase with it and thus having implications for the rest of the world, including New Zealand. Furthermore trading relations between New Zealand and China are expected to also be affected by a recently signed free trade agreement. Econometric evidence of a positive link between trade liberalisation and economic growth is plagued by problems, nonetheless the theory and the majority of studies do point to a positive correlation.

An alternative approach to trade policy and growth analysis is to use a general equilibrium model. These use a model replication of the economy in equilibrium and then analyses the effects of an economic shock on other variables within the economy. Such models also suggest a positive relationship between growth and trade and also openness and growth, this model and associated empirical studies is the subject of Chapter Six. First the following three chapters examines the developments of the Chinese and New Zealand economies and lays the foundation for the line of research taken in this paper.

Chapter Three
CHINESE AGRI-FOOD ECONOMY AND TRADE

China endured several shifts in economic priorities throughout the twentieth century, from a chaotic start which saw the end of imperial China and replaced by regional warring factions, resulting in economic contraction for much of the first twenty-five years. The re-unification of China by Chiang Kai-shek saw a decade of moderate economic growth before Japanese invasion and then civil war once again saw the economy in ruins throughout the 1940's. Upon victory in 1949, the Chinese Communist Party (CCP), under the leadership of Mao Zedong, laid the platform for a prosperous decade in the 1950's with high growth. However the overly ambitious industrial plans of the Great Leap Forward (1958 – 1962) and the anti-rightist Cultural Revolution movement (1967 – 1976) had well documented disastrous human and economic consequences. Following the death of Mao and two years of political uncertainty Deng Xiaoping took over the leadership role in 1978 and instigated wide ranging economic reforms during his fourteen year tenure including agricultural de-collectivisation, market liberalisation, the acceptance and promotion of international trade, and population controls. The successors to Deng have continued reforming China away from communist socialism and towards capitalism. The success of these reforms over the last three decades is evidenced by China's sustained high economic growth often exceeding ten percent per annum, which has seen her become an economic powerhouse in recent times.

The purpose of this chapter is to analyse the changing economic environment within China as a result of the economic reforms and its associated growth since 1978. China, with 1.3 billion people, consists of almost twenty percent of the world population, their rapidly growing incomes and changing behaviours must have significant effects for the rest of the world. Focusing on food and agricultural trends, due to its importance to both New Zealand and China, this chapter is divided into six sections. The first section will provide a historic overview of the Chinese economy; this will include an overview of the reforms implemented over the last thirty years. The second section examines China's recent economic growth performance and its potential for the future. The third section analyses the changing consumption trends

that have resulted from increased wealth of Chinese consumers. The fourth section discusses the evolving production patterns and China's ability to meet her increasing demands. The fifth section examines the trends in Chinese trade and her shifting focus to exporting and importing products according to relative comparative advantages. Finally, the sixth section concludes.

3.1. General Economic Overview

China has a long economic history, much of which has shaped her poor position in pre-modern times, and is therefore useful to briefly cover the Chinese political and economic scene prior to 1978, before examining the reforms and growth over the last thirty years that have shaped China into the economic powerhouse that it is today.

3.1.1. Early Chinese Economic History

China throughout its history has had many periods of sustained economic prosperity; however these times were ultimately ended by large scale warfare which led to sudden bursts of contraction. At the turn of the first millennium, under the Song Dynasty, China entered arguably her greatest period of technological and economic progression of China's 2000 year imperial age (221B.C. – 1911A.D.). This dynasty is characterized by relatively rapid developments throughout all sectors of the economy; including agricultural innovations such as irrigation and cultivation expansion, industrial innovations such as mining technologies and weaponry advances with the invention of gunpowder, currency innovations with the development of papermaking and woodblock printing for paper money usage, and the expansion of commercial trading activities. Like the other successful dynasties before it, the Song Dynasty was felled by war in 1271, this time by an outside source, the Mongolians. The resulting Yuan Dynasty was characterized by excessive fiscal spending, state ownership in key primary industries, hyperinflation from money printing to fund its activities, and discrimination against the ethnic Chinese population. Consequently, dissatisfaction of the Mongolian rule saw civil unrest and China was once again divided into regional factions.

The Ming Dynasty (1368 – 1644) sought to reunify China and for much of this period saw strong economic growth and prosperity return, as well as regaining many territories that were lost – including Tibet and Manchuria. China at this stage was the wealthiest country in the world while per-capita income was also comparable to that of western nations. Unfortunate disasters, both economic (global shortage of silver and resulting appreciation) and natural (extended droughts and cold weather severely affecting crops) caused disharmony among the general populace, eventually bringing this dynasty to an end.

The Manchu lead Qing Dynasty (1644 – 1911) seized Beijing and took power of China, this was initially an economically detrimental period of extreme repression and control of the Chinese people. However, with the elimination of the remaining Ming factions, the Qing relaxed its grip on the population resulting in improved economic conditions and moderate growth throughout the eighteenth century. In contrast, China in the nineteenth century was marred by foreign aggression. Firstly, Britain officials actively encouraged the illegal smuggling of opium into China in response to the lack of willing trade negotiations with Chinese officials. Then in retaliation for attempting to block British imports of opium, Britain declared war on China in 1840, and after two years the First Opium War ended with an embarrassing defeat to China further exasperated by unjust treaties, concessions, and silver payments forced upon them, as well as an epidemic of opium addiction resulting from the influx imported into the country. Secondly, taking advantage of China's weakened position other Western nations demanded similar significant entitlements to Britain. Third was the Taiping Rebellion of the 1860's, an attempt overthrow the Manchu dynasty which resulted in twenty million deaths and crippled the already unstable economy. Finally, toward the end of the century Japan invaded and defeated Korea backed by China. The sad state of China's political, economic, and military situation inevitably led to the decline of the Qing Dynasty, and with it brought an end to Imperial China in 1911.

Political instability continued in the first years of the Republic of China (1911 – 1949), and the uncertainty saw its economy continue to contract at a rapid pace. Upon instilling Chiang Kai-shek as leader China enjoyed a short-lived burst of economic growth before war devastated the country once more, first from the

Chinese Communist Party (1928-36), then from Japan (1937-45) and then the resumption of civil war (1946-49), in total accounting for approximately twenty-five million lives. Ultimately, the Communist Party (CCP) won the civil war and the People's Republic of China was born under the leadership of Mao Zedong. Agricultural land reforms (introduction of communes), state acquisition of businesses, and state controlled prices and rationing were implemented in the early stages. Economic growth during the 1950's averaged nine percent per annum, similar to that of recent times (Worden, Savada, and Dolan, 1988). The Great Leap Forward (GLF) declared in 1958 aimed to overtake industrialized countries by transferring excess labour in agriculture to the industrial sector, namely steel. Chang claims that thirty-eight million people died of starvation during this period due to the extensive cuts in agricultural workers (Chang and Halliday, 2005). This disaster resulted in the Chinese economy depressing by over 33 percent in 1961-2. Recognizing the failure of the GLF the government used more orthodox industry policies, resulting in accelerated growth for a short period. Mao's Cultural Revolution from 1966, a brutal anti-rightist movement condemning anyone perceivably opposed to the communist regime, although this was not an economic event it certainly had economic consequences, resulting in two years of recession on its introduction and also at its conclusion in 1976.

3.1.2. Economic Reforms Since 1978

Given the dissatisfactory performance of the state planning system, the unpopularity of the Cultural Revolution, and the economic success of their East Asian neighbours of South Korea, Singapore, Hong Kong, and Taiwan; China appeared ready for the drastic market-oriented reforms that would pave the way for catching up with the developed nations (Chow, 2007). These reforms initiated from 1978, under the leadership of Deng Xiaoping, covered most facets of the economy – including agriculture, industry, trade, financial institutions, and state-owned enterprises (SOE).

Agriculture was the first sector to experience major reforms under Deng, the commune system that had been implemented in the 1950's, whilst successful at first, was found to have flaws as evidenced by the lack of productivity growth and frequent food shortages in the country. Under the commune system farming

households were pooled into large groups and shared the rewards of their production evenly, thus creating a free-rider problem where individuals have minimal incentive to perform (Yang, 1999). The Household Responsibility System (HRS), endorsed from 1979, boosted productivity in two major ways. Firstly, it put households in charge of their own plot of land and kept any profits achieved, thus providing reward and encouragement for production. Secondly, it allowed farmers freedom to farm products outside of the traditional grain requirements, further enhancing farmers scope for profitability by producing higher valued agricultural products, previously banned under Mao's regime. Lin et al. (2003) attributes approximately half of all productivity growth in agriculture to the HRS, indicating its importance to China's rural population. Town and Village Enterprises (TVEs) in rural China flourished from 1979 due to the less restrictive state. TVEs proved to be a useful avenue by which unemployed or underemployed peasants could gain extra income and also providing the local governments with an extra source of extra revenue. The success of TVEs may be attributed to three factors (Koo and Yeh, 1999). Firstly, high unemployment in rural China provided enterprises with an abundant supply of labour. Secondly, the success of the agricultural reforms meant that peasants were slightly wealthier, therefore increasing their demands for light manufactures of which TVEs could supply. And thirdly, opening the economy up to domestic (interstate) trade provided a much larger market in which to distribute goods. TVEs at its peak in 1996 accounted for 35 percent of total industrial output, employed 20 percent of the workforce, and become a significant contributor to economic growth in China (MacKerras, Taneja, and Young, 1998).

Foreign trade and investment liberalisation are further areas of major reform that have been gradually implemented over the last thirty years. Under Mao's leadership, like many before him, foreign trade was deemed to be an unnecessary evil, proclaiming that China could be self-sufficient. Trade reforms in China started with the setting up of a foreign trading currency in 1978. From 1981 China developed five special economic zones (SEZs), firstly in Shenzhen (neighbouring Hong Kong) followed closely by Zhuhai (next to Macau), Xiamen (opposite Taiwan), Shantou (south-east coastline) and Hainan Province (south China island). These SEZs were devoted to large-scale economic development; all were close to the successful Asian Tigers Hong Kong and Taiwan and therefore represented an ideal region to

experiment with (Chang, 1991). Investment was focussed on establishing the infrastructure of these regions, encouraging trade through reduced tariffs or duty free concessions, and tax incentives to promote foreign investment. The SEZs, especially Shenzhen, were successful in attracting foreign trade and investment; they developed rapidly and played a major role in China's export-led growth success (MacKerras, *et al.*, 1998). Song (1999) indicated that trade liberalisation, which was done in five stages, was a long painful process for the government. The first stage involved revamping the trade sector, including the abandonment of the government's monopoly power on trade business. However the population did not have the skills to adequately exploit the opportunities trade had to offer. Stage two from 1985 involved further decentralisation, lowering trade barriers, simplifying trade procedures, and adoption of a single currency exchange rate (set at US$0.357). Stage three from 1987 saw the implementation of the Contractual Responsibility System (CRS), which essentially gave local governments the freedom to trade commodities desirable to their region (Démurger, 2000). Stage four, from 1991, was based on the desirability to re-enter GATT (now the WTO), this involved reducing export subsidies and other trade distorting policies, this coincides with significant growth in trade which averaged 23 percent between 1990 and 1992.[19] Stage five from 1994 involved further fine-tuning, most notably the devaluation of the Yuan by 33 percent. China's eventual accession to the WTO in 2001, along with subsequent bilateral trade negotiations, represents the most recent stage of liberalization.

Other reforms that fall outside the scope of this paper but still influential in shaping the Chinese economy include the gradual privatisation of many state-owned enterprises, phasing out the state controlled pricing system to one based on market signals, improvements in the availability of education which was severely hampered during the Cultural Revolution, adoption of the one-child policy in order to limit population growth, modernisation of the legal system, and the establishment of a central bank as well as commercial banks to cater for the public (Chow, 2007). As a result of the many market-based reforms from 1978, the CCP in 1992 declared China to be a "socialist market economy."

[19] World Bank Databank (2010)

3.2. Economic Growth

China has experienced unprecedented growth over the last three decades, averaging over nine percent per annum. Deng Xiaoping in 1989 boasted that gross national product had more than doubled in less than ten years.[20] From the reforms beginning 1978 it took only nine years (1978 – 1987) for per capita GDP to double, a phenomenal performance; especially when one considers the doubling times for other nations during the period of industrial transformation – 58 years for Britain, 47 years for the United States, 34 years for Japan, and 11 years for South Korea (Cai and Wang, 2004). Even more extraordinary is that China has sustained this growth to this day, incomes have doubled again (1987 – 1996) and again (1996 – 2005) since then, and is on track to do so once more by 2014. These results are summarized in *Table 3.1*, and shows that the 8.7% per annum income growth has compounded to see per capita incomes increase to more than thirteen times the levels experienced in 1978. *Figure 3.1* graphs GDP over the last fifty years on a logarithmic scale; the steep gradient from 1978 illustrates not only the importance of the market reforms, but also the heavy economic costs of the GLF and the Cultural Revolution. *Figure 3.2* clearly show these wild fluctuations in economic growth between 1960 and 1977, followed by three decades of high growth, frequently lifting above ten percent per annum. China has also performed well in spite of the Asian crisis of the late 1990's and the global recession over the last three years; the only major dip in growth occurring in the late 1980's coinciding with the 1987 share market crash and its associated recession.

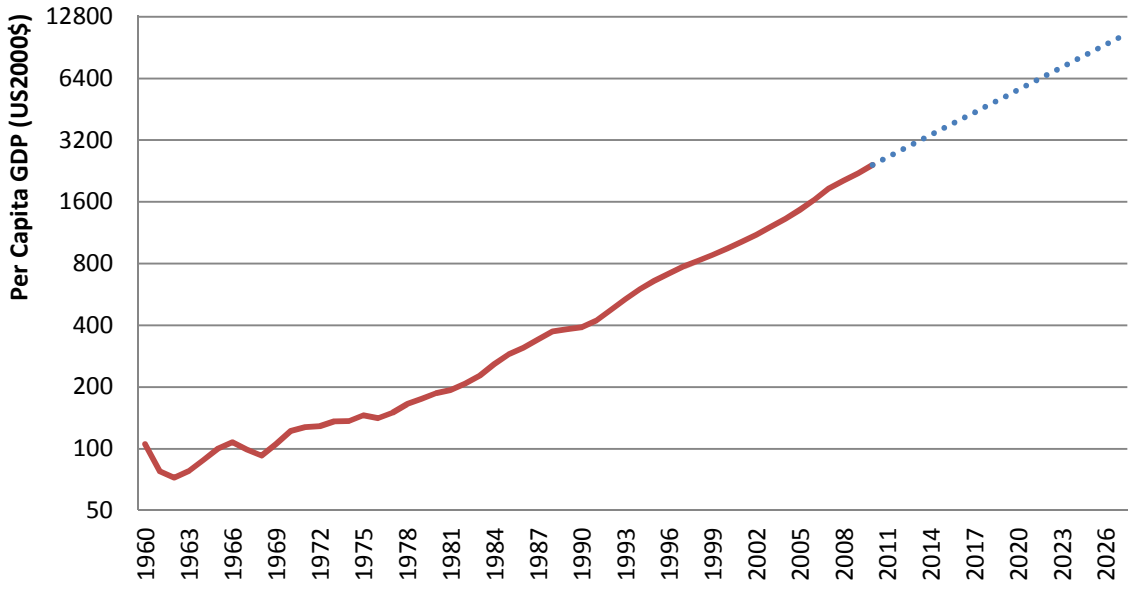
[20] Deng Xiaoping's speaks in response to the Tiananmen Square demonstrations of 1989. Taken from Schell and Shambaugh (1999, p. 99)

***TABLE 3.1** – Economic Growth and Doubling Times in China*

Year	GDP [a] *(CN¥ bn.)*	Population *(m)*	GDP per capita *(CN¥)*	GDP per capita *(US2000$)*	Annual Growth [b]	Acc. Growth [c]
1978	1305.7	956.2	1365.52	164.95	-	-
1987	3060.4	1084.0	2823.12	341.02	8.40%	2.07
1996	7219.3	1217.6	5929.39	716.25	8.59%	2.10
2005	15801.8	1303.7	12120.55	1464.11	8.27%	2.04
2009	24318.2	1331.5	18264.31	2206.26	10.80%	1.51
					8.73% [d]	**13.38** [e]

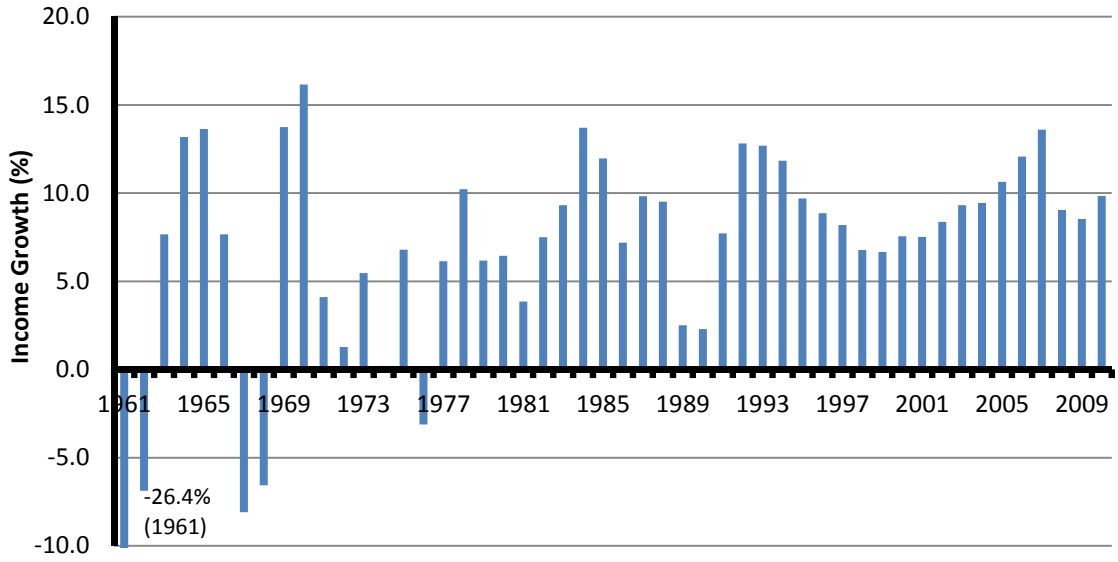
[a] World Bank data (GDP measured in constant local currency)
[b] Per-capita annual growth over the period.
[c] Accumulated growth over the period – to indicate a doubling in per capita income.
[d] Average annual compound per capita growth rate over the 31 years; overall economic growth is 9.89% pa.
[e] This shows that per capita income in 2009 is 13.38 times that of 1978.

***FIGURE 3.1** – Gross Domestic Product of China*



SOURCE: World Bank data (1960-2009) and National Bureau of Statistics (2010)

FIGURE 3.2 – *Chinese Real Per-Capita Economic Growth*



SOURCE: World Bank data (1960-2009) and National Bureau of Statistics (2010)

Following from standard growth accounting, output is accumulated through tangible inputs, capital (K) and labour (L), as well as an intangible input, total factor productivity (TFP or A), economic growth is therefore derived from changes in the quantities of these inputs, as discussed in the previous chapter. Capital growth coming from increases in physical capital stocks (accounting for depreciation) is very evident in China, studies suggesting that it makes up for 28-55% of growth since 1978.[21] Labour growth in its simplest form, measured as the change in labour force, accounted for 10-15% of overall growth in China.[22] Other measures of labour growth can account for estimated changes in labour hours and education levels. Economic growth not explained by either capital or labour is referred to as TFP and include a wide range of variables, the most notable being technological growth, sectoral reallocation, efficiency improvements, and knowledge. Many studies suggest that TFP accounts for 34-50% of China's growth.[23] Cai and Wang (2004) after accounting for capital growth (28%) and labour growth (24%) suggests that

[21] See for example Maddison (1998); Chow and Lin (2002); Chow and Li (2002); Bosworth and Collins (2003); Cai and Wang (2004); OECD (2005); Wu (2007); Perkins and Rawski (2008)

[22] Wu (2007). Some studies include estimated changes in labour hours and education levels as part of labour growth (Bosworth and Collins; 2003), others include them as part of TFP.

[23] Same as above footnote 21

human capital growth (24%) and labour mobility out of agriculture (21%) makes up the bulk of TFP, leaving a residual of just 3%.

Given past experience of growth in China predictions about the future path of growth may be estimated. Capital stocks are expected to continue to increase through investment, however probably not at the same pace. Growth in labour force will be constrained heavily by the one-child policy; this will see population growth continue its downward trend, averaging 0.43% between 2010 and 2025 and then -0.17% between 2025 and 2050.[24] TFP growth is more difficult to predict, however there are three areas in which positive growth can be assumed to continue – technological catch-up, human capital via increased availability to education, and continued urbanisation. Recognising the possibility of numerous economic growth rates this paper will analysis four possibilities – extreme growth (12%) continued high growth (9%), moderate growth (6%), and relatively low growth (3%), and in addition zero growth (0%) will be used as a base.

3.3. Consumption Trends

China's rapid economic growth over the last three decades has naturally seen consumption increase, but more importantly the composition of that consumption is evolving. The general expectation is that food expenditure will increase, but will make up a declining share of overall expenditure; while food consumption is expected to diversify away from traditional diets and towards more varied diets. This section will examine China's food consumption trends as a result of higher incomes focussing on key agricultural products that may have important implications for New Zealand.

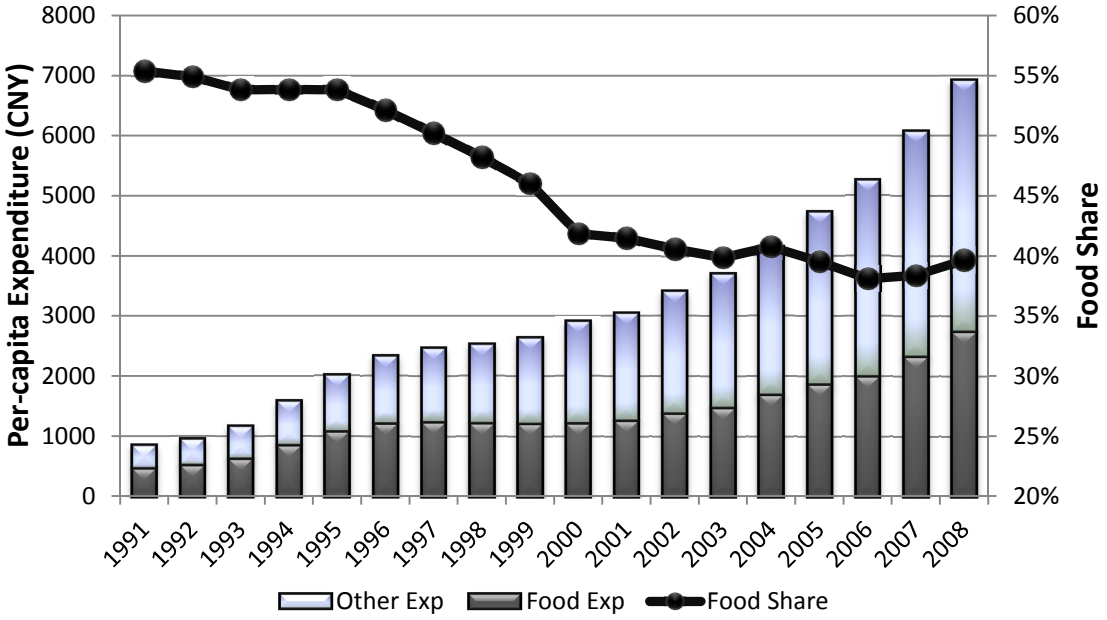
3.3.1. Food Expenditure in China

Traditionally the Chinese diet is predominantly grain based, in general, rice in the south and wheat in the north. Historically there was little scope to deviate from the traditional diet due to income restraints, however strong income growth in recent times has allowed many Chinese consumers to increase and diversify their diet.

[24] Derived from UN Population Projections for China 2010-2050 (constant fertility assumption)

According to Engel's law, this increase in food expenditure is expected to be slower than the overall increase in total incomes; that is income (or expenditure) elasticity of food is between zero and one. *Figure 3.3* shows this has indeed happened in China, between 1991 and 2008 average per capita total expenditure has increased from 855 to 6929 Yuan (13.1% p.a.) while per capita food expenditure increased from 474 to 2746 Yuan (10.9% p.a.). Food share of expenditure over this period declined from 55% to under 40%.[25] When separated, as expected, percentage of expenditure in rural households spent on food (44% in 2008) is higher than that of urban households (38% in 2008). While food consumption in China may grow slower than other commodities, lack of arable land in China limiting production growth and in conjunction with its massive population makes it a significant subject matter for not only China, but also the rest of the world, especially agricultural countries such as New Zealand.

FIGURE 3.3 – *Declining Share of Expenditure on Food in China*



SOURCE: China Statistical Yearbook (1992-2009)

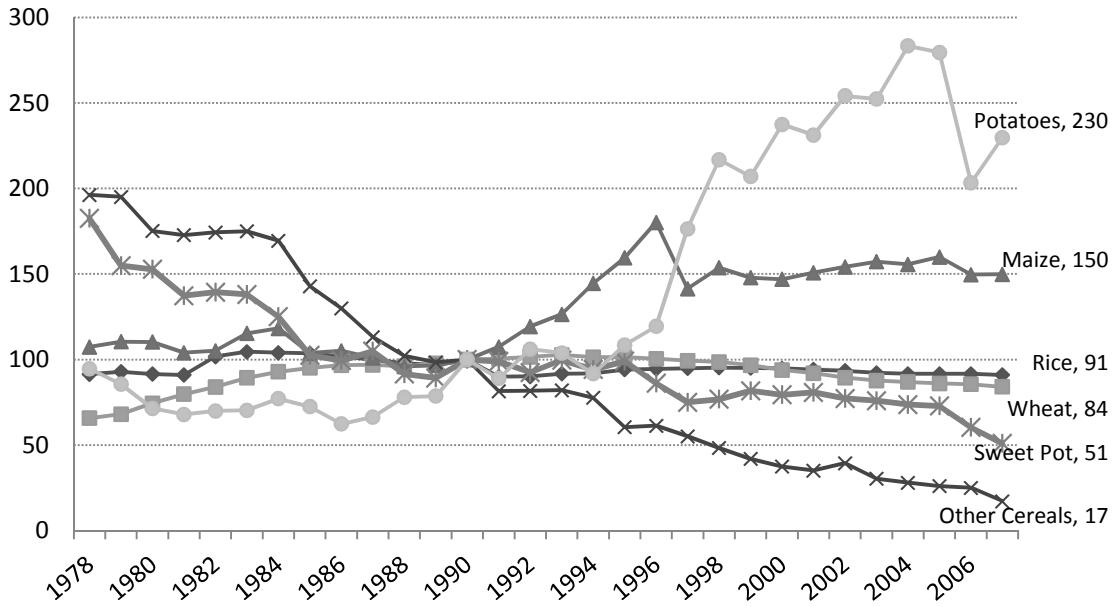
3.3.2. Food Consumption Trends

Traditional staple foods in China are mostly made up of rice, wheat, and sweet potatoes. Predictably, with the rise of incomes and accompanying diversification in Chinese diets, these traditional foods are now consumed in lower quantities than in

[25] This falls in line with many papers – for example Yu and Abler (2009)

the past. *Figure 3.4* shows the changes in the per capita quantity consumed of grains and starchy roots in China compared to the base year of 1990. Rice, although remaining the most consumed food in China, has seen a nine percent drop in per-capita consumption since 1990 (from 84 to 76 kg p.a.); wheat consumption has also declined modestly (from 80 to 67 kg p.a.); consumption of sweet potatoes, has almost halved since 1990 (52.5 to 26.8 kg) and is one-quarter of 1978 levels; other grains, which include sorghum, millet, and barley, have declined substantially as a food for human consumption (from 26.4 kg in 1978 to 1.5 kg in 2007), indicative of the reduced poverty in China and the ability for most citizens to afford improved diets. Potatoes and maize both increased throughout the period by 130 and 50 percent respectively since 1990, albeit from a relatively low base, reflecting the increased exposure to Western diets. The reduction in staple foods has more than been compensated by the increased consumption of other agricultural and horticultural products.

FIGURE 3.4 – *Per-Capita Consumption of Traditional Staple Foods in China*

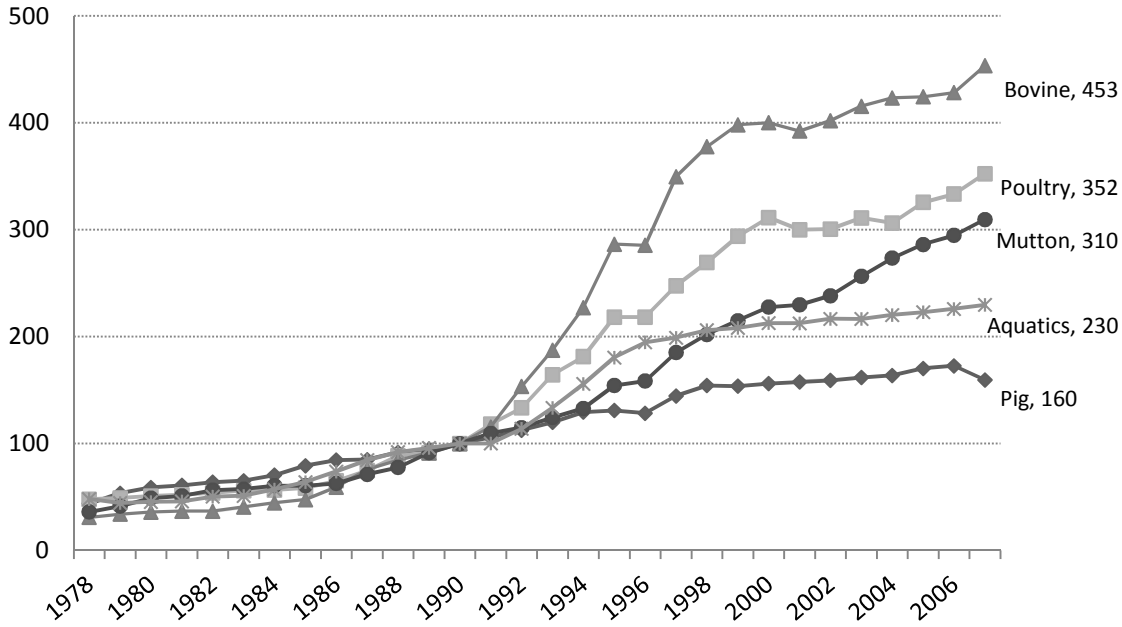


SOURCE: Derived from FAOSTAT (base year 1990 equals 100)

Consumption of meats since 1978 increased dramatically and have generally doubled in the period from 1978 to 1990, the growth in per capita meat consumption is summarised in *Figure 3*.5. Pork, the most popular meat in China increased a modest 60 percent since 1990 from 20.6kg to 32.9kg per capita per annum. Mutton,

historically consumed in Western provinces, has spread throughout China and has consequently increased three-fold (0.9kg to 2.9kg p.a.). Poultry meat consumption has also increased rapidly, by 252 percent (3.4kg to 11.8kg p.a.), much of this increase occurred during the 1990's and has slowed since then. Beef consumption has experienced the most rapid increase of the common meats, Chinese in 2007 consuming 4.5 times what they were in 1990 (1.0kg to 4.7kg p.a.), and 18 times more than in 1978 (320g), albeit from a very low base. Given that beef in New Zealand is a major agricultural product, this sustained growth of consumption in China is potentially of large interest to New Zealand's economy. Lastly aquatic products, consisting of fish and molluscs, like meat, have increased with the rising incomes in China.

FIGURE 3.5 – *Per-Capita Consumption of Selected Meat and Fish Products in China*



SOURCE: Derived from FAOSTAT (base year 1990 equals 100)

Historically, dairy products formed a negligible part of the Chinese diet. Despite strong economic growth from 1978, dairy did not experience the same level of escalation seen by other animal products and underperformed relative to the East Asian Tigers at similar stages of development (F. H. Fuller, Huang, Ma, and Rozelle, 2006). However, since 1998 dairy has expanded considerably, as indicated in *Table 3.2*. Although income growth is undoubtedly one cause of consumption growth in

dairy products, there are other influences that include increased exposure through marketing, school milk programs, increasing popularity of Western styled fast-food restaurants, and awareness of health benefits that have contributed to the recent surge (F. Fuller, Beghin, and Rozelle, 2007). With less than eighty grams consumed per day in 2007, the Chinese population still ranks among the lowest consumers of dairy in the world, providing plenty of scope for rapid growth to continue. Several studies examining income or expenditure elasticities of various foods find that dairy products are amongst the most responsive – for example Ma et al. (2004) and Yen, Fang, and Su (2004). Given that New Zealand's largest export industry is in dairy, this potentially has major benefits to its economy if China cannot adequately meet its continuing surge in demand.

***TABLE 3.2** – Per-capita Dairy Consumption in China*

Year	Consumption (kgs)	Decade Growth	Average Growth
1977	2.73	-	-
1987	5.40	97%	7.1%
1997	8.07	49%	4.1%
2007	28.70	256%	13.5%

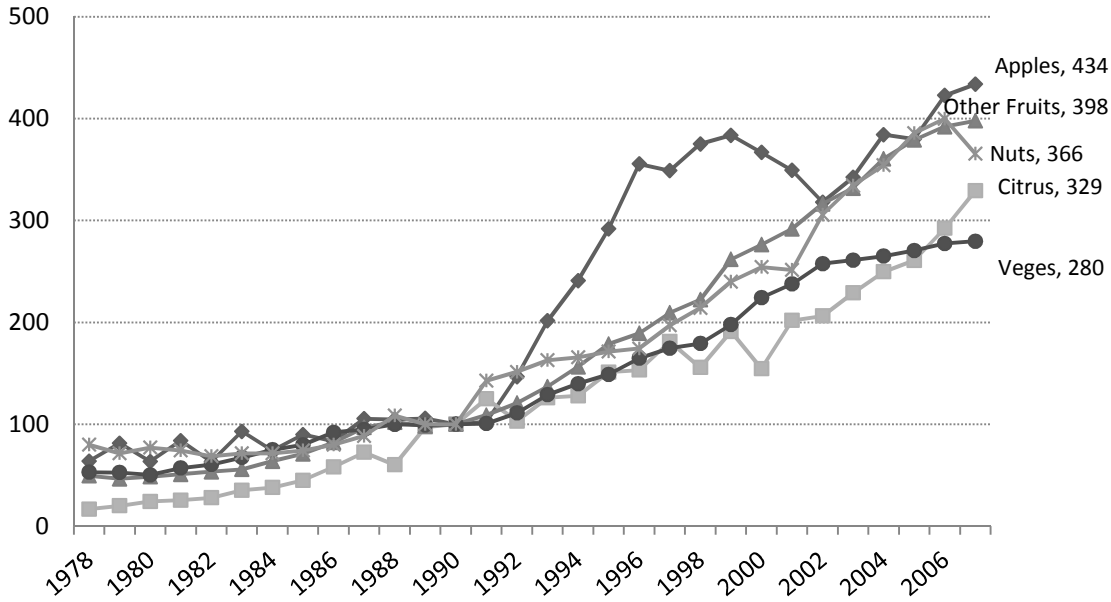
SOURCE: Consumption statistics from FAOSTAT, growth own calculations.

Consumption of horticultural products are similar to that of meats, that is strong but steady growth between 1978 and 2007, and are summarised in *Figure 3.5*. Vegetables consumed per capita in this period increased 460 percent since 1978 and 180 percent since 1990 (from 100kg to 280kg p.a.). Citrus fruits had a massive eighteen fold from a very small base, due to increased exposure to these products since China opened its borders in 1978. Apple consumption increased modestly from 1978, however a large burst during saw consumption almost quadruple in the 1990's and subsequently gained prominence in the Chinese diet. Other fruits (dominated by watermelons, table grapes, and bananas) and nuts have also increased reflecting the diversifying Chinese diet.

Processed and packaged foods being consumed in China have also increased, indicative of the growing demand for convenient products. Dining out in restaurants, including fast-food chains, have become more popular, brought about by larger incomes and a higher opportunity cost of cooking at home. The popularity of

Western styled fast-foods which has surged in recent years have contributed to the growth in consumption of beef (McDonalds etc.), chicken (KFC etc.), dairy (especially cheese and ice cream), and potatoes (chips) (Garner, 2005). Consumption of alcoholic beverages, particularly beer and wine, has exploded rising by thirteen percent per annum since 1978 according to FAOSTAT data.

FIGURE 3.6 – *Per-Capita Consumption of Selected Horticultural Products in China*



SOURCE: Derived from FAOSTAT (base year 1990 equals 100)

3.3.3. Reasons for Changing Trends

Changes in the Chinese diet can be contributed to many things, most of which stem from the reforms that have occurred in the post-Mao era. Income growth has given the means to meet these changes; however what causes consumers to deviate from the historical norm? Firstly, easier access to overseas goods followed by periodic reduction in trade barriers allowed Chinese consumers to acquire a wider range of foods; this is further complimented by increased international travel widening exposure to foreign foods and customs. Secondly, the emergence and rapid expansion of supermarkets and then hypermarkets in urban China provided consumers a one-stop shop to view an increasingly widening range of food products, these places also provided vendors with access to a large pool of customers in which

to market their products (Garner, 2005).[26] Thirdly, as mentioned previously, the growth of fast-food and foreign restaurants presented opportunities for more Chinese to experiment with foreign foods. Fourthly, advertising through various media attempts is used as a means to attract potential customers to new products. Finally, urbanization has given an increasing proportion of the population closer access to the benefits mentioned above. With all these trends expected to continue in the foreseeable future consumption patterns should continue to evolve, leading to the question of how has China supplied for this food consumption growth in the past and also into the future. The next two sections will look at Chinese food production and trade.

3.4. Production Trends

China's ability to meet her growing food consumption demands and the implications for the rest of the world has been a topic heavily discussed in recent times. Brown (1996) raised serious questions over China's ability to produce enough grains within its own border to meet their increasing requirements; he also doubted the capability of the global market to absorb this demand growth in China. Whilst it seems inevitable that China will increasingly depend on grain and other agricultural imports in the future, Brown's pessimism is not warranted as he neglected plausible productivity catch-up in China and overestimates the impact increased grain imports will have on world prices (Paarlberg, 1997). In the name of national security, near self sufficiency of food and grain supply has been a stated objective of the Chinese government (Wu and Thompson, 2003); consequently assistance has been given to farmers to assist with this goal.[27] Whether China can sustain self-sufficiency in food, in spite of the limited availability of land, has potential implications for land abundant nations, such as New Zealand. This section will examine the production of various agricultural commodities and how well it has kept pace with consumption.

[26] A survey of eight major cities indicated that hypermarkets increased its customer share significantly over the three years from 2002 in all cities, supermarkets had across the board modest increases.

[27] China Daily (2008**)** "Premier: Chinese people self-sufficient in food" http://www.chinadaily.com.cn/business/2008-04/07/content_6595479.htm accessed: 14 January 2010

3.4.1. Food Production Trends

As mentioned in the previous section, household consumption of grains has generally stagnated in recent times; however with the rise of the livestock industry in China demand for animal feed grains has increased sharply. *Table 3.3* shows that overall production of grains has increased 18.7 percent between 1990 and 2008. Despite a decline in harvesting area, increased rice productivity have compensated for this, resulting in a trivial increase in production, enough, however, to satisfy consumption requirements. Wheat lost almost one-quarter of acreage; however production rose by 14.5 percent due to a 50 percent increase in productivity, despite the drop off in household consumption indicating less reliance on imports. Maize has overtaken rice as the most planted horticultural crop in China, indicative of the rise in livestock production, of which maize is an important intermediate product. A 39 percent increase in productivity in combination with a 23 percent increase in productivity has resulted in a 71 percent rise in production. Despite this growth China is barely keeping up with the growing feed requirements and doubts remain over the sustainability of this growth into the future.

TABLE 3.3 *– Grain Production in China*

	Production (1990)	Production (2008)	Growth 1990-2008	Growth p.a.
Rice	191.61	193.35	0.9%	< 0.1%
Wheat	98.23	112.46	14.5%	0.7%
Maize	97.23	166.07	70.8%	3.0%
Other Grain	17.34	8.17	-52.9%	-4.1%
Total Grain	404.41	480.05	18.7%	1.0%

SOURCE: FAOSTAT

For the most part livestock production has kept pace with the increased demands of consumption. Pork remains the most produced meat in China, however like consumption its growth is the slowest at 3.8 percent p.a. since 1990. Production growth in both poultry and mutton was almost identical to consumption growth during the same period at 302 and 256 percent respectively. Beef is the exception, even though its growth since 1990, at 372 percent, was the fastest it could not keep up with the increased popularity of the product which increased by approximately

470 percent during the same period. Expansion in production of aquatic products, on the other hand, has exceeded the growth in demand since 1990.

TABLE 3.4 – *Meat and Fish Production in China*

	Production (1990)	Production (2008)	Growth 1990-2008	Growth p.a.
Pig meat	24.02	47.19	96%	3.8%
Poultry	1.26	5.08	302%	8.0%
Bovine	1.30	6.15	372%	9.0%
Mutton	1.07	3.81	256%	7.3%
Other Meat	0.30	1.55	424%	9.6%
Total Meat	30.42	74.51	144%	5.1%
Fish etc.	12.37	48.96	296%	7.9%

SOURCE: FAOSTAT

Prior to the reform era the dominant source of milk products was derived from buffalos. Although the production of buffalo milk continues to increase modestly, dairy milk has largely rapidly taken preference, production increasing seven fold since 1990 and represents the largest increase of the food products analysed (*Figure 3.5*). Consequently China has kept pace with the rapid growth in demand throughout the last decade, however again one has to question the sustainability of this growth.

TABLE 3.5 *– Dairy Production in China*

	Production (1990)	Production (2008)	Growth 1990-2008	Growth p.a.
Milk (Cow)	4.36	35.85	721%	12.4%
Milk (Buffalo)	1.90	2.95	55%	2.5%

SOURCE: FAOSTAT

The labour intensive nature of fruit production provides China with a suitable agricultural product to make efficient use of the limited land availability and abundant rural labour. Accordingly, China have experienced not only an increased in area harvested to fruit crops, but also large productivity growth, resulting in a quadrupling in fruit yields for many crops as indicated in *Table 3.6*. Apples, for example, has seen comparatively little growth in area planted but in spite of this production has increased almost six fold in two decades, due largely to rapid productivity growth. Vegetables, on the other hand, have had limited growth in production, a further reflection of the diversion towards high protein and sugar diets

***TABLE 3.6** – Production of Selected Fruit and Vegetables in China*

	Production (1990)	Production (2008)	Growth 1990-2008	Growth p.a.
Apples	4.33	29.85	589%	11.3%
Citrus Fruit	5.38	23.85	351%	8.7%
Bananas	1.66	8.04	385%	9.2%
Grapes	0.96	7.24	653%	11.9%
Watermelon	10.96	67.20	513%	10.6%
Other Fruits	11.64	54.96	372%	9.0%
Sweet Potatoes	104.90	81.21	-23%	-1.4%
Potatoes	32.03	69.06	116%	4.4%
Other Veges	117.43	390.63	232%	6.9%

SOURCE: FAOSTAT; Total fruits almost 10% p.a. – 451%

3.4.2. Comparative Advantage

China has approximately 120 million hectares of arable land, amounting to less than one thousand square metres per person, amounting to less than 40% of the world average.[28] This land scarcity in combination with an extremely large population puts land intensive products, such as grains, at an extreme comparative disadvantage. Livestock products, when farmed intensively in confined spaces, rely heavily on grain feed as an intermediate product, also placing this at a disadvantage. With regards to agriculture, China's comparative advantage lies in labour intensive crops, namely fruits and to a lesser extent vegetables. Outside of agriculture, their advantage lies in unskilled labour manufactures and increasingly working towards gaining an advantage in higher skilled labour products such as technology and automotive – one requirement to continue China's economic growth path.

3.4.3. Future of Agri-food Production in China

Looking to the future, China will have some major decisions to make with regards to her agricultural product mix. Assuming that consumption patterns continue the trend towards high value livestock products, China will have to decide how to approach to the pressure arising from increasing grain demand. Continue its self-sufficiency goal in grain production for animal feed is one possibility, but this Japanese style

[28] China Daily (2011) "Ministry to Protect Arable Land" www.chinadaily.com.cn/business/2011-01/08/content_11812894.htm accessed on 18 March 2011.

policy may jeopardise future economic growth, especially once productivity gains are exhausted. Alternatively, China may, in recognition of its disadvantage, increase her dependence on imported cereals to feed a growing stock, however this may become too costly, limiting the value-added income of livestock products. Finally, China could rely on the global market to supply the increased demand in these animal products, despite the negative perception of her people, while concentrating more on agri-food that will make for more efficient use of their resources. The path that China decides to take has implications for not only themselves, but also the rest of the world, especially land abundant countries that will potentially supply China's livestock and/or grains such as New Zealand.

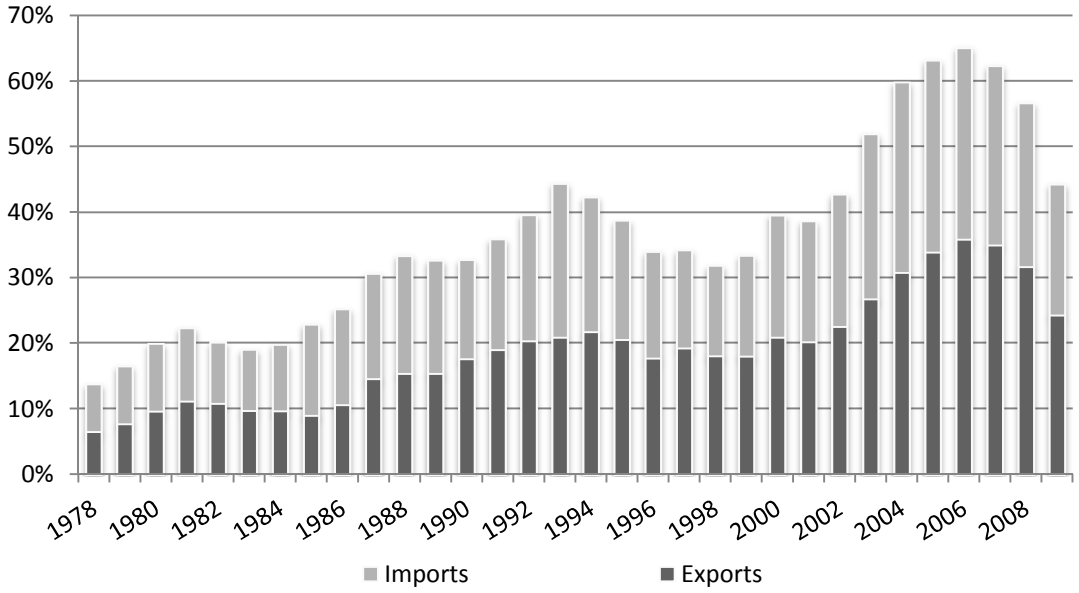
3.5. Trade

International trade was a major area of transformation when the economic reforms from 1978 were introduced. Trade reforms in the early stages included encouragement of trade through coastal ports with special economic zones, decentralization and increasing the role of private traders, adjustment of the undervalued exchange rate for export competitiveness, and a relaxation in the state set prices (Wu and Thompson, 2003). During this period trade flourished, representing thirty percent of GDP in 1988, double that of ten years earlier. Throughout the 1990's the main emphasis was on reducing tariffs and other trade barriers, partly in their effort to enter the WTO, to which they were admitted in December 2001. Bilateral and multilateral trade negotiations have been the focus in the new millennium, and, as shown in *Figure 3.6*, growth in both exports and imports have continued to grow rapidly, trade representing seventy percent of GDP by 2006, exceeding that of many Western countries including the US, UK, Australia, and NZ. Exceptionally high economic growth in combination with the global recession is the cause for the recent drop and is unlikely to be any indicative of any trend. Overall, Chinese trade in the three decades since 1978 has more than increased thirty fold, far exceeding economic growth over the same period.

Growth in both agricultural exports and imports has been comparatively modest, increasing at approximately one-sixth of the rate of total exports and imports. Consequently, the importance of agricultural trade in the Chinese economy appears to have diminished; *Figure 3.7* shows a consistent downward trend in the

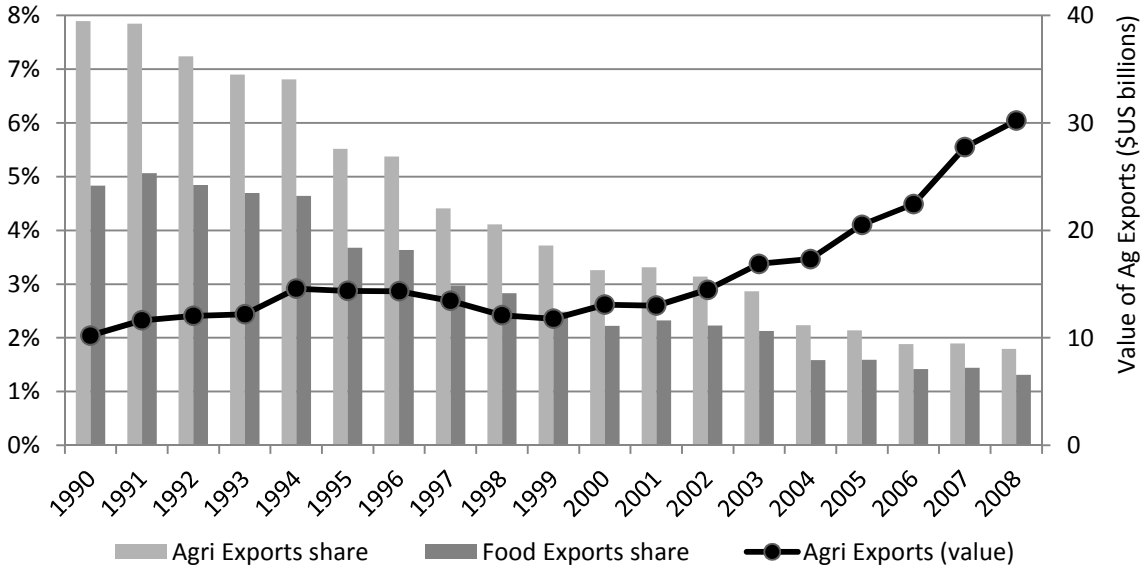
significance of agricultural exports since 1990, shrinking to a less than two percent share of total exports, while *Figure 3.8* shows that agriculture's share of imports has stabilised at approximately four percent since 1999, matching the rapid growth in overall trade.

FIGURE 3.7 – *Even Faster Trade Growth: China's Trade-GDP Ratio*



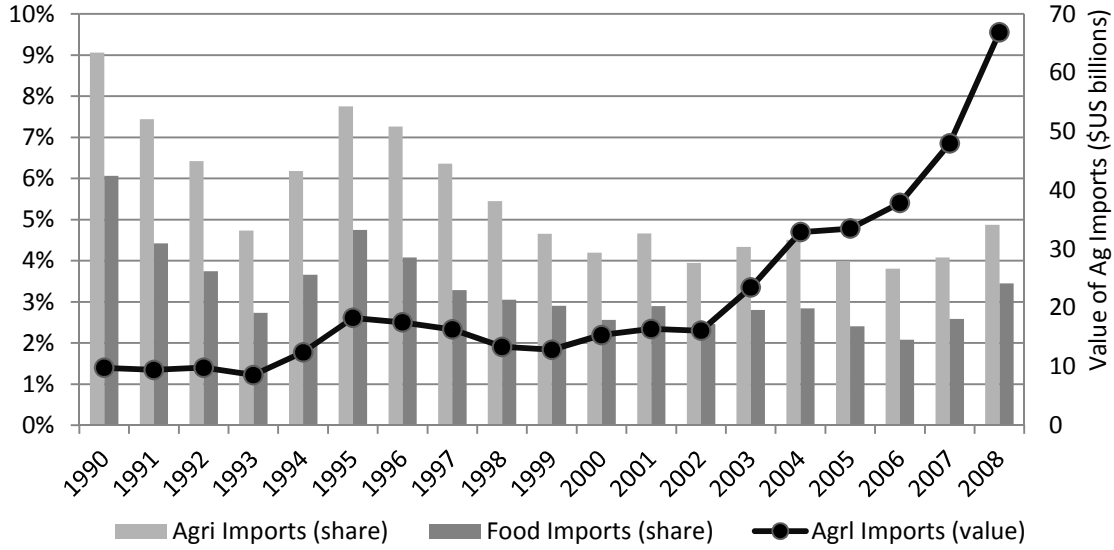
SOURCE: World Bank

FIGURE 3.8 – *Share of Agricultural Exports in China*



SOURCE: FAOSTAT

FIGURE 3.9 – *Share of Agricultural Imports in China*



SOURCE: FAOSTAT

3.5.1. Breakdown of Agricultural Trade

Traditional exports, consisting of silk and tea, although declining in importance, still featured prominently by the beginning of the reform period, making up for fourteen percent of agricultural exports in 1978. However, it was various fruits and vegetables (26%) along with rice (16%) that dominated China's agricultural exports at this time. On the other hand, wheat (31%) and cotton (21%) made up over half of all agricultural imports in 1978, followed by soy products (9%) and maize (8%). Since the implementation of the reforms, the structure of agricultural trade has changed significantly as demonstrated in *Table 3.7* showing the makeup of exports and imports in recent years. Stagnation in oilseed and meat exports accompanied by a rapid rise in their respective imports saw positive trade balances of the 1980's both reversed by 2008. Labour intensive horticultural exports have, as expected, grown the fastest and consequently doubling its share of agricultural exports. Accelerating grain imports received significant coverage during the 1990's and subsequent government efforts to encourage grain output, in the name of food security, has resulted in lower imports and now represents less than ten percent of agricultural imports. Soya bean products, the second largest agricultural export in 1978, is now China's most imported agricultural import, a reflection of the change in priorities for use of their limited land.

TABLE 3.7 – *Agricultural Exports and Imports of China by Group*

Agricultural Exports (USD millions)

	Grain + Feed		Oilseeds		Meat Products		Dairy Products		Fruit + Vege.		Other Food		Other Agri.	
	$US m	***% AX***	***$US m***	***% AX***	***$US m***	***% AX***	***$US m***	***% AX***	***$US m***	***% AX***	***$US m***	***% AX***	***$US m***	***% AX***
1985-88	1392	*16.6%*	605	*7.2%*	996	*11.9%*	12	*0.1%*	1714	*20.4%*	782	*9.3%*	2904	*34.5%*
1989-92	1812	*16.3%*	619	*5.6%*	1557	*14.0%*	17	*0.2%*	2403	*21.7%*	1248	*11.3%*	3432	*30.9%*
1993-96	1585	*11.4%*	526	*3.8%*	2487	*17.9%*	30	*0.2%*	3275	*23.6%*	1953	*14.1%*	4014	*28.9%*
1997-00	1958	*15.5%*	341	*2.7%*	1258	*10.0%*	52	*0.4%*	3388	*26.9%*	1862	*14.8%*	3743	*29.7%*
2001-04	2328	*15.1%*	525	*3.4%*	1475	*9.6%*	61	*0.4%*	5066	*32.9%*	2086	*13.5%*	3878	*25.2%*
2005-08	2924	*11.6%*	750	*3.0%*	2020	*8.0%*	210	*0.8%*	10232	*40.6%*	3681	*14.6%*	5415	*21.5%*

Agricultural Imports (USD millions)

	Grain + Feed		Oilseeds		Meat Products		Dairy Products		Fruit + Vege.		Other Food		Other Agri.	
	$US m	***% AM***	***$US m***	***% AM***	***$US m***	***% AM***	***$US m***	***% AM***	***$US m***	***% AM***	***$US m***	***% AM***	***$US m***	***% AM***
1985-88	2132	*30.8%*	500	*7.2%*	121	*1.8%*	231	*3.3%*	200	*2.9%*	860	*12.4%*	2875	*41.5%*
1989-92	3433	*34.3%*	591	*5.9%*	241	*2.4%*	323	*3.2%*	409	*4.1%*	1431	*14.3%*	3594	*35.9%*
1993-96	4017	*28.3%*	851	*6.0%*	329	*2.3%*	360	*2.5%*	630	*4.4%*	2612	*18.4%*	5394	*38.0%*
1997-00	2737	*18.9%*	2275	*15.7%*	662	*4.6%*	403	*2.8%*	945	*6.5%*	2213	*15.3%*	5237	*36.2%*
2001-04	2731	*12.3%*	5288	*23.8%*	975	*4.4%*	531	*2.4%*	1406	*6.3%*	3484	*15.7%*	7798	*35.1%*
2005-08	3612	*7.8%*	13621	*29.3%*	2057	*4.4%*	985	*2.1%*	2640	*5.7%*	7422	*15.9%*	16207	*34.8%*

SOURCE: FAOSTAT; $US m – values in US million dollars; % AX (AM) – percentage of total agricultural exports (imports)

Of most interest to New Zealand is the performance of meat and dairy imports. Both products in 2008 made up a relatively small share of agricultural imports but volume and value was increasing throughout the period since 1985. Meat has experienced a more rapid increase in imports, dominated by poultry ($US 1.1bn) and beef ($US 0.4bn). Dairy, despite rapid growth in consumption, has seen more subdued growth in imports, resulting in a declining share of agricultural (and total) imports. Trade between China and NZ will be covered in chapter five.

3.5.2. Trade Competitiveness Measures

In order to evaluate trade trends analysts have come up with various equations to measure relative performance of the products in question. Balassa's (1965) revealed comparative advantage (RCA) is a simplistic measure commonly used to determine the importance of a commodity or industry relative to other commodities and to the rest of the world, worked out as:

$$RCA_{ij} = (X_{ij} / X_{it}) / (X_{nj} / X_{nt}) \qquad (3.1)$$

where X is exports, i is the country sampled, j is the commodity in question, t is all other commodities, and n is all other countries.[29] *Table 3.8* examines the RCA of certainagricultural products in China relative to all merchandise products between 1985 and 2008. The importance of agricultural trade in China has declined substantially in this period from near neutrality (that is the ratio of agricultural exports to total exports compares similarly to the rest of the world) to significantly disadvantaged. Also, all groups examined within agriculture have low and generally declining RCA values, with only land-intensive horticultural products featuring to any degree. Alternatively, the RCA can be viewed in terms of other agricultural products only; that is t became the set of all agricultural products instead of merchandise products, and at 2.43, horticultural produce does have a significant advantage over other agricultural products.

[29] RCA value of zero denotes absolute disadvantage (no exports), a RCA of infinity denotes absolute advantage (only exporter), a RCA of one denotes neutrality (proportion of exports identical to other countries)

TABLE 3.8 – *China's Revealed Comparative Advantage of Selected Agricultural Groups*

	1985-88	1989-92	1993-96	1997-00	2001-04	2005-08
Produce	1.44	1.16	1.01	0.85	0.79	0.73
Meat	1.22	1.08	1.15	0.50	0.37	0.22
Oilseeds	1.82	1.49	0.84	0.40	0.37	0.22
Grains	0.70	0.57	0.41	0.51	0.38	0.18
Dairy	0.02	0.02	0.02	0.03	0.02	0.04
Agriculture	**0.98**	**0.83**	**0.68**	**0.51**	**0.41**	**0.30**

One disadvantage of the RCA measure is that it does not account for imports; the trade specialization index (TCI) does this by expressing net exports of a commodity or industry as a ratio to its total trade:

$$TCI_{ij} = (X_{ij} - M_{ij}) / (X_{ij} + M_{ij}) \qquad (3.2)$$

where X is exports, M is imports, i is the country, and j is the commodity.[30] Once again agriculture as a whole is performing negatively and declining, as shown in *Table 3.9*, largely due to the rapid rise in oilseed imports. Horticultural produce is the only group to realise a positive trade balance and at 0.59 represents a position of strength. Dairy and oilseeds with values of under -0.50 indicates the heavy reliance on imports. Interestingly, the trade position of meat products have declined dramatically since 1985. Between these two measures, the RCA and TCI, it becomes clear that China is progressing towards exporting more labour-intensive products while importing more land-intensive products, except for grains.

TABLE 3.9 – *China's Trade Competitiveness Index for Selected Agricultural Groups*

	1985-88	1989-92	1993-96	1997-00	2001-04	2005-08
Produce	0.79	0.71	0.68	0.56	0.57	0.59
Meat	0.78	0.73	0.77	0.31	0.20	-0.01
Grains	-0.21	-0.31	-0.43	-0.17	-0.08	-0.11
Dairy	-0.90	-0.90	-0.85	-0.77	-0.79	-0.65
Oilseeds	0.10	0.02	-0.24	-0.74	-0.82	-0.90
Agriculture	**0.10**	**0.05**	**-0.01**	**-0.07**	**-0.18**	**-0.30**

[30] TCI value of +1 indicates the country only exports the products, a RCA of -1 indicates the country only imports the product, and a TCI of 0 denotes a trade balance

3.5.3. Future Direction of Agricultural Trade

International trade in China is expected to continue flourishing as the global economy exits the current recession, however the makeup of agricultural trade depends on a number of factors. Consumption of agricultural products, especially meat and dairy, is expected to increase, and whilst domestic production has largely kept up with these growing demands through productivity catch-up growth questions do arise as to whether this can continue. China has proved dire predictions about food shortages in the past to be wrong and appears determined to remain highly self-sufficient in food. These various possibilities need to be considered in any model examining the effects China may have on other agricultural economies.

3.6. Summary

This chapter presented the past economic and trade performance of China as to gain an understanding of the anticipated direction her economy may take in the future. Following on from centuries of volatility in China, Deng Xiaoping initiated widespread economic reforms which over time transformed the country into a market-oriented economy. Rapid and unprecedented sustained economic growth, that often exceeded ten percent per year, has turned the Chinese economy into the powerhouse that it is today. As a result of the increasing incomes, consumption patterns have changed, including food. Chinese diets have become more diversified and consist of more animal products as incomes increase. Agricultural producers have, for the most part, met these changing and increasing demands despite limited land resources through growth in productivity. Consequently, agricultural trade has remained relatively low; despite this a trend towards exporting labour-intensive and importing land-intensive agricultural products has emerged. If productivity growth in the industry is exhausted in the near future, the continued consumer trend towards increased consumption of livestock products will require Chinese to rely more on imports, whether it is the animal products or the grain products required to feed them. The direction China goes down, assuming high levels of economic growth is sustained, may have large implications for land-abundant agricultural economies such as New Zealand.

Chapter Four
NEW ZEALAND AGRI-FOOD ECONOMY AND TRADE

For much of New Zealand's settlement history there has been a large reliance on British trade as a means of prosperity. The lead-up and eventual accession of Britain to the European Economic Community (EEC) saw the guaranteed trade of New Zealand's agricultural exports diminished. Consequently there was a requirement to diversify export commodities and destinations to the rest of the world. This saw a period where New Zealander's fell from being among the richest people in the OECD to one of the poorest, its moderate growth lagging that of other developed nations. Attempts to increase economic growth prior to 1984 revolved around promoting export industries through subsidies and protectionist policies; however this came at great cost to the government and with limited success. 1984 is the year that marked a significant change in direction for the New Zealand economy with the electing in of the Labour Party under David Lange, with Minster of Finance, Roger Douglas responsible for the implementation of wide-ranging economic reforms to reign in debt and eliminate market inefficiencies. The late 1980's represented tough times for the New Zealand economy in a period of rapid transition, however by the 1990's under a much more market-oriented economy it enjoyed strong growth, which was sustained on the most part till 2007.

The purpose of this chapter is to examine the New Zealand economy in a manner consistent to the previous chapter on China. With New Zealand being a land abundant country, there is potential that it can benefit from any growth in agricultural import demand from China. This chapter, again focussing on agricultural and food trends, is comprised of four sections. The first section provides an overview of New Zealand's economic history and performance, especially since 1984. The second section briefly describes New Zealand's consumption and production trends. The third section analyses New Zealand's changing trade patterns evidences over the last fifty years. Finally, the fourth section concludes.

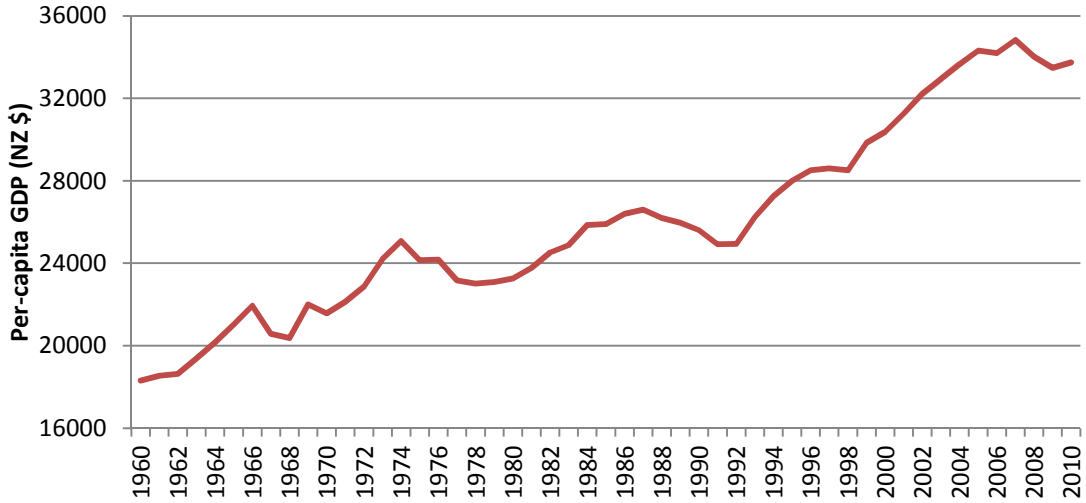
4.1. General Economic Performance

Agriculture has formed a dominant part of the New Zealand economy since the arrival of European settlers in the nineteenth century. Initially wool was the major agricultural export and was then supplemented with meat and dairy products with the invention of refrigerated shipping in 1881 (ABARE and MAF, 2006). New Zealand's major trading partner in these early days was Britain, this relationship being described by observers as "Britain's farm in the South Pacific", with its abundance of land and seasonal variation able to provide agricultural products to the comparatively heavy populated England (Smith, 2004). This guaranteed trade helped ensure that New Zealanders enjoyed good economic growth and wealth, a position which saw them became among the richest countries in the world in per-capita terms in the first half of the twentieth century. The simple economic model that New Zealand had successfully maintained became increasingly complicated in the second half of the century due to a sluggish British economy and limited growth in agricultural commodity prices.

In response to a deteriorating trade balance due to slow export growth and increased demand for imports finance minister, Arnold Nordmeyer, presented the "black budget" of 1958, this involved increasing taxes and tariffs. While successful in reversing the trade deficit it came at that cost of slow economic growth relative to the rest of the OECD (Abbott, 2007). Growth throughout the 1960's and early 1970's viewed in a historical context was very strong in New Zealand, often exceeding four percent per-annum, however feeding off a lethargic British economy and trading in slow growth agricultural economies prevented the country from booming like other developed nations in this period.

From 1974 until 1992 was the most eventful period in New Zealand's economic and political history which essentially resulted in eighteen years of stagnation, as illustrated in *Figure 4.1*. In 1973 the New Zealand was dealt a treble blow; first with Britain's formal admission to the EEC thus ending remaining preferential trade arrangements and instead implementing costly trade barriers, second was the preliminary oil crisis, and finally the global share market crash and ensuing recession

FIGURE 4.1 – *Gross Domestic Product of New Zealand*



SOURCE: World Bank and Statistics New Zealand (constant 2002 dollars)

triggering a significant decline in world prices for New Zealand's major agricultural commodities. The latter once again highlighting New Zealand's vulnerability of its export mix, Abbott (2007) reporting that the decline in terms in trade resulted in a turnaround in the current account balance from a $0.25 billion surplus to a $2.5 billion deficit (or 3.3% of GDP) in 1974. Rob Muldoon, elected as Prime Minister in 1975 and self-appointed finance minister, took issue with his predecessors' use of government debt to stimulate the economy by reducing government expenditure in his initial term. Re-elected in 1978 and 1981 policies were implemented to promote export and economic growth including the introduction of supplementary minimum prices (SMP) on key agricultural commodities, devaluation of the exchange rate, and implementation of various industrial projects. To assist the agriculture and manufacturing sectors further import tariffs and quotas were increasingly used; progressively New Zealand became one of the most distorted markets in the OECD. This combination of policy proved to be very costly to the government and inflationary, the latter of which was artificially controlled by across the board price and wage freezes. The moderate growth during this period continued to lag behind other OECD countries. Due to other political matters[31] Muldoon lost power in 1984 to the David Lange led Labour Party, bringing in Roger Douglas as finance minister to manage the inherited government debt. "Rogernomics", as it came to known,

[31] Such as the controversial Springbok tour of 1981, Nuclear stance, and an infamous drunken announcement

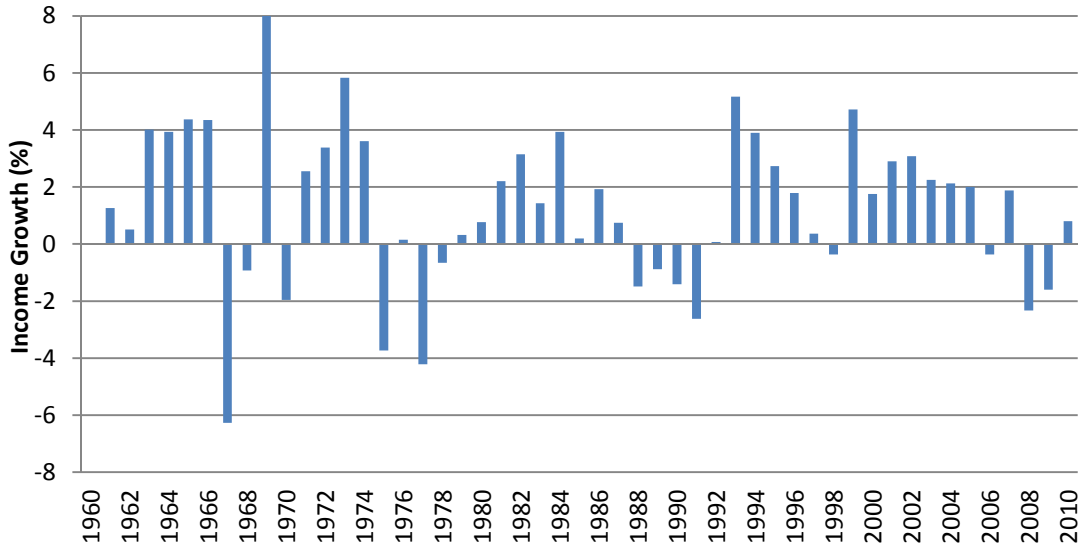
marked the most radical and comprehensive economic reforms New Zealand had seen.

Rogernomics undid many of the economic policies implemented by the Muldoon government and others before it, transitioning from Keynesian ideals such as protectionism to one that more aligns with neoclassical thought, namely a market-oriented approach. The elimination or reductions of export subsidies, SMP's, tax concessions, import quotas, and import tariffs, much of which assisted agricultural production, sought to make the economy more efficient. The agricultural sector was further set back by the floatation of the dollar in 1985 and the resulting unexpected appreciation, sluggish world commodities, and high inflation, in what was become a recurring theme. Consequently, many meat and wool farmers were placed under significant pressure without the assistance previously granted and many were forced to sell, resulting in land being reallocated to other industries such as dairy and horticultural crops. To control government debt expenditure was dropped, taxes were increased (GST implementation), and many SOEs were sold.[32] Douglas' successor, Ruth Richardson of National, continued with these reforms despite much public objection, and additionally targeted sensitive social areas such as welfare and health, resulting in her being labelled as "Roger's daughter" by The Economist (1991). Economic growth (*Figure 4.2*) for the eight years following Douglas' reform was negative, however many commentators agree that government debt fuelled growth prior to 1984 was unsustainable (New Zealand Treasury, 1984). But many argue whether the speed of transition was detrimental. While the transition was painful and arguably required, this was succeeded by sustained economic growth from 1993 until the global recession hit in 2007.[33]

[32] SOE sales generated $19.1 billion between 1988 and 1999 to the government with Telecom, Housing Corp, and Contact Energy making up for almost half of this (Smith, 2004).

[33] With the exception of the Asian crisis in the late 1990's that led to a brief contraction in the economy.

***FIGURE 4.2** – New Zealand's Real Per-Capita Economic Growth*



SOURCE: World Bank and Statistics New Zealand

Overall, real per-capita income failed to double in the fifty years up to 2010, increasing 84.2 percent, at an annualised rate of 1.2 percent. This performance was significantly weaker than the 176 percent growth in the OECD (2.1 percent per-annum) over the same period.[34] Subsequently New Zealand has fallen from fifth in the OECD income rankings in 1960 to twenty-fourth in 2009.[35] The New Zealand Treasury (2008) attributes almost half of the economic growth achieved in New Zealand to labour input growth; that is increased work hours throughout the population on average.[36] With little reason to expect a notable improvement in economic growth for New Zealand in the future, this paper will assume a rate of 1.6 percent.

4.2. Food Consumption trends

While consumption of animal products are expected to increase in developing nations such as China and India, in already developed countries this is expected to

[34] Sourced from World Bank, Statistics New Zealand, and OECD data. 2010 based on preliminary estimates.

[35] Sourced from OECD and World Bank; measured in PPP currency; includes all 34 current OECD members

[36] This increase in labour inputs can be separated into three parts – population growth, increased rate of labour participation, and increased work hours. Birks (2001) makes mention of the increase of females that have entered the labour force

stabilise regardless of increased incomes (MAF, 2009). As evidenced in *Table 4.1*, per-capita consumption in New Zealand of traditional meats, sheep and beef, have declined over the last three decades, substituted by poultry, pork, and aquatic products. Overall meat consumption has declined slightly during the period. Dairy also is consumed less which since the 1980's has halved, largely attributed to increased prices to domestic consumers through increased international demand and elimination of subsidies, and also changing tastes away from milk. New Zealander's are instead consuming larger quantities of fruit, vegetables, and rice, resulting from increased production and greater exposure to international produce. Expenditure on food, like other developed countries, makes up for small share of total expenditure, and through the last decade this was steady at between sixteen and eighteen percent (Statistics New Zealand, 2010)

TABLE 4.1 – *Consumption of Major Agricultural Products in New Zealand*

	1970's	1980's	1990's	2000's	Change
Dairy Products	250.86	255.75	168.65	106.00	- 58%
Poultry	8.04	12.87	21.39	33.76	+ 320%
Beef	57.38	47.28	33.85	24.74	- 57%
Sheep meat	37.20	30.33	30.37	23.91	- 36%
Pig meat	12.40	13.31	15.39	20.17	+ 63%
Aquatic	15.69	17.75	22.38	26.18	+ 67%
Oranges	6.27	11.60	15.67	20.20	+ 222%
Apples	21.96	28.67	26.39	26.37	+ 20%
Bananas	9.34	11.45	17.24	16.69	+ 79%
Tomatoes	16.39	17.78	23.32	25.60	+ 56%
Potatoes	57.71	55.55	68.80	65.29	+ 13%
Wheat	74.76	70.99	80.75	75.51	+ 1%
Rice	1.92	2.80	5.65	8.85	+ 361%

SOURCE: Derived from FAOSTAT (kilograms per capita per annum)

4.3. Agricultural Production

Agricultural production in New Zealand, due to its land abundant nature, has had a relatively influential but declining role in its economy. At the farm level agricultural production accounted for twenty-four percent of GDP in the 1950's reducing to four percent by 2006 (NZIER, 2009); however when including agricultural manufacturing its contribution still accounts for twelve percent of GDP. As shown in *Table 4.2*,

production of dairy product stands out with 14 million tonnes produced per annum last decade, double that of the 1970's, with growth faster than that of global production, in spite of the decline in domestic consumption (Lattimore and Amor, 1998). Traditional meats, sheep and beef, along with their by-products, wool and hides, were relatively flat throughout the period. Alternatively, other meats, especially poultry, have increased significantly. Production in many horticultural products has also increased significantly since the 1970's. Increased diversification in land usage and ideal climatic conditions has resulted in several regions specialising in certain horticultural products and accompanied with growth.[37]

Like the rest of the world, New Zealand has many industries competing for limited land resources. Future production trends are likely to be determined by world prices. ABARE and MAF (2006) expects increasing returns for sheep meat, dairy products, and wine; reasonable predictions considering the increasing demands for these products coming from the continuing emergence middle classes in developing countries, such as China and India. Given New Zealand's comparative advantage in these products, combined with better returns, it would be hoped that production can continue to grow in these product through land reallocation and productivity growth.

***TABLE 4.2** – Production of Major Agricultural Commodities in New Zealand*

	1970's	1980's	1990's	2000's
Milk – Dairy	6,171,339	7,312,056	9,485,941	14,360,581
Cattle meat	480,680	509,203	576,142	629,943
Cattle Hides	52,157	46,593	55,535	55,361
Sheep meat	526,270	633,765	530,042	548,591
Sheep Wool/ Skins	462,105	541,680	424,530	398,696
Poultry Meat	25,943	44,266	80,562	140,880
Pipfruit	172,303	299,090	527,191	510,258
Kiwifruit	6,327	106,641	238,200	299,315
Grapes	25,389	53,343	65,580	135,411
Potatoes	245,202	258,414	404,640	489,556
Vegetables	322,133	452,858	870,133	966,068
Cereals	782,668	924,060	843,728	899,061

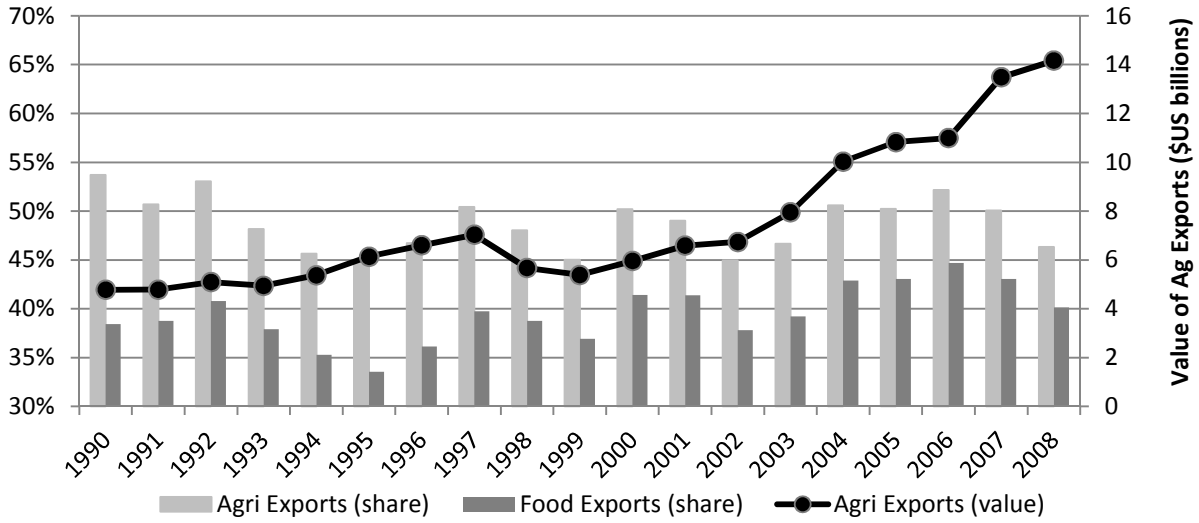
SOURCE: Derived from FAOSTAT (production tonnes)

[37] For example – Central Otago (stonefruit), Tasman (pipfruit and berries), Marlborough (wine grapes), Hawkes Bay (pipfruit and stonefruit), and Bay Of Plenty (Kiwifruit).

4.4. Agricultural Trade in New Zealand

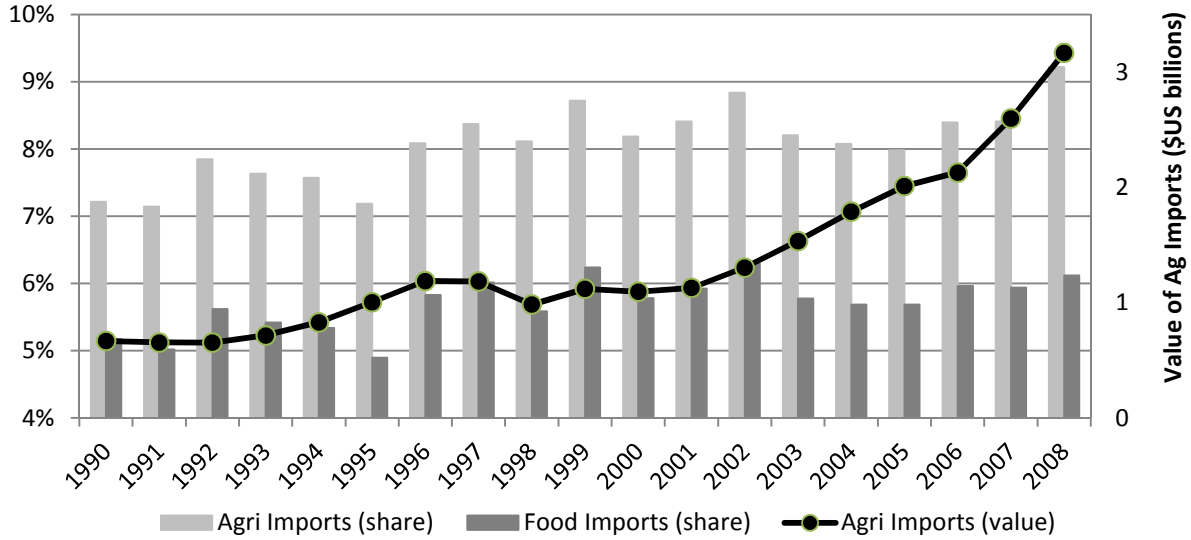
Trade in New Zealand amounts to approximately 65 percent of GDP, very high compared to the rest of the world, and is essential for a small economy without the scope to produce efficiently a wide range of goods (Chatterjee, 2001; Abbott, 2007). Specialisation in and exportation of a limited number of products is critical, while importing the rest. Its land-abundant nature makes agricultural products an important component, of which over 90 percent is exported and make up for approximately half of all merchandise exports since 1990, as shown in *Figure 4.3*, and has evidenced as far back as the 1950's (R. Johnson, 2001). Smith (2004) also notes that the contribution of primary products to exports is considerably higher than the OECD average of seven percent, reinforcing the importance of agriculture, forestry, and fisheries to the New Zealand economy. Importation of agricultural products (*Table 4.4*), naturally, is much lower, accounting for between seven and nine percent of merchandise imports since 1990. These two figures show that the New Zealand agricultural trade surplus stood at US$11 billion (9.1% of GDP).

FIGURE 4.3 – *Share of Agricultural Exports in New Zealand*



SOURCE: FAOSTAT

FIGURE 4.4 – *Share of Agricultural Imports in New Zealand*



SOURCE: FAOSTAT

Agricultural protectionism which formed a major part of trade policy in New Zealand was largely eliminated from 1984, as discussed in *Section 4.1*; however it still faces much protectionism from other countries. The New Zealand agricultural sector, already disadvantaged in its isolation and the associated transportation costs of trade, is subjected to high tariffs, export subsidies, and import controls from other OECD countries, especially Japan and the EU, which is very costly to the industry. In spite of some of the natural advantage in agriculture being eroded due to trade barriers New Zealand has remained competitive without resorting back to distortionary policies of the past. Promoting freer trade has been the goal of the New Zealand government recently to help its exporters reduce costs and gain increased access to protected markets. Multilateral negotiations through GATT prior to the Uruguay round proved counterproductive for the agricultural sector with member nations instead focussed on liberalising non-food manufactured goods and further protecting agriculture (Abbott, 2007). The Uruguay round did target agricultural trade, intensely negotiated over eight years due to disagreements from the US and EU over the scope of the reforms required. The main achievements of this round were the tariffication of import quotas and the setup of the WTO which provided an organisation to deal with trade disputes between nations. Consequently, this provided New Zealand with increased access to foreign markets, especially in other OECD countries, as well as an avenue to settle some long running trade

disagreements (Smith, 2004).[38] The Doha round, which commenced in 2001, was expected to further benefit New Zealand with more liberalisation in agriculture by reducing eliminating export subsidies and reducing tariffs, however talks stalling the focus for New Zealand has turned to bilateral and regional trade negotiations.

4.4.1. Breakdown of Agricultural Exports

Agricultural exports has made up for about half of all merchandise exports over the last three decades, *Table 4.3* show the exports of eight selected groups which total more than 80% of agricultural exports. Wool and sheepskins were the largest export in the 1980's however has declined in value terms throughout the last two decades and thus seen its share of merchandise exports drop from over 15 percent to just 2.1 percent. Traditional meats, mutton and beef, while increasing in value terms have also decreased their shares. Dairy exports, like production, have seen considerable growth over the last two decades to become New Zealand's major export and second only to tourism in its contribution to national GDP. Expansion in the apple and kiwifruit industries in the 1980's have since stagnated and now account for 1.1 and 2.2 percent of exports respectively, although kiwifruit exports have recovered in recent times. Wine exports in the 1980's was almost non-existent, however with the attraction of high value-added returns and ideal climatic conditions it has seen exponential growth in recent times. Cereal products, somewhat surprisingly, obtained a sudden burst in exports over the last five years largely attributed to cereal-based food preparations.

4.4.2. Trade Competitiveness Measures

Both the RCA (*Table 4.4*) and TCI (*Table 4.5*) measures emphasise the importance of agricultural products to the New Zealand economy. Interestingly, despite very high starting RCA values in wool, dairy, and meat, they continue to increase, indicating that these exports in these commodities are growing faster in New Zealand the same trend from a lower base. Cereal products, due to strong recent growth, have

[38] Disputes that NZ took to the WTO with success include exorbitant tariffs on lamb in the US, butter in the EU, beef in South Korea, and various agricultural products in Canada (Smith, 2004). Most recently the apple industry was granted access to Australia after taking the complaint to the WTO.

TABLE 4.3 – *Value of Selected New Zealand Agricultural Exports*

	Dairy Products		**Sheep meat**		**Beef**		**Wool & Skins**	
	$US m	**% MX**	**$US m**	**% MX**	**$US m**	**% MX**	**$US m**	**% MX**
1985-88	772	*12.0%*	556	*8.7%*	502	*7.8%*	1004	*15.6%*
1989-92	1223	*13.1%*	676	*7.3%*	751	*8.1%*	964	*10.3%*
1993-96	1683	*13.5%*	773	*6.2%*	743	*6.0%*	834	*6.7%*
1997-00	2104	*17.0%*	852	*6.9%*	669	*5.4%*	622	*5.0%*
2001-04	2779	*17.0%*	1186	*7.3%*	933	*5.7%*	521	*3.2%*
2005-08	4800	*19.2%*	1687	*6.7%*	1207	*4.8%*	519	*2.1%*
	Kiwifruit		**Wine**		**Pipfruit**		**Cereals**	
	$US m	**% MX**	**$US m**	**% MX**	**$US m**	**% MX**	**$US m**	**% MX**
1985-88	189	*2.9%*	4	*0.1%*	70	*1.1%*	45	*0.7%*
1989-92	297	*3.2%*	14	*0.1%*	162	*1.7%*	28	*0.3%*
1993-96	222	*1.8%*	29	*0.2%*	274	*2.2%*	55	*0.4%*
1997-00	218	*1.8%*	68	*0.6%*	248	*2.0%*	67	*0.5%*
2001-04	331	*2.0%*	157	*1.0%*	240	*1.5%*	91	*0.6%*
2005-08	555	*2.2%*	472	*1.9%*	270	*1.1%*	413	*1.7%*

SOURCE: FAOSTAT; $US m – values in US million dollars; % MX – percentage of total merchandise exports

(relative to other commodities) than the world average. Fruit and vegetables follow switched from being comparatively disadvantaged to advantaged. These RCA values are roughly in line with Abbott (2007, p. 20), in addition to this aquatic (5.23) and forestry (4.34) products also showed a comparative advantage. Overall, the proportion of agricultural export in New Zealand are 7.81 times that of the rest of the world and rising, indicative of the stronger growth in non-agricultural exports in other countries. The trade competitiveness index tells a similar story; agriculture has a high positive value symptomatic of a definite comparative advantage. Given that agriculture is subjected to the highest protectionist measures overseas these already large RCA and TCI would likely be larger.

TABLE 4.4 – *Revealed Comparative Advantage of Selected Agricultural Groups in New Zealand*

	1985-88	1989-92	1993-96	1997-00	2001-04	2005-08
Wool - Skins	62.03	52.47	49.79	65.80	54.84	62.68
Dairy	19.63	21.54	23.97	37.41	40.32	48.97
Meat	17.85	15.97	14.42	17.77	19.90	19.28
Produce	4.16	4.62	4.27	4.87	4.80	4.85
Cereals	0.48	0.22	0.37	0.56	0.64	1.96
Agriculture	**5.67**	**5.63**	**5.23**	**6.50**	**7.03**	**7.81**

TABLE 4.5 – *New Zealand's Trade Competitiveness Index for Selected Agricultural Groups*

	1985-88	1989-92	1993-96	1997-00	2001-04	2005-08
Wool - Skins	0.98	0.97	0.93	0.95	0.90	0.98
Dairy	0.99	0.99	0.99	0.98	0.98	0.97
Meat	0.99	0.98	0.96	0.95	0.94	0.92
Produce	0.59	0.64	0.60	0.57	0.57	0.50
Cereals	0.23	-0.48	-0.34	-0.36	-0.34	0.12
Agriculture	**0.79**	**0.77**	**0.72**	**0.69**	**0.69**	**0.67**

4.4.3. Future Direction of Agricultural Trade

There been three major problems with having a dominant agricultural sector; firstly is the heavy international protectionism faced by exporters, second the relatively slow growth in demand for food, and thirdly is the exposure to wild fluctuations in commodity prices. Looking forward, trade barriers are expected to come down either through multilateral negotiations or bilateral trade agreements, rapid growth in protein-based food demand from the emerging middle classes of China, provides two reasons to be optimistic about future potential of the agriculture sector in New Zealand.

Chapter Five
SINO-NZ BILATERAL TRADE

Economic connections between New Zealand and China date back to 1792 with the exportation of seal skins, for which there was flourishing demand in along with plentiful supply in New Zealand. However due to a decline in supply and demand seal skin trade only lasted twenty years and as a result for much of the nineteenth and early twentieth century trade between the two nations was limited with China representing less than half of one percent of New Zealand's trade. During this period the imports from China was predominantly tea while exports consisted of gold and fungus (Watt, 1992).[39]

The civil war in China saw the Communist Party take control of the country while the previous government, the Nationalist Party, had to flee to Taiwan. Consequently, the newly founded People's Republic of China (PRC) was not immediately officially recognised as a country by New Zealand, following the line of the United States among others. While recognition was often considered events such as the Korean War where China sided with the north and the Cultural Revolution stalled the desirability of this (Scott, 1990). Eventually, twenty-three years after its founding, in December 1972, the PRC was given diplomatic recognition by New Zealand under Norman Kirk's Labour Government. Although this decision was based more on geopolitical reasons rather than any trade; potential bilateral trade flows did flourish from this point on. Green (2003) reports that trade between New Zealand and China increased from NZ$11 million in 1972 to over NZ$3 billion in 2002, a thirty-fold increase in real value. By 2010 trade had exceeded NZ$11 billion continuing strong trade growth between the two nations.

The purpose of this chapter is to examine bilateral trade movements between China and New Zealand starting from when diplomatic relations between the two nations resumed in 1972. The first section covers trade data with a focus on the makeup of New Zealand agricultural exports to China. The second section discusses recent developments in trade relations, especially the free trade agreement signed by the

[39] Fungi are an ingredient in many traditional Chinese medicines.

respective governments of the two countries. The third section briefly discusses the potential future of trade between the two nations before leading into the next two chapters which models this.

5.1. Trade History between China and New Zealand

Prior to New Zealand's official recognition of the PRC there was limited opportunity for trade between the two nations and consequently China's share of New Zealand exports was approximately 0.1 percent in 1972, the year recognition was granted. Although trade expansion in China was very much a secondary goal of resuming diplomatic ties with China the attractiveness of having better access to such a large market was enticing for traders (McKinnon, 1999). Just one year later trade with China more than doubled with exports alone increasing from NZ$6.0 million to $16.0 million of which over ninety percent was wool, imports rose from NZ$6.9 million to $14.3 million of which approximately half was cotton textiles, this year also marked the beginning of a sixteen year run of bilateral trade surpluses with China.[40] Export growth to China continued its strong run through to 1988 mostly attributed to the wool trade.[41] Due to this rather one-dimensional structure of exports up to this point the analysis in this chapter begins from 1988 when new trends start to emerge.

5.1.1. New Zealand Trade Statistics with China since 1988

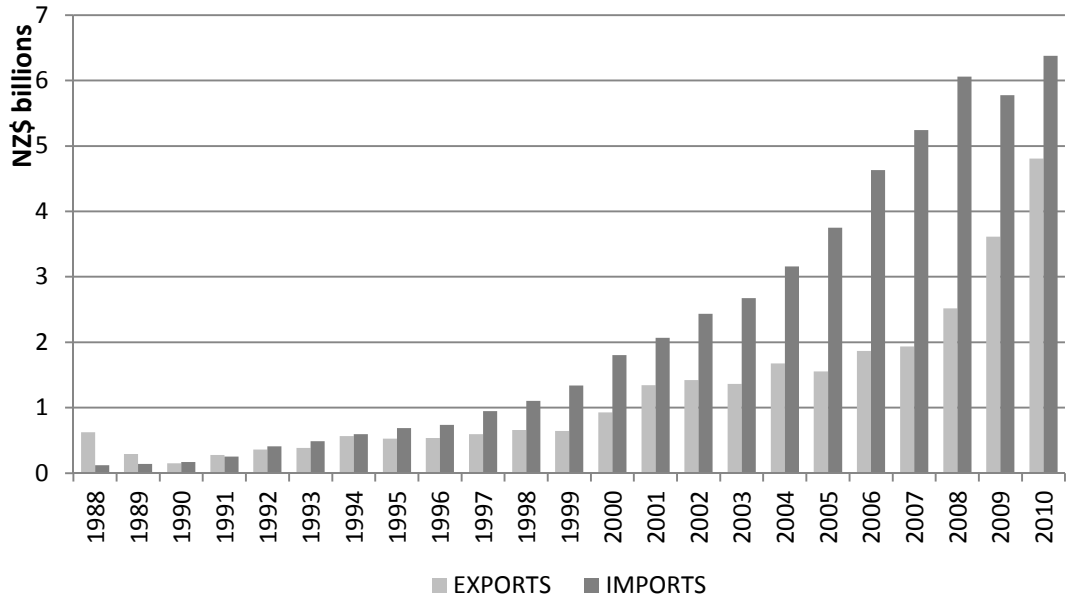
Despite growing trade with China since 1972 after officially recognising China as a country it nonetheless was still very low during this period and on the most part New Zealand exports comprised mainly of wool. By 1988 the value of exports to China was a relatively healthy NZ$626 million, while imports were at NZ$118 million. The strength of exports at this time was solely due to a short-lived wool boom which made up over 90 percent of its exports to China in 1988. In the following two years, like the wool boom of the 1950's, wool demand and prices plummeted in the major export destination, in this case China. Total exports therefore quickly fell by over 75

[40] Bilateral trade data prior to 1988 was obtained from *External Trade of New Zealand* (1972-80) and *Report and Analysis of External Trade* (1980-87) both published by the Department of Statistics.

[41] Wool exports in most years represented at least half of all exports destined for China between 1972 and 1989.

percent in these two years to NZ$151 million. Due to the success of the wool industry in China, New Zealand held bilateral trade surplus with China during the 1980's, but following the wool crash this trade balance was reversed into China's favour from 1992 which has been maintained in the eighteen years since with the trade deficit peaking at NZ$3.5 billion in 2008, the year in which a free trade agreement between the two nations was signed off. Since 1990 exports have increased yearly, especially notable over the last three years, contributed largely by dairy and forestry products. Imports too have increased throughout this period except for a slight decline in 2009 due to the effects of the global recession on New Zealand's ability to spend. Imports from China are made up from a diverse range of commodities with textile products being the largest making up for at least twenty percent of New Zealand imports from China since 1988.

FIGURE 5.1 – *Value of New Zealand's Trade with China since 1988*



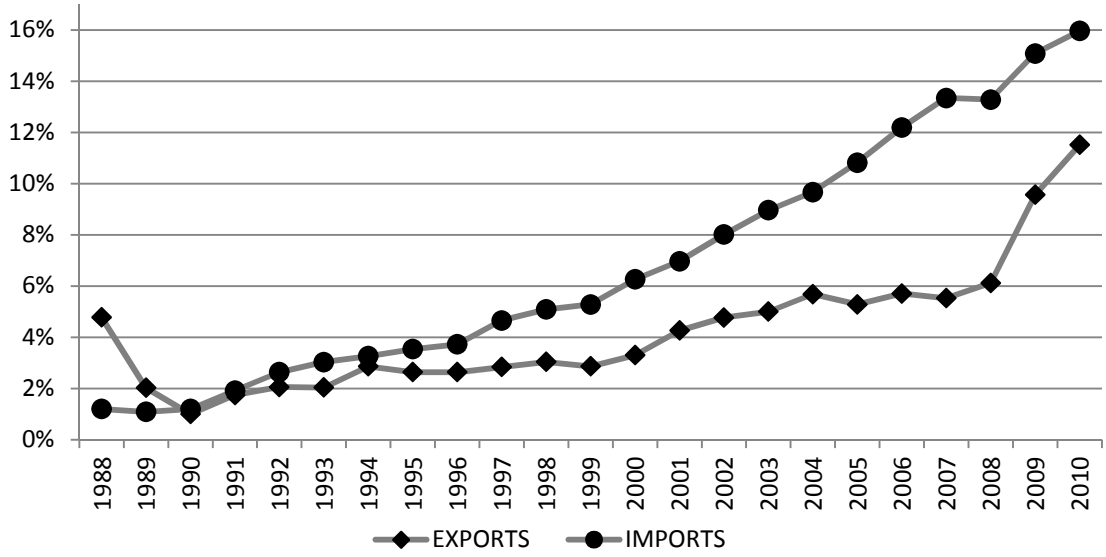
SOURCE: Statistics New Zealand – R = Ranking

5.1.2. Agricultural Trade between New Zealand and China

Unsurprisingly, given New Zealand's overwhelming comparative advantage, agricultural and other primary products (including forestry, fisheries, and food) makes up the majority of exports to China. Prior to 1995 agricultural exports from New Zealand to China hovered at around ninety percent of total exports going there.

This dropped steadily to seventy percent by 2000 largely due to a rise in methanol and aluminium exports; however with the subsequent decline in these sectors and the

FIGURE 5.2 – *China's Share of New Zealand's Exports and Imports since 1988*



SOURCE: Statistics New Zealand

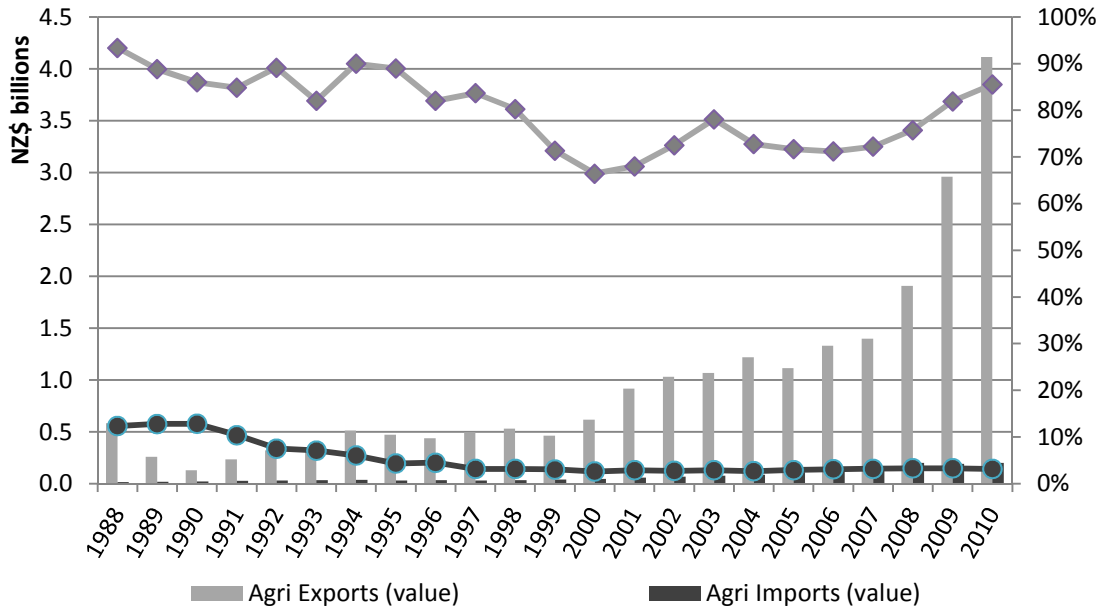
TABLE 5.1 – *The Rise of China as a Trading Partner to New Zealand*

	1990			**2000**			**2010**		
	Exports	Imports	R	Exports	Imports	R	Exports	Imports	R
Australia	2,795	3,229	1	5,561	6,804	1	9,190	7,697	1
China	**151**	**190**	**16**	**928**	**1,924**	**4**	**4,809**	**6,762**	**2**
USA	1,975	2,823	3	4,136	5,293	2	3,633	4,393	3
Japan	2,540	2,468	2	3,935	3,445	3	3,322	3,107	4
Korea	672	256	6	1,311	677	6	1,407	1,387	5
UK	1,089	1,160	4	1,384	1,173	5	1,502	955	6
Germany	372	739	5	677	1,306	7	641	1,739	7
Singapore	182	226	15	438	512	10	739	1,622	8
Malaysia	274	143	14	591	798	8	762	1,524	9
Thailand	136	87	24	334	449	16	666	1,372	10
Indonesia	159	139	20	451	295	17	925	647	11
Taiwan	264	398	8	697	678	9	839	732	12
World	**15,097**	**15,896**		**28,103**	**30,736**		**41,773**	**42,360**	

SOURCE: Statistics New Zealand (NZ$ millions)

increase in dairy and forestry exports the agricultural sector share of exports to China again is approaching 1995 levels in 2010, making up NZ$4.1 billion of the NZ$4.8 billion in merchandise trade. The heavy reliance on primary products has had some researchers questioning New Zealand's capability to exploit the full potential out of Chinese growth. Watt (1992) argues that while New Zealand is well endowed for producing primary products and compliments China's lack of such endowments, the reality is that these agricultural products are generally low growth sectors which may have periodic but unsustainable bursts. NZIER (2000) also attributes the composition of New Zealand's exports being in low-growth sectors due to demand in agricultural products responding least to economic growth.

FIGURE 5.3 – *Share of Agricultural Trade between New Zealand and China*

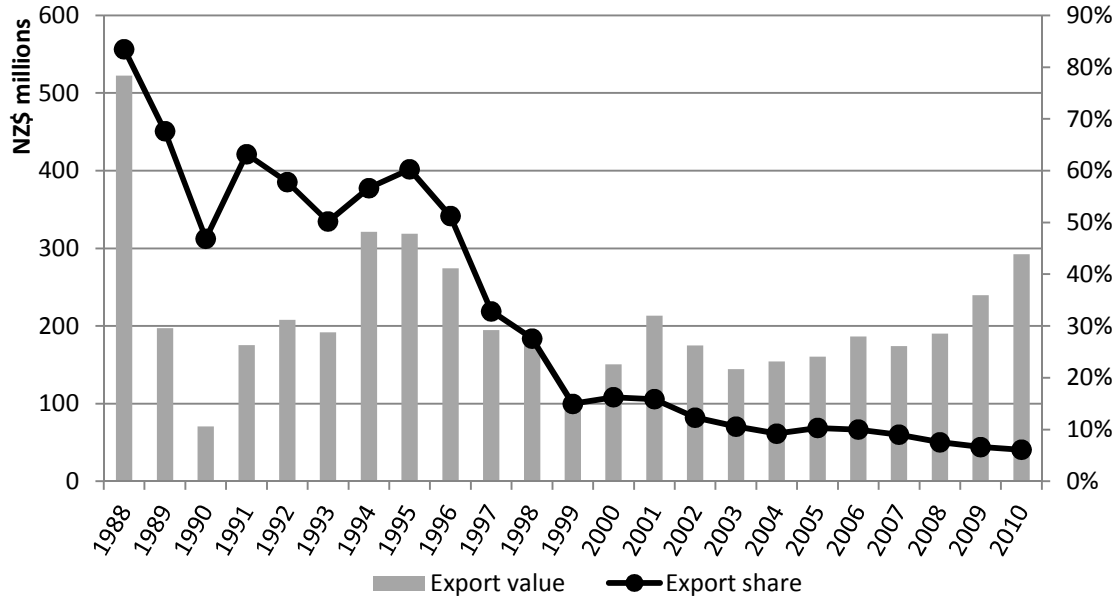


SOURCE: Statistics New Zealand

Having discussed earlier the importance of wool exports to the New Zealand economy in the past it is appropriate to illustrate the significance of the decline, as shown in *Figure 5.4*. In 1988 wool exports from New Zealand to China accounted for NZ$522 million of the NZ$625 million in total exports to China, representing an 83 percent share. Just two years later this value dropped by 86 percent to NZ$71 million, however due to the lack of alternative exports commodities wool still accounted for almost half of the NZ$151 million in exports to China in 1990. While

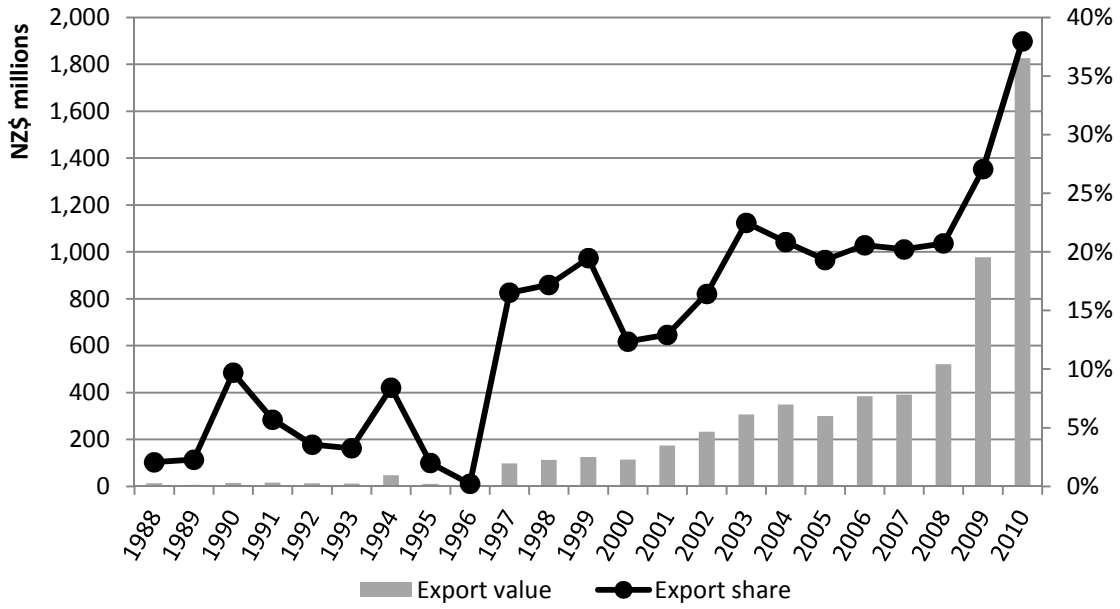
there was a recovery from 1991 wools exports never returned to the levels achieved in 1988, and over the last decade has stabilised at around NZ$200 million. Consequently its share of total exports to China has diminished to five percent as other exports have boomed.

FIGURE 5.4 – *The Decline of New Zealand's Wool Exports to China*



SOURCE: Statistics New Zealand

FIGURE 5.5 – *The Rise of New Zealand's Dairy Exports to China*



SOURCE: Statistics New Zealand

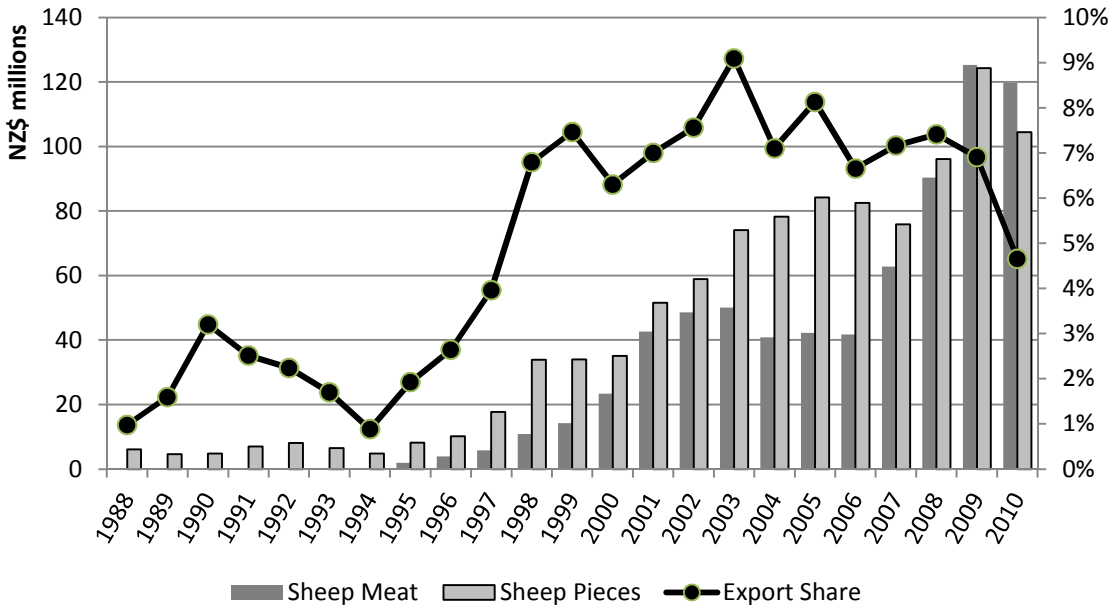
As discussed in chapter three, dairy consumption in China until recently has been very limited, but with increased incomes and increased exposure to dairy products there has been a rapid rise in consumption since the mid 1990's, some of which is met through importation. For New Zealand, the world's largest dairy exporter, this has led to a gradual increasing trend in dairy exports since 1996 when exports to China amounted to little more than a million dollars. The expansion is especially noticeable over the last two years to 2010, more than trebling to NZ$1.83 billion and making up for 38 percent of merchandise exports to China. Milk powder makes up the majority of dairy exports to China representing NZ$1.58 billion or 86 percent of dairy.

Sheep meat, like wool, is a traditional New Zealand export and its exports to China are shown in *Table 5*.6. Like most export commodities, except for wool, sheep meat had a very limited amount destined to China in early years and contributed less than NZ$10 million, or less than one percent of total exports, to China up until 1994, comprising almost entirely of sheep pieces.[42] For the remainder of the 1990's sheep meat ($14.2 million) and sheep pieces ($34.0 million) exports surged to make up 7.5 percent of exports to China by 1999. Since then its share has stabilised with growth in exports to China keeping up with the rest of exports, with the noticeable exception of 2010 where they dropped to under five percent for the first time since 1997.

The final noteworthy export is forestry which like dairy this sector has increased its exports to China gradually since 1996 at which time was valued at NZ$11.9 million. The past two years to 2010 has seen a significant increase in exports to China almost trebling to approach NZ$1 billion contributing 20.6 percent of merchandise exports; this now makes forestry the second largest export commodity destined for China. Consequently, dairy and forestry together made up for almost sixty percent of all merchandise exports to China in 2010.

[42] Sheep pieces refer to the Statistics New Zealand category of guts, bladders, and stomachs (HS Code 0504) which is categorised separately from traditional sheet meat products.

FIGURE 5.6 – *The Importance of Sheep Meat Exports to China for New Zealand*



SOURCE: Statistics New Zealand

New Zealand's agricultural imports of Chinese origin, which is also shown in *Table 5.3*, plays only a small role in trade between the two countries. At the start of the period examined these imports made up approximately twelve percent of total imports from China ($14.7 million) with tea being the largest contributor ($4.0 million). However as trade between New Zealand and China has expanded rapidly since then, agricultural imports have remained relatively stagnant and subsequently its share to total imports from China has fallen to just three percent which is dispersed across a range of sectors. As expected, light manufactures, especially clothing, makes up a large proportion of imports from China.

5.2. New Zealand and China Free Trade Agreement

Official talks of a free trade agreement (FTA) between New Zealand and China began in October 2003 by their respective head of states, Helen Clark and Hu Jintao. As part of the process the two governments composed and published a joint feasibility study of the potential effects of a FTA in 2004. This study by MFAT and the China Ministry of Commerce (2004) analyses the trade situation at the time, the potential impacts of trade liberalisation on various sectors, and models the economic impact within a general equilibrium framework. They note the complementary

nature of goods trade between the two nations, Zhang and Nie (2008) further elaborate on this noting the importance of New Zealand's agricultural sector to the Chinese economy and likewise the Chinese light manufacturing sector to the New Zealand economy. Each country has a distinct set of comparative advantages; for New Zealand these are land and knowledge based while for China these are based on labour intensive sectors. Given the targeted trade protectionist measures that were in place in both countries these advantages could not be fully realised. China imposed relatively high tariffs on agricultural products compared to other products and New Zealand, recognised as among the least protected economies, still had tariffs in place for the textiles and clothing industry.

As part of their analyses the joint feasibility study modelled the potential effects of complete elimination of tariffs between the two countries. Using the G-Cubed general equilibrium model they found welfare in New Zealand could be lifted by 0.55% (translating to US$2.3 billion over twenty years) while for China this is lifted by 0.07% (or US$24.7 billion over twenty years) (MFAT: 2004).[43] Furthermore it was anticipated that New Zealand exports to China would rise by 20-39 percent per annum while imports from China would increase by 5-11 percent per annum.

Following the release of the joint study fifteen rounds of negotiations between the Chinese and New Zealand governments were held. In New Zealand a potential FTA with China was met with both objections and support. Critics of the FTA fell into two camps; the first objected to it on political grounds, citing the Chinese record on human rights, the undemocratic political system, and the Chinese mistreatment of Tibet and Taiwan.[44] The second group rejected the proposal on economic grounds citing the expected negative effects on the clothing and textile industries in particular. On the other hand proponents suggested that opening up to China will provide much greater access to a significant market to do business.[45] Subsequently the free trade agreement was signed on April 7, 2008 and supported by both major

[43] See McKibbin and Wilcoxen (1999) for an overview of the G-Cubed CGE model.

[44] Sunday Star Times (2008) "Politicians jittery as China trade deal nears" www.stuff.co.nz/sunday-star-times/news/337901 - accessed on 25 October 2010

[45] For example - The Press (2008) "Meat and wool men smile" www.stuff.co.nz/the-press/business/352332 - accessed on 25-October 2010

political parties in New Zealand and in the process became the first western nation to complete an FTA with China.

The FTA implemented was comprehensive with New Zealand eliminating all tariffs on Chinese imports by 2014. China eliminates the majority of tariffs on New Zealand imports by 2019 with three notable exceptions. Firstly, wool is subjected to tariff rate quotas (TRQ) whereby a limited amount may enter China tariff free and beyond that MFN tariff rates applies which currently stands at 38 percent. Secondly, is the "safeguard" measure imposed on many dairy products which is a quantity which if exceeded allows the Chinese officials to implement the MFN tariff rate. Thirdly, no tariff concessions were made to many processed wood and paper imports due to an agreement with WTO upon accession that any FTA tariff reduction negotiated in these products must be passed on to all WTO nations.

Two years have now passed since the signing of the FTA and these early stages suggest that export growth to China has met the very high end of the expectations from official reports, almost doubling from NZ$2.5 million to $4.8 million (39 percent per year), imports however have been relative flat at 2.5 percent growth per year, easily attributed to reduced demand from New Zealanders caused by the global recession. The government optimism for the future of trade with China in expressed by current New Zealand Prime Minister's, John Key, desire to double trade between the two nations in the five years to 2015.[46]

5.3. Summary

New Zealand's trade with China since 1972 has expanded faster than that of any other nation following official recognition of them and is accompanied by strong economic growth in China. Consequently China is now New Zealand's second largest trading partner behind Australia. In line with the comparative advantages of the two nations New Zealand's exports to China consist mainly of land-intensive products, especially dairy and forestry in recent times, while imports from China are made up largely of labour-intensive manufactures especially clothing. Trade

[46] Stuff (2010) Key pledges to double China trade www.stuff.co.nz/business/3893719/Key-pledges-to-double-China-trade - accessed on 20 March 2011

relations between the two nations received a further boost with the signing of a free trade agreement in 2008, the first for China with a developed nation. Since then exports from New Zealand to China have almost doubled, although imports have been relatively static.

Given that Chinese growth is expected to remain strong in the medium future and the FTA between the two nations gradually comes into full effect by 2019, there is strong potential for continued growth in trade. The purpose of the last three chapters have been to give a background of the Chinese and New Zealand economies as well as the trade relations between them. This leads into the next two chapters which models the impact of Chinese economic growth and the NZ-China FTA on the New Zealand economy.

Chapter Six
COMPUTABLE GENERAL EQUILIBRIUM MODELS

This research takes a computable general equilibrium (CGE) approach to analyse the effects of Chinese economic growth on the rest of the world with a focus on New Zealand. Furthermore, the signing of a free trade agreement between China and New Zealand will be examined on top of that due to its importance to New Zealand. The CGE model used in this research is the Global Trade Analysis Project (GTAP) model and enables one to estimate economic changes including in economic welfare, trade balance and patterns, output quantity, and world and domestic prices.

Introduced by Leon Walras in 1874 general equilibrium models have advanced over time in as to increase their accuracy in the portrayal of the real economy. General equilibrium theory recognises that the economy consists of many economic agents interacting with each other and consequently decisions targeting one market have flow on effects on other markets. In contrast partial equilibrium models and its underlying ceteris paribus assumption presumes that all other factors outside the target market remain constant, thus potentially neglecting important outside impacts. With the development and increasing power of computers CGE models are able to deal with ever increasing data sets representing the real world with improved precision. For this reason the use of CGE models gained popularity among economists and policy analysts to evaluate changes and shocks within the economy.

This chapter opens up with an overview of general equilibrium theory and is accompanied by a technical appendix giving an example of the mathematical derivation of equilibrium in a simple economy. The second section then introduces CGE models and their purpose including an overview of the GTAP model and associated economic modelling software GEMPACK (General Equilibrium Modelling PACKage) program. The third section discusses the GTAP data and the aggregations used in this research. The fourth section then covers the methodology used to determine how Chinese economic growth affects other economies. Finally the fifth section concludes.

6.1. General Equilibrium Theory

Adam Smith's notion of an invisible hand guiding the economy is perhaps the first implicit mention of the plausibility of equilibrium, a situation whereby the economy is balanced, that is prices and quantities are at market clearing rates or supply equals demand in all markets (Starr, 1997). Leon Walras, more than a century later, formalised the notion of a general equilibrium. Walras postulated that the economy could be represented by a series of behavioural simultaneous equations which thereby could be solved; this was illustrated by using a simple hypothetical economy and could theoretically be extended to the real world, however with the billions of equations required an accurate representation it was recognised that this was unfathomable (Kohler, 1990). The efforts of Walras received little attention for some time due in part to the mathematical complexity of the model (Medema and Samuels, 2003). Kenneth Arrow and Gerard Debreu were two major contributors to revive general equilibrium analysis from the 1950's proving that equilibrium can exist in the real world under certain conditions; these include perfect competition, perfect information, and optimising behaviour of economic agents (Mansfield and Yohe, 2000).[47] General equilibrium incorporates the many interactions within markets and its development has provided a useful tool that enables analysts to evaluate the flow-on effects of changes or shocks to the rest on the economy.

6.1.1. Simple General Equilibrium Model

Several different mathematical[48] or diagrammatic approaches can be used to illustrate how a general equilibrium can be derived. For simplicity these models are explained using a two-person two-commodity closed economy with perfect competition which can then be extended to incorporate features of a larger economy. Standard textbook models incorporate the Edgeworth box for consumption with the production possibilities frontier (PPF) to demonstrate the plausibility of equilibrium

[47] Arrow and Debreu both received Nobel awards for their contribution to economics, specifically within the general equilibrium field. Other important contributors in this period include Lionel McKenzie, Frank Hahn, and Paul Samuelson. See Arrow and Debreu (1954), Debreu (1959), McKenzie (1959) or Arrow and Hahn (1971) for more information regarding this early work in general equilibrium modelling.

[48] Varian (1992) provides a detailed step-by-step mathematical derivation of a general equilibrium (Ch. 17-22).

within this simple economy.[49] An important aspect of equilibrium is the assumption that economic agents fulfil optimising behaviour, namely that consumers maximise utility or satisfaction given budget constraints and producers maximise profits given input constraints. In this simple economy there are two people, Person A and Person B, and two goods, Good 1 and Good 2. To illustrate the demand side of the equilibrium equation textbook models use an Edgeworth box, initially assuming endowments are fixed, to show how consumers may exchange goods to increase utility levels for each consumer. Consumers are expected to exchange goods until neither can increase utility any further, occurring at a point where their indifference curves are at a tangent, and therefore have the same slope. While there is an infinite number of locations where this can occur, there is only one combination that falls within the budget of both consumers and thus this is the equilibrium in an exchange only economy. The supply side of this simple model is shown with the use of a PPF displaying the maximum combinations that can be produced of the two goods given current inputs and technology by these two people. The choice of production is then determined by the combination of goods that maximises satisfaction within the economy and for this to hold the marginal rate of transformation (MRT) must equal the marginal rate of substitution (MRS), keeping in mind the MRS for both consumers must be the same in equilibrium (Mansfield and Yohe, 2000).[50] *Figure 6.1* puts these features together to show this simple two-person two-commodity economy in equilibrium.

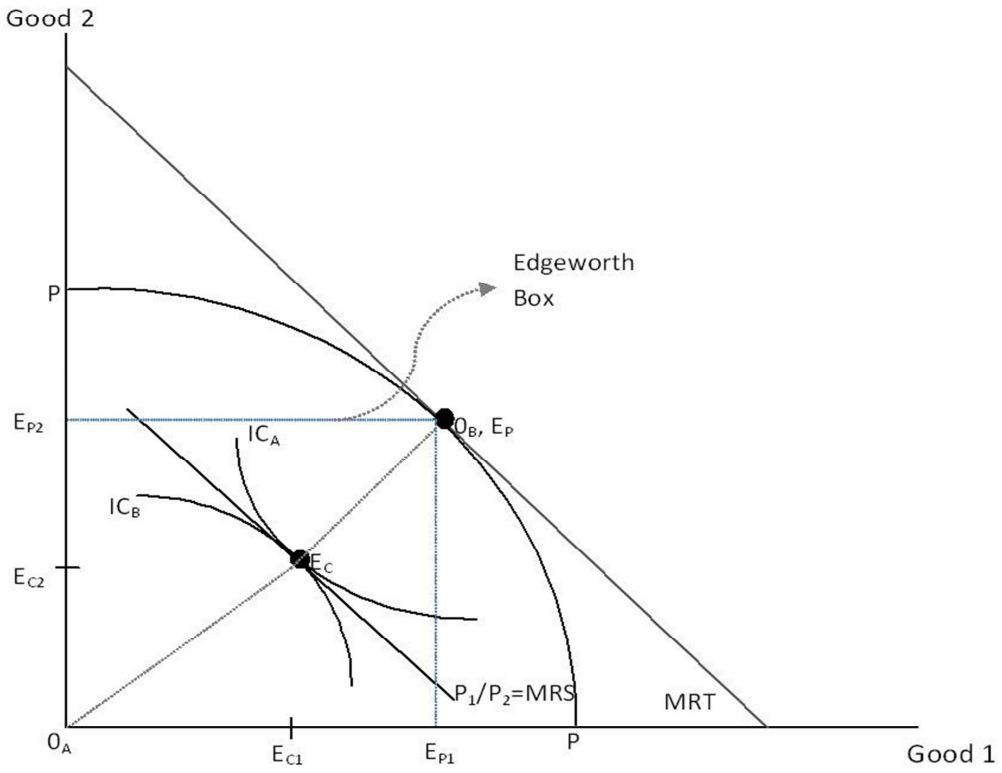
PP is the PPF representing all the possible output combinations of the two goods. The Edgeworth box is represented by $E_{P2}0_B E_{P1}0_A$. IC_A and IC_B are the indifference curves for the two people. MRS is the relative price of the two goods. MRT is the slope of the PPF which must be the same slope as the MRS. E_P is the equilibrium level of production. E_C is the equilibrium level of consumption for the two

[49] Hope (1999), Mansfield & Yohe (2000), Varian (2003), and Nicholson & Snyder (2008) provide this diagrammatic approach to general equilibrium, each to varying degrees of complication. Mukherji (1990), Shoven & Whalley (1992), Varian (1992, 2003) and Starr (1995) provide mathematical approaches.

[50] MRS is the slope of the consumers indifference curves and indicates the rate the consumer is willing to substitute one good for the other, aka marginal utility. MRT is the slope of the PPF and indicates the rate at which output of one good can be converted to the other, aka marginal opportunity cost. The proof for this requirement of equality between MRS and MRT is beyond the scope of this paper, suffice to say that utility cannot be maximised if the slopes are different, see Mansfield & Yohe (2000: pp 551-2) for more.

individuals. Therefore in equilibrium this simple economy would produce E_{P1} units of Good 1 and E_{P2} units of Good 2. Of that production Person A would consume E_{C1} of Good 1 and E_{C2} of Good 2 (or $0_A E_C$) while Person B would consume the rest ($0_B E_C$). Furthermore, by using isoquants in the Edgeworth box instead of indifference curves the distribution of inputs (labour and capital) can be established by locating the point at which the isoquants of the two products are tangent to each other and consistent with the PPF.[51]

FIGURE 6.1 – *Equilibrium in Two Person Two Commodity Economy*



6.1.2. Shocks to the Simple Model

Shocks in this simple economy may come from some change in production affecting the PPF (for example technological advances shifting the PPF outwards) or in consumption affecting the indifference curves (tastes) or budget line (income) Referring again to *Figure 6.1* it can be seen that any shock causing a shift in one of

[51] Ibid (p. 550)

the curves will require movements to the rest of the diagram in order to return to equilibrium. Movements resulting from the shift in equilibrium can then be analysed across all facets of this economy.

6.2. Computable General Equilibrium Models

The potential for general equilibrium analysis prior to the 1970's was largely restricted to theoretical models given the significant data requirements and limited time and technological availability to model real economies. The first recognised attempts at designing a multi-sectoral general equilibrium model were developed by Johansen (1960) of the Norwegian economy and Harberger (1962) on tax effects in the United States. Further significant progress in the field was contributed by Herbert Scarf in two publications (1967 and 1973) who designed an algorithm to solve the simultaneous equations required to generate a unique general equilibrium solution, this pioneering development marked the beginning of an explosion in applied general equilibrium (AGE) modelling (Shoven and Whalley, 1984).[52] Much like the earlier general equilibrium theoretical studies the first AGE models predominantly focussed on the effects of taxes and trade liberalisation on the economy, both widely discussed topics of the time. Shoven and Whalley (1972 and 1973), both students of Scarf, applied these solution techniques in their first papers analysing taxation in the United States.

During the 1980's AGE models started to give way to more reliable computable general equilibrium (CGE) models. The difference between the two models is summarised neatly by Mitra-Khan (2008) explaining that an AGE model "first establishes the existence of equilibrium through the standard Arrow-Debreu exposition, and then apply [sic] Scarf's algorithm to solve for a price vector that would clear all markets instantly", while CGE models "are solvable as simultaneous equations, where exogenous variables are changed outside the model, to give the endogenous results", the most important implication being that the economy is assumed to be in a state of equilibrium at all times under a CGE model, implicitly

[52] Shoven and Whalley (1992) provides a useful overview of the algorithm designed by Scarf.

assuming that all economic agents follow the optimising behaviour required for equilibrium to exist.[53]

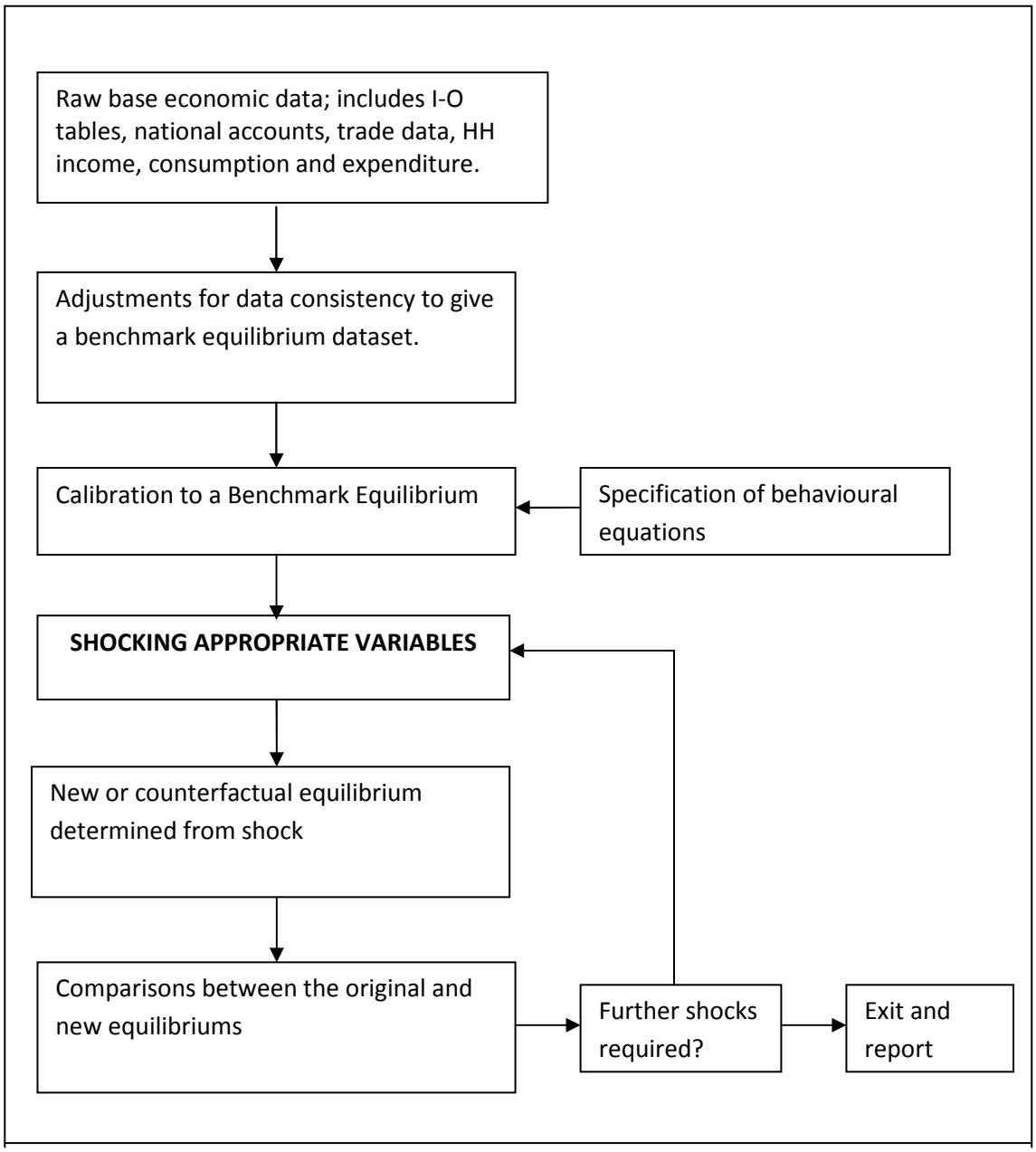
Figure 6.2 shows a flowchart derived from Shoven and Whalley (1984) designed to illustrate the process of designing and evaluating an AGE model, however can also be applicable to CGE model. The first step is to acquire all the relevant economic data; this includes household incomes and expenditures, government revenues and expenditures, producer input-output (I-O) tables, detailed international trade flows, savings and investment data, and key macroeconomic data. The detail of the microeconomic data is necessarily aggregated in order to handle the substantial amount, although with the increasing power of computers models are able deal with the increasing demand for more disaggregated models. Secondly, in recognition of the vast amounts of data it is necessary to make adjustments for any inconsistencies. Thirdly, the data is calibrated to form a baseline general equilibrium and the closure defined. The final component in setting up the equilibrium model is to specify the behavioural equations, namely all the various elasticity values which are the core components of determining the interrelationships across the various sectors of the economy. Having set up a general equilibrium system it becomes possible to shock exogenous variables which is explained by the bottom half of the chart. Having implemented a shock a new counterfactual equilibrium is found as determined by the interrelationship between the behavioural specifications and the economic data. Finally comparing the counterfactual equilibrium to the base equilibrium the relevant changes can be analysed.

As mentioned earlier, the economy is assumed to be in a state of general equilibrium in a CGE model and that economic agents are all displaying optimising behaviour. Because of this, consumers are assumed to be maximising utility given their budget constraints and producers are maximising profits given the relevant production functions. Trade flows incorporate the Armington assumption whereby commodities are assumed to be heterogeneous across regions; this allows trade to occur despite the concept of comparative advantage in that products may be differentiated by region, therefore the models requires bilateral trade elasticities between every region for

[53] Despite the differences between the two models AGE and CGE are often used interchangeably, for consistency the models used in this research are referred to as CGE models.

each sector. Other assumptions often include perfect competition so that zero economic profits are earned, full or constant level of employment, and balanced or fixed balance of payments. Finally, given the extremely large amount of activity within models, aggregations are necessary to make it manageable. While these assumptions may not be entirely realistic they serve a purpose for comparing alternative scenarios. CGE models, depending on their primary purpose may be adapted to suit.

FIGURE 6.2 – *Flowchart of the CGE Process*



SOURCE: Derived from Shoven and Whalley (1984: p. 1019)

Questions regarding the validity of CGE models have been expressed by some researchers for various reasons. Taylor and Von Arnim (2006) suggests that the many elasticities are difficult to measure accurately and are open to manipulation in order to fit the desired results and given the thousands of elasticities required in a comprehensive inter-region CGE model this is a fair criticism. Elasticities form an essential part of a CGE model as they represent the behavioural patterns of economic agents in response to price changes throughout the system, these are econometrically derived and are open to variation. Another often cited criticism of CGE models is their lack of statistical foundations, Shoven and Whalley (1992; p. 6) defends their use stating that while econometricians "are more accustomed to thinking in term of models where economic structure is simple but whose statistical structure is complex", CGE models work in the opposite manner, thus trading off statistical robustness for a more advanced economic structure. As with any model, the results of CGE modelling must be treated with caution due to the assumptions and estimations in place, these results are intended to be indicative rather than predictive in nature.

6.3. The GTAP Model

The Global Trade Analysis Project (GTAP) database and associated multiregion, multisector CGE model was developed in 1992 at Purdue University, USA.[54] The GTAP model contains "bilateral trade, transport, and protection data characterizing [sic] economic linkages among regions, together with individual country input-output data bases that account for intersectoral linkages with each region" (Hertel; 1997: p. 4). Thomas Hertel, a major founding contributor, explains that the idea of GTAP was to make a comprehensive international CGE model more accessible to researchers for use in examining policy and economic issues and thus eliminating the need for unnecessary duplication from developing one's own model; the publication of his book '*Global Trade Analysis: Modeling and Applications*' comprehensively documents the derivation of the GTAP database and model,[55] a useful illustration of the money flows between economic agents without government intervention is also

[54] GTAP website: www.gtap.agecon.purdue.edu

[55] The reader is advised to read the first six chapters of this book for an understanding of the GTAP structure, data, behavioural equations, and how they come together to form a CGE model.

shown in chapter two (p. 17), this is extended by Brockmeier (2001: p. 16) to include government intervention and this diagram is duplicated in *Figure 6.3*.

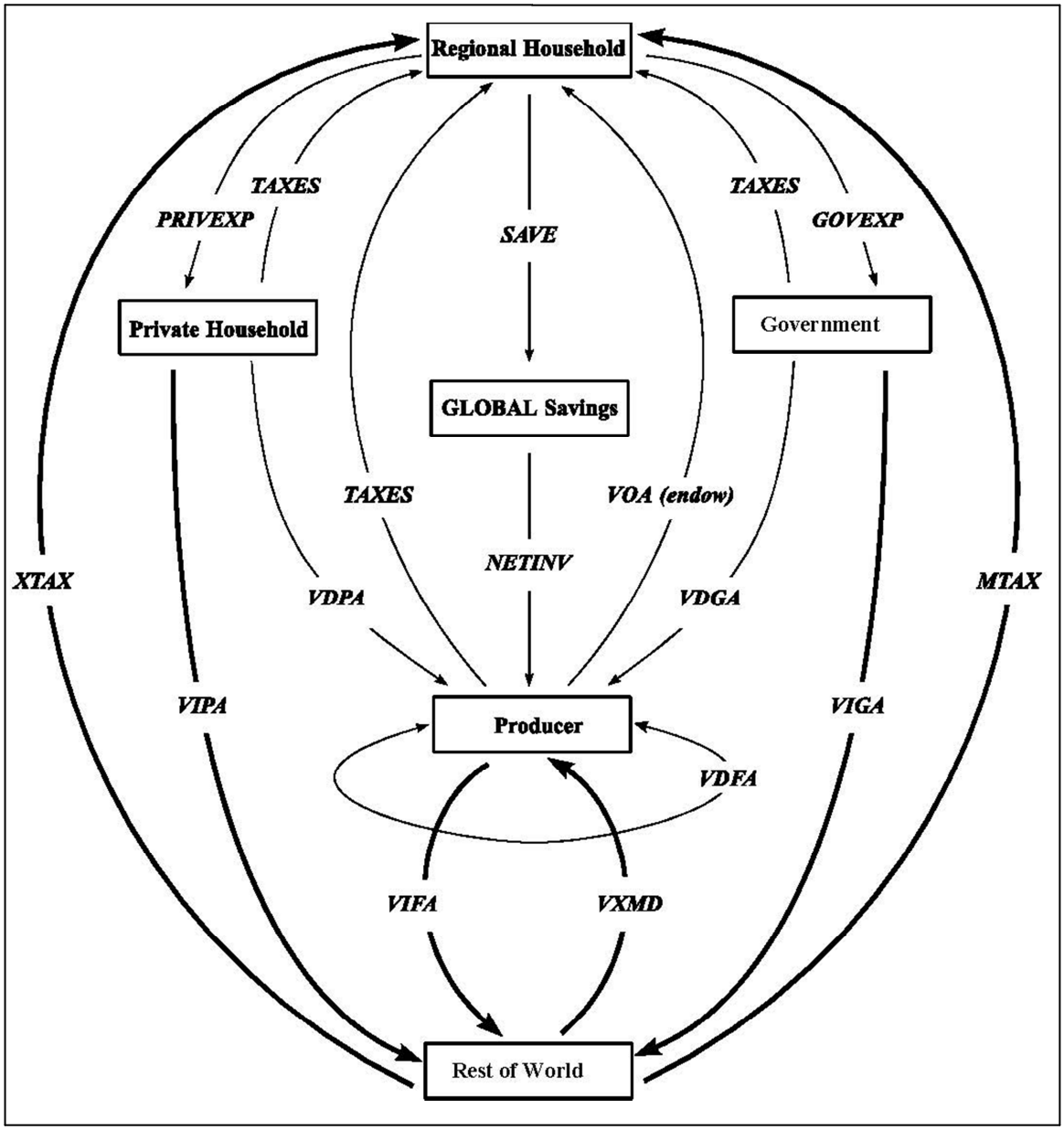
There are six economic agents represented in this diagram. Firstly the Regional Household of the model country collects all income created in this economy which is then distributed to other agents. Secondly, the Private Household represents all the consumers within the economy that spend income received. Thirdly, the Producer is the representative producer of the economy and purchase endowments (VOA (endow)) and products (VDFA) to manufacture products which are then supplied to other agents. Fourthly, the Government collects taxes which are then used to spend accordingly. Fifthly, GLOBAL Savings is a representative financial agent that collects savings (SAVE) and distributed for investment (NETINV). Finally, the Rest of World characterises the trade flows between the model economy and its trading partners. While this diagram is necessarily simplistic in order to illustrate the essential features of the CGE model the reality is that these representative agents can and are disaggregated into many groups.

Arrows represents the flow and direction of money transfers between agents. Starting with the Regional Household, money is collected from endowment returns (VOA (endow)) and various taxes and subsidies (TAXES, MTAX, and XTAX), this money is then flowed through to the Private Household as income payments and used for private consumption (PRIVEXP), the Government as tax revenue and other income for government expenditure (GOVEXP), and the excess income is then attributed to savings (SAVE) which is then passed on to producers as investment (NETINV). Having received money for expenditure the Private Household then spends this on domestic products (VDPA), imported products (VIPA), and taxation. Government income is distributed in much the same way, to domestic (VDGA) and imported (VIGA) products, along with taxation. The Producer, having received money flows from the private households and government for manufactures, also receives and spends money through domestic inter-industry business (VDFA) and international exports (VXMD) and imports (VIFA).[56] Finally completing the linkage is the role of trading partners. It is worth noting at this point that all monetary flows

[56] A summary of these and other GTAP variables are shown in Appendix One.

from purchases in this diagram are examined at agent prices rather than market prices with consumption taxes making up the difference.[57] To complete the analysis of monetary flows within the economy a transportation sector, which differentiates between c.i.f. and f.o.b. prices between trading partners, and a global financial sector, which recognises financial transactions between countries, are required but are not included in this diagram due to congestion.

FIGURE 6.3 – *Monetary Flows in the GTAP model*



SOURCE: Brockmeier (2001: p. 16)

[57] Agent prices, or tax exclusive prices, are denoted by the letter A in the flows notation. Markets prices, or tax inclusive prices, substitutes A for the letter M

For each monetary flow in the GTAP model there must be an associated behavioural equation, for example in the case of trade how do domestic agents respond to a change in the price of an importable good, or how does a foreign market respond to changes in the price of domestic exports? The behavioural specifications forms an integral part of policy analysis in a CGE model, how agents react in response to changes in relative prices determines the magnitude of change to the general equilibrium of the economy. The four behavioural parameters in GTAP are elasticities of substitution, transformation elasticities, regional investment flexibility, and consumer demand elasticities (K. M. Huff, Hanslow, Hertel, and Tsigas, 1997). It is these parameters, along with economic accounting identities that determine the effects an economic shock will have on the economy.

6.4. Previous GTAP Empirical Studies

6.4.1. GTAP Models of Economic Growth

Modelling the impact of a country's economic growth on the rest of the world within a CGE framework is still a relatively new development. However with the emergence of China as world's second largest economy fuelled by an exceptional growth performance over recent decades makes it a topic worth investigating. The pioneering work by Gehlhar, Hertel, and Martin (1994) was the first to model the impacts of growth in GTAP within a published source.[58] They posed the question as to what effect healthy economic growth would have on trade within the Pacific Rim. Their justification for using the GTAP CGE model, as opposed to an econometric model for example, was that economic growth in one region affects the rest of the global economy through a series of interrelationships between optimising economic agents. Incorporating such linkages within an econometric model would be an extremely difficult task and certainly would be incapable of providing the sectoral details that general equilibrium models can. Economic growth was incorporated into the GTAP model by projecting forward the model by shocking predicted growth in real GDP and its components (population, labour stock, and capital stocks) for each

[58] Their model extends on the work of Gehlhar's PhD thesis titled "Economic Growth and Trade in the Pacific Rim: An Analysis of Trade Patterns" where he used history to test the predictive accuracy of the GTAP model in explaining the changing trade composition in the Pacific Rim (Gehlhar*, et al.*, 1994).

region while allowing total factor productivity (TFP) to be endogenous, allowing the model to be consistent with growth accounting. From here the model is solved and results interpreted. It should be noted here is that the increase in trade as a result of economic growth in their model is consistent with the theory and empirical econometric models as discussed in Chapter Two.

In GTAP models since mid-1990s, this process described in the preceding paragraph has been used to project forward a baseline equilibrium from which further shocks are made. Arndt et al. (1997) were among the first to utilise this methodology in GTAP to determine the impact of China's growth on the rest of the world. Projecting the global model forward to 2005 using growth estimates and other economic expectations to generate a baseline model, they shocked a decrease in only China's growth, the difference between baseline results and new results being interpreted as the effect of Chinese growth. Results suggested that all regions except South Asia and Thailand would see positive welfare effects with China, as expected, gaining the most. China's trade was expected to grow by 7.1 percent per annum compared to the 9.2 percent economic growth, and trade growth in the rest of the world to increase by 0.36 percent.

A decade later, interest stemming from China-like spectacular performance of the Indian economy resulted in this baseline GTAP growth model being extended to include them. In one such research, Dimaranan, Ianchovichina, and Martin (2007) examined the effects of a two percentage point increase in economic growth for both China and India on other regions. Outside of China and India the welfare effects are mixed with the African continent and the Former Soviet Union gaining the most while South Asia and parts of South-East Asia are negatively affected. New Zealand and Australia are aggregated together and see moderate gains of US$2.7 billion over the nineteen years. Further models making use of GTAP to examine the global effects are outlined in *Table 6.1* below. A common theme in all these models is the terms of trade effect on welfare. Increased demand for imports alongside increased supply of exports in the growth countries results in a deterioration of these terms and thus eroding some of the positive effects from growth. In turn this growth positively affects those nations that supply these imports and negatively affects those nations that compete in the same export markets.

6.4.2. GTAP Models of Trade Policy

Given its name, the Global Trade Analysis Project, it should come as no surprise that the majority of the literature involving GTAP has to do with exploring the effects of various trade policies. The simplest method of doing this is to appropriately shock the relevant trade variable(s) straight into the GTAP model. Young and Huff (1997) for example considers the abolishment of tariffs and NTBs within the Pacific Rim and they find that all regions within the FTA experience an increase in economic growth and most see improved welfare, while the Rest of World aggregation lose out. Much of the literature on this topic follows the same theme and is summarised in *Table 6.2*.

TABLE 6.1 – *Empirical CGE Models on Economic Growth*

Author	Model	Experiment	Main Findings
Arndt et al. (1997)	GTAP (v.3)	Chinese growth of 9.2% p.a. vs. stagnant growth (1992-2005)	All regions except South Asia and Thailand experience welfare gains on the back of Chinese economic growth. Chinese trade increases by 7.11% p.a. World trade increases by 0.36% p.a.
Anderson and Strutt (1999)	GTAP (v.3)	Comparison between high growth and interrupted growth in East Asia – focus on Indonesia (1992-2005)	Affects trade and output composition – a slower transition from agricultural to manufactured goods. Lower growth diminishes some of the positive effects of trade liberalisation – namely the Uruguay round.
Ianchovichina, McDougall, and Hertel (1999)	GTAP (v.3)	Slower than projected growth in China (1992-2005)	Welfare losses to developed countries however developing countries gain from lower growth in China.
Rivera and Tsigas (2005)	GTAP (v.6)	Chinese endowment growth of 1% and 9%	India experiences welfare losses. Rest of Asia experiences welfare gains.
Dimaranan, Ianchovichina, and Martin (2007)	GTAP (v.6)	Chinese and Indian growth 2 percentage points p.a. higher than projected (2001-2020)	Australia and New Zealand small welfare gains. South Asia (excluding India) suffers a slight loss. Global trade increases by 0.23% p.a.
Hertel et al. (2007)	GTAP (v. 6.1)	Chinese economic growth of 9% p.a. (1997-2025)	Five-fold increase in forestry world price, most other prices fall. Focuses on the effects to Bangladeshis living on the poverty line – negative impact on consumption and nutrition.
Bussolo et al. (2008)	LINKAGE (based on GTAP v.6)	10% reduction in the baseline economic growth of China and India (2005-2030)	Share of global agricultural exports from China falls from 10% to 1% while imports rise from 24% to 45% under baseline scenario. Outside of China and India global welfare declines by 0.20% as a result of the slightly lower growth. South Asia (excl. India) least affected and Middle East most affected.
Ianchovichina, Ivanic, and Martin (2008)	GTAP (v.7p)	Chinese and Indian economies grow 2 percentage points p.a. higher than projected (2005-2020)	Australia and New Zealand small welfare gains. South Asia (excluding India) suffers a slight loss. World prices fall except for horticultural products and energy.

TABLE 6.2 – *Empirical CGE Models on Trade Policy*

Author	Model	Experiment Summary	Main Findings
Diao and Somwaru (2000)	GTAP (v.3)	Tariff elimination between MERCOSUR members	The two MERCOSUR members studied, Argentina and Brazil, both have significant rises in trade and is accompanied by modest welfare gains and GDP growth. The rest of the world experiences very minor welfare losses, the worst affected being Chile, a decline in welfare by 0.05%.
Walmsley and Hertel (2000)	GTAP (v.4)	Effect of China's accession to the WTO on China and the rest of the world (2000-2020)	The largest absolute welfare gains at US$27.1 billion over twenty years are seen in China as a result of liberalisation, especially from other countries. Australia and New Zealand are expected to do very well, considering their relatively small size, with welfare gains of US$2.3 billion combined. South Asia and Turkey endure notable welfare losses and GDP reductions. Despite reasonable gains in the US there is concern over the impact on the textile and clothing industry with employment in the sector more than halving, hence the motivation for quota protection.
Lejour (2001)	WorldScan / GTAP (v.4)	Effect of China's accession to the WTO on China and major trading nations	Positive GDP effects for China and its major trading partners (US, Japan, West Europe, SE Asia).
Chirathivat (2002)	CAMGEM	ASEAN-China FTA	Both regions gain through trade liberalization. Non-tariff barriers to trade more influential than tariffs.
Andriamananjara and Tsigas (2003)	GTAP (v.5)	Simulating the effect on the US of 65 different FTAs	US-Japan FTA the most beneficial to the US; however Japan stands to lose. US-China is the best option for mutual welfare gains New Zealand, due in part to size, ranks as the tenth worst FTA for the US
Rae and Strutt (2004)	GTAP (v.5)	Based on WTO Doha round negotiations – reductions in import tariffs, export subsidies, and domestic support	Up to US$30 billion in global welfare gains most of which accrues to developed nations particularly the EU. The benefits to developing nations from cuts in the production support of developed nations are negligible. Lowering of trade barriers more important.
Brown, Kiyota, and Stern (2005)	GTAP (v.5.4)	US-CAC FTA US-Australia FTA US-Morocco FTA	In all three FTAs the US has the largest absolute welfare gain however the smallest relative gains (0.1-0.2% of GNP) – CAC 4.4%, Australia 1.1%, and Morocco 2.0% welfare gain from their respective FTAs with the US. Provides a model of complete multilateral free trade and shows global welfare improves by US$2.4 trillion – 22.4% of which comes from the US.

Table 6.2 cont.

Author	Model	Experiment Summary	Main Findings
Mai et al. (2005)	Monash MC	Australia-China FTA	GDP improves for both nations – Australia 0.12% and China 0.05%. Consumption or welfare improves by 0.21% and 0.02% respectively. Australian exports to China rise across the board. Bilateral trade balance falls in Australia's favour. Relative sectoral effects much greater for Australia. Agricultural output up by 1.2% (wool 7.1%) and manufactures up 0.2% (apparel -5.5%) which falls in line with Australia's comparative advantage. Trade creating in that global trade rises as a result of an FTA.
Winchester (2006)	GTAP (v.6)	Analysis of 14 trade agreements of interest to NZ	Global liberalisation is the best-case scenario for New Zealand. An FTA with China is the next best option. An FTA between Australia and the US negative impacts on New Zealand, as do the other FTAs that do not involve them.
Ianchovichina, Ivanic, and Martin (2010)	GTAP (v.7p)	Malaysia-China FTA Malaysia-India FTA Malaysia MFN Liberalisation	Malaysia stands to gain the most in all three of these liberalisation simulations relative to GDP with MFN liberalisation providing the largest welfare gains at US$6.5 billion. China and India also receive modest gains from respective FTAs with Malaysia however the rest of the world generally suffer welfare losses. Other than Malaysia, the Hong Kong-Taiwan aggregation benefits the most from the MFN liberalisation scenario.
Tan and Cai (2010)	GTAP (v.6)	NZ-China FTA	New Zealand welfare gains of US$300 million. China welfare gains of US$53 million. Rest of World welfare losses of US$308 million
Tsigas and Wang (2010)	GTAP (v.7)	China-ASEAN FTA	ASEAN benefit the most, especially Vietnam and Singapore. China receives modest welfare gains. Minor welfare losses for most other regions including New Zealand and Australia.

6.5. GTAP Data and Aggregations

The GTAP version 7.1 database was publicly released in May 2010; it comprises 112 regions and 57 sectors and is based on 2004 data. The required macroeconomic data is predominantly obtained from the Development Economic Prospects of the World Bank; this includes GDP and its components, investment, capital stocks and depreciation, trade, and population (Aguiar and Dimaranan, 2008). Microeconomic I-O tables for each country are contributed and updated by volunteer individuals or organisations for their respective countries of interest in accordance with GTAP guidelines (K. Huff, McDougall, and Walmsley, 2000). This data, with the behavioural parameters, are then calibrated to form a CGE model as discussed in *Section 6.2*. The GTAP database is updated approximately every three years; however there is a lag between the base-year data and the public availability of the database due to time taken to set up the model.

While the six year old data may draw criticism for being out of date the comprehensive nature of this database is unsurpassed and therefore it is accepted that some accuracy has been sacrificed for a more complete model. It can be recalled that the purpose of CGE analysis is not to provide predictions of the economic shock, but rather be indicative of the direction and relative magnitudes of these effects.

Given the large amount of regions and sectors in the GTAP database it is recommended aggregating these into a more manageable set with focus on those regions and sectors of interest to the modeller. This allows the computer program to solve the new general equilibrium and associated changes faster and also allows the modeller to concentrate on the most applicable solutions. This research aggregated the 113 regions down to 15 and from 57 sectors down to 17; these are listed in *Table 6.3*. As New Zealand and China are the main subjects of this research, they are not aggregated. Australia and India are also left as regions of their own as simulations involving them are made at a later stage. Major economies of Japan and the USA are not aggregated due to their significance in the world economy. Standard convention is then followed from the literature for the rest. Thus, Hong Kong and Taiwan are aggregated together due to their close geographical proximity to China. Members of the European Union are aggregated into one region. Other countries are either

grouped together by geographical location or placed in the Rest of the World. Given the importance of primary products to New Zealand's economy these sectors are left relatively detailed, manufactures are divided into four categories, and finally all services are aggregated together[59]

TABLE 6.3 – *Aggregation of the GTAP Data*

REGIONS		**SECTORS**	
Notation	**Regions Defined**	**Notation**	**Sectors Defined**
NZL	New Zealand	dairy	Dairy
CHI	China	meat	Meat products
AUS	Australia	wool	Wool
JAP	Japan	o.ani	Live animals
HKT	Hong Kong and Taiwan	hort	Fruit, vegetables, and nuts
SEA	Southeast Asia	rice	Rice
IND	India	cereal	Wheat and grains
RSA	Rest of South Asia	bevtob	Beverages and tobacco
CAN	Canada	o.food	Other foods n.e.c.
USA	United States of America	forest	Forestry products
SCA	South and Central America	fish	Fish and seafood
EU-27	European Union	mmr	Minerals and metals
MENA	Middle East & North Africa	tcf	Textiles, clothing, and footwear
SSA	Sub-Saharan Africa	wood	Wood and paper products
ROW	Rest of the World	mmp	Mineral and metal products
		o.man	Other manufactures
		service	All services

6.6. GTAP Simulations and Methodology

The objective of this research is to determine the effects on New Zealand from growth in and trade liberalisation with a large booming country such as China making use of a CGE model. Given that Australia is now in free trade talks with

[59] Appendix Two lists all the GTAP regions and sectors in each aggregation

China is of interest to ascertain what effects a successful deal may on New Zealand. Four GTAP simulations are being run to analyse the impacts of these economic events to the year 2020.

6.6.1. Simulation 1 – Chinese Economic Growth

Chinese average growth over the last three decades has stood at an unprecedented nine percent and these high growth rates are assumed to continue in the medium term. Given the rapidly growing middle classes and resulting changes in consumption patterns, this research attempts to analyse the affects this may have on trade relations with New Zealand and any welfare effects arising from this.

A common approach to analyse the effects of growth in one country on third party regions within the GTAP model is to use a baseline model. This requires projecting forward the world economy to a target year and then *shocking* growth and growth components[60] of the target country to alternative levels; the results then show the differences between the base case and the alternative scenario(s) in the target year [see for example: Gehlhar, Hertel, and Martin (1994), Arndt et al. (1997), Anderson and Strutt (1999), Ianchovichina, Ivanic, and Martin (2008, 2010)]. A problem with such an approach is the reliance of economic predictions over a ten year period which can take unpredictable turns, as evidenced by the recent global recession. Consequently, this research takes an alternative but more simplistic approach in that it only considers growth in the Chinese economy and therefore holds economic activity constant in other regions, similar to the growth model by Hertel et al. (2007).

Starting with a base of zero growth in China, this simulation *shocks* GDP growth against four possible alternatives, these being slow growth (3% p. a.), moderate growth (6% p. a.), maintained high growth (9%), and extreme growth (12%). Also for consistency the components that make up this growth must also be shocked according to their relative projected contributions; the per-annum growth rates are displayed in *Table 6.4* and the 10-year accumulated growth rates that are shocked are shown in *Table 6.5*. It is assumed the population and unskilled labour growth

[60] The components of growth include but are not limited to changes in capital stocks, labour stocks (skilled and unskilled), population, and productivity growth

remains unchanged regardless of economic growth, skilled labour and capital stocks are assumed to grow in proportion to economic growth, and total factor productivity growth is calculated within the GTAP model based on the previous growth projections.[61] Having implemented the shocks, the model is then solved with ten subintervals, one for each year.

TABLE 6.4 *– Modelled Per-Annum Growth of China*

Shocks	3%	6%	9%	12%
GDP	3.00	6.00	9.00	12.00
Unskilled Labour	0.80	0.80	0.80	0.80
Skilled Labour	1.30	2.60	3.90	5.20
Capital	2.83	5.67	8.50	11.33
Population	0.60	0.60	0.60	0.60
TFP (GTAP derived)	1.29	2.87	4.10	5.96

SOURCE: Ianchovichina, Ivanic, and Martin (2010: p. 125), World Bank, and author's assumptions.

TABLE 6.5 *– Modelled Ten-Year Accumulated Growth of China (2010-2020)*

Shocks	3%	6%	9%	12%
GDP	34.4	79.1	136.7	210.6
Unskilled Labour	8.30	8.30	8.30	8.30
Skilled Labour	13.8	29.3	46.6	66.0
Capital	32.2	73.6	126.1	192.5
Population	6.20	6.20	6.20	6.20

SOURCE: Author's calculations based on *Table 6*

6.6.2. Simulation 2 – China and New Zealand Free Trade Agreement

The examination of the effects of trade liberalisation, especially tariff and export subsidy reductions, using GTAP has been extensively covered in the literature and the design of the GTAP model makes this a relatively easy process. This simulation incorporates the recent signing of the FTA between China and New Zealand in order to examine the extra effects of the agreement. This firstly is done on its own and is then incorporated with the first simulation to show the overall influence of the two events. The first requirement is to check pre-FTA tariffs rates between the two nations for accuracy and adjusted where necessary using the Alter Tax facility within

[61] It is worth noting here that to model growth the closure of the GTAP is changed slightly from the standard closure; Chinese economic growth (qgdp) becomes an exogenous variable and swapped with the productivity variable (afereg) which in turn becomes endogenous.

the RunGTAP program, this is done as to not over (or under) exaggerate the results.[62] Secondly, the bilateral tariff rates are then shocked in accordance with the agreement, which on the most part are all phased out by 2019 in both countries.

6.6.3. Simulation 3 – Potential China and Australia Free Trade Agreement

As a close competitor to New Zealand in many export markets any FTA Australia can obtain with China will have consequences. It is assumed that any FTA between China and Australia will have the same terms as the NZ agreement and thus the target tariff rate shocks are the same as that in *Simulation 2*.

6.6.4. Simulation 4 – Indian Economic Growth

Although India has not experienced the levels of economic growth seen in China, it has nonetheless performed well with average rate of 7.2 percent per annum over the decade to 2009 (World Bank, 2010). Again, the size of the India means that high growth may also make a meaningful contribution to New Zealand and the rest of the world economy. The purpose of this simulation is to add another example of the third country effects of high growth in an emerging large country. The process takes a similar format to that of *Simulation 1* with the ten-year accumulated growth shocks implemented shown in *Table 6.7*. This simulation can then be merged with that of the Chinese growth scenario to examine the combined effect of high economic growth of the world's two largest nations on the rest of the world. Finally, given that New Zealand and India are currently involved in trade negotiations it is worthwhile considering the potential benefits of free trade, modelled simply as across the board tariff elimination between both countries within ten years.

[62] Differences between the GTAP tariff rate and the actual tariff rate can arise from inconsistent data on bilateral trade between the two countries. These tariffs on the most part are correct in the GTAP model, however dairy imports from China to New Zealand, for example, were observed at 91% and was corrected to 2%, other more minor corrected. Actual pre-FTA tariff rates were taken from MFAT (2008)

TABLE 6.6 *– Modelled Per-Annum Growth of India*

Shocks	**3%**	**6%**	**9%**
GDP	3.0	6.0	9.0
Unskilled Labour	1.6	1.6	1.6
Skilled Labour	2.0	4.0	6.0
Capital	3.1	6.1	9.1
Population	1.1	1.1	1.1
TFP (GTAP derived)	0.9	2.2	3.6

SOURCE: Ianchovichina, Ivanic, and Martin (2010: p. 125), World Bank, and author's assumptions.

TABLE 6.7 *– Modelled Ten-Year Accumulated Growth of India (2010-2020)*

Shocks	**3%**	**6%**	**9%**
GDP	34.4	79.1	136.7
Unskilled Labour	17.2	17.2	17.2
Skilled Labour	21.9	48.0	79.1
Capital	35.0	80.8	140.0
Population	11.6	11.6	11.6

SOURCE: Author's calculations based on *Table 6.4*.

Chapter Seven
RESULTS AND DISCUSSION

Having discussed the methodology and proposed experiments to be performed in Chapter Six this chapter reports and analyses the data output provided by the GTAP general equilibrium model. By their nature, CGE models provide a vast amount of changes within each 'new' simulated world economy that may be considered. This is because of the many interrelationships within the model which are affected by any shock. This research concentrates on those results most applicable to New Zealand while branching out to discuss any other interesting results involving China and other regions.

Major economic indicators that this research focuses on in each of the simulations are:

- Welfare effects and composition
- GDP and income changes
- Global and bilateral trade patterns
- Regional consumption and production
- World and domestic price effects

Making use of these results it can then be determined to what extent the New Zealand economy, and specifically its agricultural sector, can benefit from future Chinese economic growth and in combination with the free trade agreement between New Zealand and China. How a successful signing of an Australia-China FTA currently under negotiation may influence any gains New Zealand makes is also considered.

The first four sections examine each of the four experiments from Chapter Six in turn. The fifth section then provides an industry summary focussing on those agricultural sectors most important to New Zealand.

7.1. Chinese Economic Growth

Economic growth in China is evaluated with four different simulations, each representing different levels of growth over the ten years to 2020. Unlike the baseline models which project the world economy forward to the target year and then shocks growth accordingly, a common technique for analysing growth with the GTAP model, these simulations bypasses the messy and questionable projections and instead shocks growth in China assuming the status quo in the rest of the world. The results in this section may therefore be viewed as complementary to whatever may transpire in the world economy over the next decade.[63] This section attempts to answer several questions regarding the effects of China's growth, both on China and the rest of the world, paying close attention to New Zealand. Some of the specific questions include:

- What is the impact on consumption in China?
- How much of this increased demand is met by domestic production and how much by international trade?
- How does China's growth affect bilateral trade with New Zealand and the rest of the world?
- How does China's growth affect overall trade in New Zealand?
- What affect does China's growth have on world and domestic prices?
- What is the impact on welfare and incomes in each region?

Firstly, the effects that economic growth has on China's consumption trends are shown in *Table 7.1*. As expected, consumption in all commodity groups does increase. Changes in consumption are caused by the change in income resulting from growth and hence the income elasticities are the major determinant to the magnitude of these increases. These results are consistent with empirical evidence that suggest that food and agricultural products are less receptive to changes in income while manufactured products are more responsive. Consumption of dairy products is expected to experience the strongest growth out of the food groups while common staple, rice, sees the weakest growth. In a scenario where growth in China continues on a nine percent growth path over the next decade the growth in dairy

[63] This section excludes the impact of the NZ-China FTA which is covered in the following section.

consumption is expected to rise by 125.5% percent (8.5% p.a.); meat and wool also perform adequately with 112.2 percent (7.8% p.a.) and 105.9 percent (7.5% p.a.) respectively. Overall, the category 'other manufactures' exhibits the highest response to economic growth; this is in line with expectations as this aggregation includes high valued products such as electronics, machinery, and vehicles.

TABLE 7.1 *– Decomposition of Consumption Growth in China under Selected Growth Scenarios*

	3% p.a.	6% p.a.	9% p.a.	12% p.a.
Dairy	31.4%	71.9%	125.5%	200.8%
Meat	29.6%	66.2%	112.2%	171.6%
Wool	27.2%	61.3%	105.9%	171.8%
O. Animal	27.0%	59.5%	98.4%	145.0%
Hort	23.7%	50.8%	83.1%	122.0%
Rice	22.8%	47.7%	76.4%	109.5%
Cereal	26.6%	59.3%	99.2%	149.6%
Bev & Tob	28.7%	63.4%	105.5%	155.7%
O. Food	26.4%	57.7%	95.2%	141.2%
Forestry	34.4%	76.8%	126.8%	184.1%
Fisheries	24.7%	53.4%	86.0%	122.9%
MMR	34.5%	77.7%	129.9%	193.5%
TCF	36.4%	84.0%	148.9%	241.8%
Wood	39.5%	92.6%	163.9%	259.8%
MMP	40.2%	94.9%	170.0%	274.8%
O. Manu	46.0%	111.1%	203.6%	335.2%
Services	35.0%	80.9%	139.3%	211.1%

SOURCE: Model simulation

Given that consumption has increased in all commodity groups to varying degrees the next task is to evaluate where this extra demand is sourced from. *Table 7.2* shows the changes in volume of production, exports, and imports in China for each sector at the nine percent growth rate.[64] Simulation results show that like consumption, output has increased across all sectors; however of more interest are the changes in exports and imports. The import volume of all sectors has increased but the export volumes have generally decreased for primary industry sectors and increased for manufactured sectors, especially textiles and clothing (TCF). By

[64] See *Table A3.1* in appendix for the details on the other three growth rates.

subtracting the change in imports from the change in exports the overall change in trade can be observed; a positive (negative) value reflects an improvement (deterioration) in the self-sufficiency ratio of that sector.[65] With this information it can be concluded that as a result of this increased growth China will increasingly rely more on imports in the primary industry sectors, especially raw minerals and metals (MMR) and wool, and to lesser extent but important to New Zealand, dairy products and forestry.

***TABLE 7.2** – Change in Production and Trade Volumes in China under the High-Growth Scenario*

	Δ Output	Δ Exports	Δ Imports	Δ Trade	Δ Trade / Δ Output
Dairy	4679.4	-12.4	687.7	-700.1	-15.0%
Meat	20318.6	-155.1	984.9	-1139.9	-5.6%
Wool	4060.7	-37.9	1561.7	-1599.6	-39.4%
O. Animal	99702.8	-519.0	2916.6	-3435.6	-3.4%
Hort	98684.4	-849.0	1435.2	-2284.3	-2.3%
Rice	35023.2	48.8	192.3	-143.4	-0.4%
Cereal	17876.0	-193.1	2259.7	-2452.8	-13.7%
Bev & Tob	48826.9	535.5	316.8	218.7	0.4%
O. Food	90285.5	37.8	17693.8	-17656.0	-19.6%
Forestry	45318.8	-100.4	9139.4	-9239.8	-20.4%
Fisheries	31263.4	-817.4	722.8	-1540.2	-4.9%
MMR	238157.0	-7621.9	139360.8	-146982.7	-61.7%
TCF	389580.8	131446.3	11035.7	120410.6	30.9%
Wood	212570.9	27150.9	7707.2	19443.7	9.1%
MMP	1314219.1	107106.1	88727.6	18378.5	1.4%
O. Manu	1813056.9	652047.6	179510.3	472537.2	26.1%
Services	2417082.0	64134.4	34039.4	30095.1	1.2%

SOURCE: Model simulation and author's calculations; values based on constant base-year prices and exclude any subsequent price effects.

Having seen that China will rely on international markets for agricultural products[66] it is worth considering what role New Zealand is likely to play in filling this gap.

[65] The self-sufficiency ratio is defined as the domestic production ($Y_{i,r}$) as a ratio of domestic consumption ($C_{i,r}$); a ratio greater than 1 ($Y_{i,r} > C_{i,r}$) indicates more than sufficient and is therefore a net exporter while a value less than 1 ($Y_{i,r} < C_{i,r}$) denotes the economy is less than sufficient in that sector and is therefore a net importer. For evidence of this see Appendix 3, *Table A3.2*

[66] From here on, for simplicity, agricultural products include all food products and non-manufactured tradables.

Results in *Table 7.3* show the share of imports to China from selected sectors in New Zealand and Australia. Both countries contribute a significant share of China's shortfall in all animal products. In dairy 35.3 percent of China's extra import demands are met by New Zealand and 7.0 percent by Australia while the EU supplies 36.1 percent; this is representative of the respective share in the world export market. For meat products New Zealand's share is 7.9 percent and for Australia is 9.5 percent; the larger USA (27.5%), South America (22.6%), and the EU (18.4%) regions also make significant contributions. Being the world's dominant producer and exporter of wool Australia makes up the majority of additional import demand at 65.3 percent; this sector is also important to the New Zealand wool industry at 13.4 percent. Share of other animal products also feature strongly in both countries. New Zealand's role in forestry and raw minerals are small in significance for China however they are large in absolute value for New Zealand.

TABLE 7.3 *– Share Share of Additional Chinese Imports of New Zealand or Australian Origin for Selected Sectors* [67]

	New Zealand		Australia	
	Δ Volume	**%**	**Δ Volume**	**%**
Dairy	242.73	35.3	47.87	7.0
Meat	78.09	7.9	94.01	9.5
Wool	209.92	13.4	1019.75	65.3
O. Animal	195.15	6.7	434.69	14.9
Horticulture	35.45	2.5	18.20	1.3
Cereal	0.01	0.0	494.12	21.9
Forestry	264.70	2.9	109.33	1.2
Fisheries	1.56	0.2	17.75	2.5
MMR	167.32	0.1	9757.70	7.0

SOURCE: Model simulation and author's calculations

Table 7.4 shows the overall effect on exports, imports, trade balance, and output for each sector in New Zealand under the Chinese high-growth scenario. The strongest overall performers for the New Zealand economy are the wool and forestry industries, both of which are important raw materials to the growing Chinese economy, with exports growing at 145.9 and 62.1 percent respectively and output

[67] See *Table A3.*3 and *Table A3.4* in appendix for full results.

increasing by 46.9 and 12.4 percent respectively. Raw minerals[68] and other animal products[69] also perform strongly as exports increase by 26.6 and 35.9 percent respectively and production also increases modestly. Dairy products, currently New Zealand's major export industry, sees relatively small gains as large growth in exports to China is met by declining exports to other regions. Exports and output of all manufactured sectors decline in New Zealand, however the highly aggregated nature of these sectors may hide any potential benefactors from China's growth;[70] conversely, total imports of manufactures increases.

TABLE 7.4 *– Effect on New Zealand Trade and Production resulting from China's High Growth*[71]

	Trade Balance (US$ mil.)	% Change in Exports	% Change in Imports	% Change in Output
Dairy	78.68	2.3	-0.5	1.5
Meat	-218	-6.8	-1.3	-4.8
Wool	214.52	145.9	25.1	46.9
Other Animal Prod.	196.46	35.9	-6.2	2.8
Horticulture	34.86	3.6	1.4	1.9
Rice	-0.04	-0.2	0.2	0.9
Cereal	-0.84	-1.2	3.2	2.0
Bev. & Tobacco	-8.6	-1.9	0.2	-0.1
Other Food	38.08	2.8	1.2	0.9
Forestry	307.87	62.1	4.9	12.4
Fisheries	15.94	13.7	6.3	2.1
Raw M&M	304.69	26.6	0.0	10.1
TCF	-367.78	-31.0	1.6	-20.7
Wood	-219.39	-9.0	3.0	-3.9
M&M Manu.	-111.33	-5.7	-0.3	-2.9
Other. Manu	-662.02	-19.6	1.5	-8.4
Services	-96.46	-0.5	1.1	0.6

SOURCE: Model simulation

[68] Further disaggregation reveals that coal contributes much of the growth in raw minerals and metals sector.

[69] Other animal products include raw hides and skins – a relatively large industry in New Zealand.

[70] For example, further disaggregation showed that only the paper and paper products of the manufacturing sector saw gains.

[71] See appendix tables A3.5 to A3.7 for further data on other countries

Of considerable interest is the decline in meat exports and output in New Zealand. The rise in bilateral exports to China is more than nullified by reduced exports to the rest of the world, especially the EU and the USA. This is best explained by the increased profitability in using fixed land resources on wool production and other animal products and thus transferred away from meat.

The changes to domestic prices in New Zealand, Australia, and China as well as changes to the world price index are shown in *Table 7.5*.[72] These results are consistent with previous findings – world prices in wool (5.77%), forestry (42.13%), fisheries (66.14%), and minerals and metals (8.65%) realise the greatest increases caused by strong demand growth in China. Naturally China, the source of this growth, generally sees the greatest fluctuations in domestic prices of which some does flow through to the New Zealand and Australian economies. Although the world price index falls for meat and dairy, domestic prices for both rise slightly in New Zealand and more so for Australia and China. This decline in the world index is brought about by falling domestic prices in South Asia (including India), the EU, and the USA, consequently this causes a shift in relative prices between nations and ultimately draws some meat and dairy exports away from New Zealand and Australia and towards the former regions. Prices of manufactured products are expected to lower significantly as a result of high Chinese economic growth and the resulting expansion in production. Price of land in New Zealand is expected to rise by 13.1 percent which is the trend throughout all regions except South Asia, Chinese land prices increase a dramatic 260 percent. Of concern to New Zealand may be the slight decline in wages for both skilled and unskilled. There is two points worth noting here; firstly is a reminder that this GTAP model can only account for the trade effects of third party economic growth and therefore any associated technological spillover effects resulting from Chinese growth is excluded. Secondly, as the prices of manufactures and services decline, which both make up a significant proportion of expenditure, the reduction in wages would be compensated through lower prices in other areas.

[72] The world price index is a weighted average by commodity of each regions real domestic price.

***TABLE 7.5** – Effect on World and Selected Domestic Prices resulting from High Growth in China*

	New Zealand (percent)	Australia (percent)	China (percent)	World Price Index
Dairy	0.20	2.07	2.01	-2.12
Meat	0.23	2.24	0.89	-1.52
Wool	2.81	6.81	11.66	5.77
Other Animal Prod.	0.71	2.88	12.73	3.78
Horticulture	0.73	3.00	13.78	3.96
Rice	-0.13	1.79	-2.54	-1.89
Cereal	0.64	3.35	8.17	0.40
Bev. & Tobacco	-0.07	1.90	-20.41	-4.90
Other Food	0.53	1.92	-0.81	-1.87
Forestry	7.52	5.46	49.71	42.13
Fisheries	4.86	4.99	103.82	66.14
Raw M&M	3.36	5.78	10.83	8.65
TCF	-1.64	-0.69	-16.41	-9.86
Wood	0.57	1.45	-16.06	-4.14
M&M Manu.	0.42	2.08	-13.57	-3.67
Other. Manu	-0.57	0.74	-17.04	-6.78
Services	-0.24	1.82	-21.95	-4.13
Land	13.12	12.74	260.07	
Unsk. Labour	-0.43	1.92	46.81	
Skilled Labour	-0.30	2.14	5.51	
Capital	-0.03	2.44	-23.96	
Nat. Res.	51.84	33.53	649.20	

SOURCE: Model simulation

A desirable task of any CGE analysis is an examination of the changes in welfare for each region and the components that make up this welfare; this is shown in *Table 7.6*. Welfare change is measured in terms of equivalent variation (EV)[73] and is made up of six components – terms of trade effects,[74] allocative efficiency effects,[75] an investment-savings (I-S) effect,[76] endowment changes, productivity changes, and population changes. Because of the nature of this GTAP simulation the last three components are only applicable to China as they are growth variables which are held

[73] Put simply, this welfare measures the change in consumption of utility maximising consumers.

[74] Terms of trade are the price of exports relative to the price of imports in a region.

[75] The allocative efficiency effect is the welfare change derive from more efficient use of resources

[76] Put simply, the I-S effect is equivalent of terms of trade within the financial markets

constant for other regions, the first three components are reported in *Table 7.6*. Naturally, China experiences the greatest welfare gains as a result of its own growth increasing by US$1.86 trillion, and even when discounting for the growth components this still amounts to US$209 billion.[77] This is largely due to a more efficient allocation of resources. Terms of trade in China, on the other hand, deteriorate as export prices decline relative to import prices due to the increased supply of Chinese products and exports stemming from growth. Most regions, including New Zealand, also see improved welfare as a result of China's growth mostly derived from improved terms of trade with allocative efficiency making a smaller positive contribution. For New Zealand welfare is expected to improve by US$700 million or 0.73 percent of GDP; this is made up of a terms of trade improvement of US$631 million, an allocative efficiency improvement of US$139 million and a small negative I-S effect of US$70 million. Real GDP in New Zealand is also expected to improve marginally by 0.14 percent under the Chinese high-growth scenario.

Australian welfare improvements follow the same trend but are roughly double in magnitude to that of New Zealand (relative to GDP). The regions expected to gain the most outside of China are its neighbours Hong Kong and Taiwan and South-east Asia; Sub-Saharan Africa also performs strongly. Only India and South Asia suffer welfare losses as a consequence of high Chinese growth which is most likely a result of the close competition it has with China in common export markets, especially textiles and clothing. Overall global welfare gains outside of China totals US$176 billion.

Lastly, it is useful to evaluate how welfare changes in New Zealand at the other levels of Chinese growth, shown in *Table 7.7*. Unsurprisingly the welfare gains accrued to New Zealand rises with Chinese growth, more interesting however is that these welfare gains accrue faster than the rate of growth. Also New Zealand's share of welfare gains to total global gains increases at higher levels of Chinese growth. This is indicative of the increasing reliance on agricultural imports at higher rates of growth.

[77] All currency estimations in this chapter are in US 2004 dollars, the base year of the model.

TABLE 7.6 *– Change in Economic Welfare for each Region under the Chinese High-Growth Scenario*

	Welfare (EV)	Welfare (% of GDP)	Allocative Efficiency	Terms of Trade	I-S Effect	% Change Real GDP
New Zealand	700	0.73	139	631	-70	0.14
China[78]	1862574	111.26	375303	-192552	26413	136.7
HK & Taiwan	13920	2.97	191	15247	-1519	0.04
Australia	8760	1.37	1222	7390	148	0.19
Japan	13899	0.30	2023	15649	-3773	0.04
India	-3106	-0.48	-733	-1871	-502	-0.11
USA	30436	0.26	5771	27677	-3012	0.05
Canada	4562	0.47	893	4252	-583	0.09
European Union	20881	0.16	7348	18377	-4844	0.06
SSA	11784	2.25	2207	9890	-313	0.42
Sth. & Cent. Amer	9508	0.48	439	10765	-1696	0.02
MENA	23610	1.65	297	25140	-1827	0.02
SE Asia	14716	1.87	1196	14688	-1168	0.15
South Asia	-639	-0.35	169	-487	-320	0.09
ROW	27263	1.16	4368	27408	-4513	0.18
Total	2038868	4.98	400833	-17797	2421	5.65
Total (exc. China)	176294	0.45	25530	174755	-23992	0.06

SOURCE: Model simulation and author's calculations

TABLE 7.7 *– Welfare Changes to New Zealand and Australia under Various Chinese Growth Scenarios*

	Slow Growth (3%)	Medium Growth (6%)	High Growth (9%)	Extreme Growth (12%)
New Zealand	147 (0.15%)	355 (0.37%)	700 (0.73%)	1352 (1.40%)
Australia	1905 (0.30%)	4597 (0.72%)	8760 (1.37%)	15488 (2.43%)
Total (exc. China)	40920 (0.10%)	95410 (0.24%)	176294 (0.45%)	310994 (0.79%)

SOURCE: Model simulation and author's calculations. Welfare as a percentage of GDP shown in parentheses.

[78] In addition to the components reported China had extra growth components that contribute to welfare – an endowment effect of US$567 billion, a productivity effect of US$938 billion, and a population effect of US$148 billion

7.2. China and New Zealand Free Trade Agreement

New Zealand and China signed a free trade agreement in 2008. As part of this agreement the majority of bilateral tariffs between the two countries are to be eliminated by 2019. The purpose of this section is to analyse the effects of the tariff removal within a GTAP framework, this will be examined both on its own and also incorporating Chinese economic growth as discussed in the previous section.[79] Issues to be covered include:

- What happens to bilateral trade between New Zealand and China?
- The impact on New Zealand's overall trade to the rest of the world
- Changes in New Zealand domestic prices and output
- Welfare effects resulting from the FTA

Changes in bilateral trade between New Zealand and China as a result of the FTA are displayed in *Table 7.8*. The first two columns examine New Zealand's exports to and imports from China without considering growth. As expected, dairy (US$172.4m), meat (US$91.5m), and wool (US$243.4m) exports increase substantially, all of which can be attributed to its ability to better take advantage of its comparative advantage over China in these products that were previously subject to relatively high tariffs. More surprising is the contribution of textiles and clothing (TCF) with exports to China growing by US$204.8 million from a small base. Although this sector was subjected to higher tariff rates in China prior to the FTA questions still remained as to the magnitude of this increase in exports. To examine this further this sector was disaggregated and then remodelled, this revealed that it is the textile component of this sector that made of the majority of the increase. Given the labour intensive nature of the textile industry the most plausible explanation for this unexpected growth is the relationship with a rapidly expanding wool industry as a result of the FTA. Despite this growth in TCF exports it is outweighed by growth in imports from China which amounts to US$392.8 million and makes up over half of all import growth; again referring to the TCF disaggregated model these imports

[79] Incorporating Chinese growth involves simulating the FTA using updated data derived from the high-growth (9%) simulation carried out in the previous section. Results therefore measure the impact of the FTA assuming that China grows at nine percent per annum over the next decade.

are led by wearing apparel. Almost all of the remaining growth in imports is made up of other manufactured products. Overall the increased value in exports to China exceeds the imports coming in from China and thus improving the bilateral trade balance from New Zealand's point of view by US$308 million. The last two columns of *Table 7.8* show the changes in trade between the two regions having accounted for Chinese growth. These results display similar export trends to those already discussed however the effects are magnified especially for animal products which more than doubled. There is also further US$573 million improvement in New Zealand's bilateral trade balance with China when the FTA is simulated based on the updated high-growth model.

TABLE 7.8 *– Change in Bilateral Trade by Sector between New Zealand and China with implementation of FTA*

	Without Growth		**With Growth**	
	Exports to China	**Imports from China**	**Exports to China**	**Imports from China**
Dairy	173.4	0.1	386.4	0.2
Meat	91.5	0.1	169.4	0.1
Wool	243.4	0.0	544.7	0.0
Other Animal Prod.	26.3	0.0	55.7	0.0
Horticulture	16.4	0.1	40.7	0.1
Rice	0	0.0	0.0	0.0
Cereal	0	0.0	-0.0	0.0
Bev. & Tobacco	0.5	0.2	0.8	0.2
Other Food	72.1	7.6	135.6	8.7
Forestry	-0.5	0.1	-3.4	0.0
Fisheries	0.1	0.0	0.5	0.0
Raw M&M	23.2	4.8	75.4	3.1
TCF	204.8	392.8	283.8	413.7
Wood	30.7	27.9	40.1	56.8
M&M Manu.	43.1	96.0	71.6	175.9
Other. Manu	25.8	109.2	37.9	286.4
Services	-2.6	1.1	-8.0	4.5
Total	**948.2**	**640.0**	**1831.2**	**949.9**

SOURCE: Model simulation and author's calculations

Having analysed bilateral trade flows with China *Table 7.9* observes changes in New Zealand's total world trade resulting from the FTA with China. This shows that much of the export growth with China is at the expense of other trading partners. Total value of meat exports actually decline by US$138 million and the gains to the dairy industry are less significant at US$137 million. The outlook for wool exports (US$500 million increase) however remains strong as China is the major importer of New Zealand wool. Again, against expectations, TCF experiences strong export growth in New Zealand driven by increased exports of textiles and is the second largest contributor to increased exports in the base simulation, however at US$294 million does not receive the same boost as other industries in the growth-based simulation. New Zealand's overall trade balance deteriorates slightly in both simulations as a result of the FTA.

TABLE 7.9 *– Change in New Zealand's Global Exports and Imports resulting from FTA with China*

	Without Growth		**With Growth**	
	Exports to World	Imports from World	Exports to World	Imports from World
Dairy	55.2	1.5	137.1	3.3
Meat	-60.0	2.8	-137.5	6.3
Wool	218.1	0.5	499.7	1.6
Other Animal Prod.	19.8	0.8	40.2	1.3
Horticulture	-0.0	2.5	-0.2	6.3
Rice	-0.0	0.1	-0.0	0.1
Cereal	-0.1	1.2	-0.2	2.8
Bev. & Tobacco	-1.6	1.4	-3.6	3.0
Other Food	42.2	15.9	76.8	30.4
Forestry	-4.6	0.01	-8.4	-0.0
Fisheries	-0.9	0.1	-1.6	0.2
Raw M&M	-3.4	1.6	8.9	4.4
TCF	230.0	187.0	293.6	254.3
Wood	-4.1	23.2	-17.2	46.4
M&M Manu.	9.0	61.5	8.7	115.7
Other. Manu	-26.2	92.0	-47.2	203.3
Services	-95.2	54.6	-185.5	113.5
Total	**378.1**	**446.7**	**663.6**	**792.9**

SOURCE: Model simulation and author's calculations

Table 7.10 shows the expected effect on New Zealand domestic prices and output resulting from the FTA with China. With the exception of TCF and natural resources all prices increase and these are amplified when Chinese growth is taken into account. Most notable is the price rises in wool (7.69%) and land (24.15%) as well as modest price increases for other animal products for which New Zealand predominantly exports. On the other hand, the prices of manufactured products only marginally increase while TCF prices actually fall slightly. One positive for New Zealand is the expected rise in wages through increase unskilled and skilled labour prices which, again, are magnified when observed in the growth-based simulation. Changes in domestic output are most significant in the wool industry with an increase of 69.7 percent whereas dairy and textiles experience moderate increases. Meat, given the land constraints, makes way for dairy and wool and subsequently sees a moderate 3.8 percent decline in output.

TABLE 7.10 *– New Zealand Domestic Price and Output Changes as a result of FTA with China*

	Price (percent)		Δ Output (percent)	
	Without	**With**	**Without**	**With**
Land	8.30	24.15	-	-
Unskilled Labour	0.74	1.47	-	-
Skilled Labour	0.59	1.18	-	-
Capital	0.61	1.23	-	-
Natural Resources	-0.87	-1.76	-	-
Dairy	0.75	1.71	0.61	1.50
Meat	0.75	1.73	-1.56	-3.76
Wool	3.31	7.69	49.86	69.69
Other Animal Prod.	0.98	2.44	-0.34	-1.20
Horticulture	1.02	2.57	-0.52	-1.40
Rice	0.50	1.08	-1.53	-3.28
Cereal	1.05	2.62	1.11	1.84
Bev. & Tobacco	0.48	1.00	-0.18	-0.35
Other Food	0.53	1.08	0.55	0.93
Forestry	0.31	0.37	-0.56	-0.94
Fisheries	0.86	1.64	0.17	0.23
Raw M&M	0.26	0.59	-0.81	-1.10
TCF	-0.41	-0.27	2.89	4.15
Wood	0.45	0.87	-0.57	-1.26
M&M Manu.	0.34	0.70	-0.53	-1.13
Other. Manu	0.32	0.67	-0.97	-2.20
Services	0.53	1.07	-0.04	-0.05

SOURCE: Model simulation

An overview of the welfare effects resulting from the China-New Zealand FTA within the standard model are shown in *Table 7.11* below. Here New Zealand is the only region to register meaningful welfare gains amounting to US$182 million or 0.19 percent in the base-case model, the majority of which is derived from an improvement in the terms of trade. China's US$18 million welfare gain is insignificant relative to the size of its economy. Most other regions record marginal welfare losses as a result of the FTA; Australia being the worst affected with a US$44 million loss due largely to a worsening terms of trade, a consequence of increased competitiveness of New Zealand exports, though this amounts to less than 0.01 percent of GDP. *Table 7.12* once again highlights the advantage for New Zealand signing a FTA with a fast growing Chinese economy. Welfare gains, assuming China's economic growth continues at nine percent, increases the benefit of the FTA to US$415 million or 0.43 percent of GDP for New Zealand. This is more than double that of the standard model which excludes Chinese growth. Combining the positive welfare gains from high Chinese economic growth from the previous section with the gains from the FTA covered in this section, total welfare gains amount to US$1,115 million which amounts to 1.16 percent of GDP. China, as a result of its growth and associated terms of trade deterioration, sees welfare decline from the FTA with New Zealand, although this is insignificant relative to the size of its economy. Welfare losses in Australia resulting from the NZ-China FTA are magnified with the inclusion of Chinese-based growth.

TABLE 7.11 *– Welfare Effects resulting from NZ-China FTA under the Base-Case Scenario*[80]

	Welfare (EV)	Welfare (% of GDP)	Allocative Efficiency	Terms of Trade	I-S Effect
New Zealand	181.5	0.19%	33.7	150.7	-2.9
China	18.0	0.00%	29.1	-5.0	-6.1
Australia	-43.5	-0.01%	-1.6	-40.4	-1.6
World	**9.4**	**0.00%**	**9.6**	**-0.3**	**0.0**

SOURCE: Model simulation and author's calculations

[80] Welfare effects on other countries shown in appendix table A3.8

TABLE 7.12 *– Welfare Effects resulting from NZ-China FTA under the Chinese High-Growth Scenario*

	Welfare (EV)	Welfare (% of GDP)	Allocative Efficiency	Terms of Trade	I-S Effect
New Zealand	415.1	0.43%	57.6	359.8	-2.3
China	-31.7	-0.00%	75.8	-100.9	-6.6
Australia	-84.7	-0.01%	-0.2	-81.7	-2.8
World	**28.1**	**0.00%**	**29.6**	**-1.5**	**0.0**

SOURCE: Model simulation and author's calculations

7.3. China and Australia FTA – the effect on New Zealand

Trade talks between Australia and China commenced in 2005 and to date there have been fifteen rounds of negotiations, the last one being in July 2010 (DFAT Australia, 2011). A successful signing of a FTA between these two nations is expected to have an impact on New Zealand given the similar trading patterns to that of Australia. This section analyses, within the high-growth model, how the signing of a China-Australia FTA affects the gains established to New Zealand under its FTA with China.[81] For this analysis it is assumed that the tariff reductions between Australia and China are the same as that signed between New Zealand and China and will be fully implemented by 2020, also it is assumed that China will grow at nine percent per year and thus the simulation is based on the updated data derived from *section 7.1*.

Much of New Zealand's export gains came from the wool and textiles industries as discussed in the previous section, however if Australia signs the FTA with China much of these gains are eroded. *Table 7.13* quantify these changes in total exports and imports with both New Zealand and Australia signed up for FTAs with China. While wool exports still rise by US$33.3 million in New Zealand this is substantially less than the $499.7 million when they are alone on the FTA with China, this is due to the increased competitiveness of Australia, the world's largest wool producer and exporter. For Australia, wool exports to China increases by $US2.61 billion which translates to a $US2.27 billion growth in total wool exports, this makes the Australian wool industry the biggest winner upon the implementation of a FTA with

[81] Base case results can be found in the appendix.

China.[82] Consequently, the increased competitiveness of Australian wool lowers wool exports (and output) in New Zealand, the upshot is that dairy, meat, and horticultural exports (and output) all increase. Australia, on the other hand, sees decreased exports in other agricultural products, but also performs strongly in raw minerals and textiles. For China, as expected, export gains again predominantly come from the TCF sector. The value of Chinese imports from New Zealand drop across the board with the inclusion of Australia in a FTA, most notably in agricultural sectors. Overall, both exports and imports are lowered in New Zealand with the inclusion of an Australia-China FTA with export gains falling by 23.7 percent and imports by 21.9 percent, regardless both are still up overall.

The Australia-China FTA has a depressing effect on the prices in most sectors of the New Zealand economy with only two exceptions, natural resources and fisheries. Wool prices would drop the most, from a 7.79 percent increase with the NZ-China FTA to a 1.55% increase with the inclusion of Australia-China FTA. Almost half of expected rises in both unskilled and skilled labour wages under a New Zealand-China FTA are eroded in this simulation. Land prices which saw a large 24.15 percent increase as a result of the NZ-China FTA is reduced to 7.45 percent with the addition of Australia. New Zealand production in each sector follows a similar trend to that of exports, specifically output of wool declines while rising in other agricultural sectors.

Welfare effects of Chinas' implementation of FTAs with New Zealand and Australia, under high-growth scenario, are shown above in *Table 7.14*. In this scenario Australia gains the most with a welfare improvement of US$1.91 billion amounting to 0.30 percent of GDP, largely comprised of terms of trade gains. Welfare gains for New Zealand amount to US$219 million (0.23%) which is approximately half of what was achieved under only the NZ-China FTA scenario. For China, welfare gains of US$313 million (0.02%) are a reversal from the small losses made in the NZ-China FTA scenario. The rest of the world suffer a small loss as a result of these

[82] These values are the differences between the change in wool exports resulting from the already implemented FTA between NZ and China simulated in the previous section, and the inclusion of an Australia-China FTA into the simulation as described in this section. For example, Australia lost $0.15 billion in total wool exports under NZ-China FTA but gains $2.12 billion with Australia's inclusion, a net gain of $2.27 billion.

TABLE 7.13 *– Change New Zealand and Australia's Global Export and Import Changes with Australia's inclusion of FTA with China*

	New Zealand		Australia	
	Exports *(US$ millions)*	**Imports** *(US$ millions)*	**Exports** *(US$ millions)*	**Imports** *(US$ millions)*
Dairy	244.7	1.1	-21.9	9.4
Meat	6.0	1.3	-238.4	19.1
Wool	33.3	0.1	2123.5	8.3
Other Animal Prod.	55.5	0.6	73.0	4.4
Horticulture	25.3	3.0	-24.1	22.0
Rice	-0.0	0.2	-4.5	2.0
Cereal	-0.0	0.6	-324.7	0.5
Bev. & Tobacco	-0.9	1.8	-14.0	7.2
Other Food	96.3	24.2	-77.9	89.2
Forestry	-4.4	-0.0	-0.4	0.2
Fisheries	-2.1	0.4	4.3	0.8
Raw M&M	16.1	3.6	956.9	239.9
TCF	190.1	229.9	969.9	1867.7
Wood	-15.3	35.5	42.2	225.6
M&M Manu.	11.3	97.4	344.8	648.6
Other. Manu	-36.1	151.3	221.7	1103.2
Services	-113.5	68.3	-453.7	322.2
Total	**506.2**	**619.2**	**3576.7**	**4570.2**

SOURCE: Model simulation

TABLE 7.14 *– Welfare Effects resulting from a CER-China FTA under the Chinese High-Growth Scenario*

	Welfare (EV)	**Welfare (% of GDP)**	**Allocative Efficiency**	**Terms of Trade**	**I-S Effect**
New Zealand	218.8	0.23%	42.6	177.2	-1.1
China	312.6	0.02%	794.6	-292.0	-190.0
Australia	1907.2	0.30%	445.0	1365.4	96.8
Total	**820.9**	**0.00%**	**824.8**	**-3.8**	**-0.2**

SOURCE: Model simulation and author's calculations

FTAs due to deteriorating terms of trade, with Japan ($306 million) and the EU ($468 million) seeing the largest decreases. Global welfare increases in this model by US$821 million, attributed entirely to improved allocation of resources resulting from the removal of distortionary tariffs by the three countries, this gain is significantly larger with the inclusion of the FTA between Australia and China.

***TABLE 7.15** – Welfare Effects of China signing FTA with only Australia*

	Welfare (EV)	Welfare (% of GDP)	Allocative Efficiency	Terms of Trade	I-S Effect
New Zealand	-94.9	-0.10%	-8.3	-87.6	0.9
China	204.0	0.01%	672.1	-286.8	-181.3
Australia	2012.9	0.32%	447.7	1463.9	101.2
Total	**725.3**	**0.00%**	**729.4**	**-3.8**	**-0.2**

SOURCE: Model simulation and author's calculations

For comparative purposes *Table 7.15* below shows the effects on welfare when considering only a FTA between Australia and China. This confirms the adverse effect to New Zealand from the carrying out of this FTA. Out of the four possible scenarios for New Zealand a FTA between Australia and China is the worst (-$95 million), followed by no FTA with China by either country ($0), then FTAs with China signed by both nations ($219 million), and finally the best scenario is an exclusive FTA with China ($415 million).

7.4. Indian Economic Growth

Given the impact that Chinese growth has had on the world economy it was considered worthwhile to examine India, another large emerging economy with which New Zealand is currently negotiating a free trade agreement. Simulations were done based on slow (3%), medium (6%), and high (9%) growth rates over the next ten years and the welfare effects are shown for selected countries in *Table 7.16*. While welfare does improve in New Zealand these gains are substantially smaller than the positive effects realised from the Chinese economic growth scenarios. For example, in the high-growth scenario welfare gains amount to US$28.1 million (0.029 percent of GDP), most of which is derived from an I-S pricing effect. Outside of India, MENA, a major oil exporting region, are expected to see the greatest welfare gains from Indian growth. Conversely, it is the South-east Asian regions, especially China, that suffer small welfare losses in these Indian growth simulations. Overall, global welfare, excluding India, increases by almost US$40 billion. The final column in *Table 7.16* shows the welfare effects from simulating high growth in both China and India. This specifies that global economic welfare improves by

US$2.82 trillion of which 66 percent goes to China, 26 percent to India, and the remaining eight percent to the rest of the world.

With respect to the effects on production and trade in New Zealand resulting from high Indian economic growth, as summarised in *Table 7.17*, the wool industry sees the largest gains with output rising by 8.3 percent and export receipts increasing by 25.4 percent, stimulated by a five-fold surge in exports to India. Production and exports are also up for forestry and raw minerals and metals. However New Zealand exports of dairy and meat are both down which is symptomatic of India's relative strength in these industries. Overall, both export receipts and import payments are slightly lower and thus there is a minimal effect on New Zealand's trade balance. Prices generally remain relatively stable.

TABLE 7.16 *– Welfare Changes to Selected Regions under Indian High-Growth Simulation*

	Slow Growth India	Medium Growth India	High Growth India	High Growth India and China
New Zealand	6.0 (0.01)	12.5 (0.01)	28.1 (0.03)	739.5 (0.77)
China	-389.8 (-0.02)	-947.1 (-0.06)	-1961.0 (-0.12)	1854945.5 (110.8)
Australia	748.7 (0.12)	1777.3 (0.28)	3289.0 (0.52)	12327.5 (1.93)
India	191026.4 (29.8)	436626.9 (68.1)	747735.3 (116.6)	733326.9 (114.4)
MENA	3452.9 (0.24)	8370.8 (0.59)	15597.5 (1.09)	41829.6 (2.93)
Total (exc. India)	9267.3 (0.02)	21557.3 (0.05)	39672.4 (0.10)	233152.8 [a] (0.58)

SOURCE: Model simulation and author's calculations. Welfare as a percentage of GDP shown in parentheses. [a] Excludes both India and China.

Lastly, a simulation of a potential NZ-India FTA was carried out on the basis that all bilateral tariffs would be eliminated by 2020. The main implication for New Zealand is that exports to India would more than double; however much of these gains fall outside the agricultural sector with wool the only exception. Imports from India would increase by a comparatively small 23 percent mostly consisting of textiles and

clothing. The overall effect of the New Zealand economy, while small, is that welfare gains worth approximately US$100 million are achieved, as shown in *Table 7.18*. Of concern for India is that very minor welfare losses are expected and consequently may hinder the possibility of a comprehensive FTA.

TABLE 7.17 *– Sectoral Effects to New Zealand from High Growth in India*

	Δ Exports (percent)	Δ Imports (percent)	Δ Price (percent)	Δ Output (percent)
Dairy	-0.57	-1.85	-0.26	-0.23
Meat	-3.06	-2.26	-0.29	-1.78
Wool	25.43	-4.09	0.12	8.30
Other Animal Prod.	0.52	-1.78	-0.31	-1.08
Horticulture	0.73	-0.31	-0.26	0.58
Rice	-1.02	-0.19	-0.26	0.23
Cereal	1.61	-0.89	-0.28	-0.10
Bev. & Tobacco	0.00	-0.36	-0.22	0.06
Other Food	-0.38	-0.47	-0.20	-0.02
Forestry	16.79	1.40	1.68	3.98
Fisheries	0.69	-0.07	-0.06	0.11
Raw Min. & Metals	13.67	0.70	1.94	6.46
TCF Products	-5.77	-0.29	-0.41	-3.09
Wood Products	-1.02	-0.25	-0.04	-0.33
Min. & Metal Manu.	-0.81	0.00	0.30	-0.32
Other Manufactures	-2.40	-0.22	-0.17	-0.95
Services	-0.45	-0.01	-0.32	0.00
Total	**-0.13**	**-0.11**		

SOURCE: Model simulation

TABLE 7.18 *– Welfare Changes to New Zealand and India resulting from FTA*

	Welfare (EV)	Welfare (% of GDP)	Allocative Efficiency	Terms of Trade	I-S Effect
New Zealand	103.0	0.11	15.142	89.791	-1.931
India	-28.9	-0.00	-7.25	-20.519	-1.175
World	**-26.111**	**-0.00**	**-25.997**	**-0.117**	**0.003**

SOURCE: Model simulation

7.5. Industry Summary

The main purpose of this research was to examine the impact to New Zealand's major agricultural sectors resulting from free trade with China in combination with its economic growth.[83] This section thus summarises the results for the dairy, meat, wool, and forest industries in New Zealand.

7.5.1. New Zealand Dairy Industry[84]

Consumption of dairy products in China under this CGE model is expected to increase more in response to high economic growth over the next ten years than any other food group at 125 percent (or 8.5% p.a.). This result complements the several empirical studies that established that dairy was amongst the most responsive food groups to income. Although production in China is expected to rise to meet much of this added demand there is nonetheless an increased reliance of imported dairy products. With New Zealand being a major dairy producer and exporter it is expected to supply 35 percent of China's additional import requirements and in the process more than double exports to China over ten years. Total export receipts are lifted by 2.3 percent and dairy production is lifted by 1.5 percent with prices up slightly by 0.2 percent. This translates to a 1.7 percent income growth for the industry.[85]

These gains are complemented by the implementation of the FTA between China and New Zealand with exports to China increasing by a further 91 percent and total export receipts by 4.0 percent in 2020. Dairy production expands by a further 1.5 percent with prices up by 1.7 percent and thus total income for the dairy industry increases by 3.2 percent with the FTA. In total, combining China's high economic growth with the FTA sees the New Zealand dairy industry better off by 5.2 percent in 2020 amounting to $US410 million.

[83] Growth in both China and India is evaluated at nine percent per annum to 2020 in this section unless otherwise stated.

[84] Please refer to Appendix Six, *Table A6.1* for data.

[85] Income growth refers to the product of output growth and price change.

Despite declining exports to China, the New Zealand dairy industry, like most other industries, actually gain from the introduction of Australia into a FTA with China as exports to the rest of the world increase. An increase in production is slightly offset by a decline in prices and in total the Australia-China FTA adds an additional 1.8 percentage points or $US144 million to the industry. Finally, the impact stemming from Indian growth and a NZ-India FTA are both minimal due to India's ability to meet its own rising dairy demands.

7.5.2. New Zealand Meat Industry[86]

As expected, growth in meat consumption in China also performs strongly in response to high economic growth as Chinese consumers opt for more diverse and high-protein diets with larger incomes. Consumption of meat is expected to be 112 percent higher in 2020 (or 7.8% p.a.) which ultimately increases China's imports of meat by over US$1 billion. New Zealand meat exports to China doubles and contributes approximately seven percent of its import growth; however this is more than offset by reduced exports to the rest of the world with total exports receipts down 6.8 percent. Consequently domestic output of meat falls by 4.8 percent with a slight 0.2 percent increase in price. This surprisingly mediocre performance is largely due to demands being put on the fixed land for wool production (as discussed in the next section).

The trend is similar upon the implementation of the NZ-China FTA. Once again exports of meat to China more than doubles which is negated by lower exports to the rest of the world and thus overall exports falls by 4.5 percent. One positive is that prices for New Zealand meat producers increase by 1.7 percent although output declines by 3.8 percent; amounting to a 2.1 percent drop in overall revenue. The meat industry fares better with the inclusion of the potential Australia-China FTA into the model recouping much of the losses from the New Zealand FTA with China. This turnaround again is attributable to wool as the model predicts that New Zealand will lose much of its advantage in wool production with Australia signing an FTA with China. Incorporating Indian growth and FTA into the model follows the same theme as China but on a smaller scale.

[86] Please refer to Appendix Six, *Table A6.2* for data

7.5.3. New Zealand Wool Industry[87]

The New Zealand and Australian wool industries are shown to be extremely sensitive to the economic activities of China. There are two reasons for this; the first being that Australia and New Zealand make up for over ninety percent of Chinese imports, and the other is that China imports make up approximately half of all of the formers' exports.[88] Demand for wool in China increases by 106 percent (7.5% p.a.) over ten years of high economic growth, much of which has to be imported. Consequently New Zealand's exports to China increases more than three-fold with global exports also increasing by 146 percent. Inevitably, domestic output expands significantly along with a 2.8 percent rise in prices which adds up to a 51 percent increase in revenue for the industry. The success and increased profitability of the wool industry resulting from Chinese growth draws resources, namely land, away from other agricultural industries such as meat and dairy.[89]

Further major gains are expected under the FTA with China with exports there almost trebling on top of the gains from Chinese growth and total exports are lifted by an additional 138 percent, much of which is at the expense of the Australian wool industry. With prices increasing by 7.7 percent and output by 70 percent the FTA revenue to the wool sector is boosted by 83 percent. This burst in the growth of exports to China is largely attributed to the fact that wool was the highest protected sector with a 38 percent tariff, however it must be noted that the potential of these gains are limited by the tariff-rate quotas (TRQ) in place for wool.[90] The combined effect of China's growth plus an FTA would see a twelve-fold increase in exports to China, with total exports rising five-fold, total output by 156 percent, and prices by 10.7 percent.

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[87] Please refer to Appendix Six, *Table A6.3* for data

[88] Derived from GTAP base data.

[89] A drawback of the GTAP model is that (sheep) meat and wool compete for resources despite the close relationship (McDougall, 2008)

[90] Unfortunately TRQs cannot be directly modelled within the standard GTAP. A further line of research on the NZ-China FTA would be to modify the GTAP tablo files to include TRQ into the model. A GEMPACK licence is required and instructions by Ken Pearson (2005) accessible via the internet at www.monash.ed.au/policy/gptrqrgt.htm.

These phenomenal gains that are realised under the NZ-China FTA are all but eroded with the inclusion of Australia on a level playing field. The 192 percent increase in wool exports to China from the NZ-China FTA scenario shrinks to just 7.6 percent, amounting to a reduction of over $US500 million in total export receipts. This also filters through as lower output and prices and thus reducing industry earnings. However the large benefits to the wool industry from high growth in China remain unscathed. The impacts of the India-based simulations have much the same effect as China but from a much smaller base.

7.5.4. New Zealand Forest Industry[91]

China sees strong demand for forestry products in response in high economic growth with consumption expected to increase by 127 percent over the ten years (8.5% p.a.). As a result import demand for forestry products is expected to rise by over 400 percent transpiring to lift New Zealand forestry exports to China by 506 percent and increasing total export receipts by 62 percent. With output up by 12.4 percent and prices raised by 7.5 percent this results in a 20.9 percent increase in industry revenue in New Zealand. The effect of high Indian growth has much the same effect on New Zealand forestry although due to India's economy being smaller than China the benefits are on a smaller scale.

While economic growth in both China and India is hugely advantageous to the New Zealand forestry sector, the effects of the FTA with China is minor in comparison. This is because of China having to extend any preferential treatment of many forestry products to all WTO member as a condition of entry, and products exempted from this condition were already subjected to low tariffs. The result of an FTA with India reveals the possibility of minor gains to the sectors.

[91] Please refer to Appendix Six, *Table A6.4* for data

Chapter Eight
CONCLUSION

The main contribution of this research has been to quantify the effects of China's growth on New Zealand within a computable general equilibrium framework. In general, the GTAP results of this thesis are in line with other studies discussed in Chapter 6.4, namely that South Asia is negatively affected from China's growth while the rest of the world benefits to varying degrees. However previous studies have not modelled New Zealand on its own and have instead aggregated them with Australia or the rest of the world. This research rectifies this and finds that the New Zealand economy benefits from China's growth, especially its agricultural sector. Research was then extended to incorporate New Zealand's FTA with China and the extra gains resulting from China's growth. Finally, India's recent high growth performance and current trade negotiations with New Zealand was also modelled, both of which prove to also be beneficial to New Zealand albeit on a smaller scale.

Since China initiated widespread economic reforms from 1978 she has experienced rapid and unprecedented economic growth averaging over nine percent. As a consequence of strong growth her consumption pattern has changed significantly. Although the expenditure share on food has declined, tastes have gradually shifted away from traditional and towards a Western type diet. Consumption of beef, mutton, dairy products, apples, and kiwifruit in 2007 were at least three times that of 1990, all of which are key exports for New Zealand. Producers in China that have until recently adapted well to the changing domestic consumption patterns are now facing stiffer competition from imports. Given that New Zealand is a land-abundant country with a comparative advantage in agricultural production, a question was posed as to what impact Chinese economic growth and trade relations would have on New Zealand economy, especially in the agricultural sector.

It is useful to look at past trends in bilateral trade with China to evaluate how recent growth has impacted trade relations between the two nations as this provides clues as to what may happen in the future. From virtually no trade in 1972, trade with China is now worth NZ$11.6 billion making them New Zealand's second largest trading

partner in 2010. Major merchandise exports include wool, sheep meat, forestry, and dairy products. Some smaller agricultural export markets have also seen strong growth from a low base; these include kiwifruit, wine, and beef. Imports from China mainly consist of labour-intensive manufactures, especially clothing.

With strong growth in China expected to continue in the medium term a GTAP CGE model was used in this research to evaluate the impact on New Zealand to 2020. A common attempt within other GTAP models on growth impacts is to project the world economy forward to the target year and then implement any shocks based on this updated global economy. A problem with this approach is the heavy reliance on long term projections on a world economy which can take many unpredictable turns, as highlighted by the recent global recession. Instead this research has taken an incremental approach which may be interpreted as the additional impact stemming from Chinese growth over and above the effect of further developments over the next ten years.

Addressing each of the research questions of this thesis in turn, the first asked how agricultural consumption in China would likely evolve with sustained economic growth. Results suggest that China's consumption of all agricultural products would increase, with dairy and forest products most affected. Following on from this, the second questioned how reliant would China be on imports to meet increased demand for agricultural products. It is clear that imports of all agricultural sectors rise significantly relative to output growth.

With reference to the third research question querying what impact China's growth will have on key agricultural exports in New Zealand, results suggest that New Zealand's dairy, wool, other animal products, forestry, and coal are the industries that have the most to gain from Chinese growth. On the flip side all manufacturing aggregations suffer as a result of Chinese growth. Overall, economic welfare improves in New Zealand by 0.73 per cent in 2020 (as measured in E.V. terms) assuming that China continues to grow at nine percent per annum, largely due to better terms of trade.

Another important development has been the recent free trade agreement between New Zealand and China which was also modelled with GTAP under two scenarios –

one using the original GTAP data and the other incorporating the effects of Chinese growth. An FTA with China provides a one-off increase in welfare of 0.19 percent for NZ, however this welfare measure more than doubles to 0.43 percent when accounting for China's growth at an expected rate of nine percent, this provides a positive response to the fourth research question. Wool is the big winner with increased prices by 3.3 (7.7) percent and output by 50 (70) percent and there are more moderate gains to dairy, cereals, and textiles. Despite some fears, there is a positive impact on both unskilled and skilled labour. China does not appear to benefit directly from an FTA with NZ. This is not surprising given that New Zealand is very small relative to the Chinese economy and had minimal protection prior to the FTA. An important conclusion for New Zealand is that China's economic growth extends the advantages gained from a FTA with them. However if Australia, a close competitor in many of New Zealand's export markets, also sign a FTA with China, some of these gains will be eroded. In total, the combined impact of high economic growth in China and the free trade agreement with them lifts economic welfare of New Zealand by 1.16 percent by 2020 holding growth and policy in other countries constant. It must be recognised nonetheless that the global economy is a very dynamic system and as such any results obtained here will be affected by changes of other economic events, especially involving New Zealand or China.

TABLE 8.1 *– Simulated Welfare Effects on New Zealand under various Scenarios measured in E.V. (US$ m.)*

Chinese Growth	Base (no FTA)	NZ-China FTA	ANZ-China FTA
Base	-	181	80
3%	147	243	114
6%	355	319	159
9%	700	415	219
12%	1352	521	296

SOURCE: Model simulation

The possibility that Chinese growth may deviate from the high growth scenario of nine percent was considered throughout the research and a summary of the welfare effects on New Zealand are summarised in *Table 8.1*. Welfare gains to New Zealand prove to be relatively sensitive to economic growth in China and moderately

sensitive to bilateral trade arrangements. The upshot is that larger China's economic growth leads to more than proportional gains to New Zealand and the positive effects of the FTA agreement signed with them.

The main policy implication for New Zealand is that while a multilateral solution to free trade remains elusive, bilateral trade agreements provide a viable alternative in the meantime. In modelling FTAs with China and India it is New Zealand that receives the greatest welfare gains in both percentage and absolute terms. Conversely, being left out the regional trade agreements can have adverse effects, as evidenced by the Australia-China FTA model. Therefore New Zealand's recent signing of a FTA with China was a sensible decision and current negotiations with other countries, especially India, is highly recommended.

Possible future extensions of this research could be to disaggregate sectors beyond the capabilities of the standard GTAP model in order to evaluate the effects of China's growth on New Zealand agricultural industry with more detail. Secondly, given the importance of wool to free trade with China in this research and being subject to tariff-rate quotas (TRQ), one may wish to incorporate TRQs and other non-tariff barriers into the model. Finally, in terms of objectives of this thesis and the research questions stated in *Section 1.1*, answers have been provided based on established economic theory using a state-of-the-art estimation package.

References

ABARE and MAF. (2006). *Agricultural economies of Australia and New Zealand*. Canberra, AUS: ABARE.

Abbott, M. (2007). *New Zealand and the global economy*. Wellington: Dunmore Publishing.

Aguiar, A. H. and Dimaranan, B. V. (2008). Macroeconomic Data. In B. G. Narayanan & T. L. Walmsley (Eds.), *Global trade, assistance, and production: The GTAP 7 data base*. West Lafayette, IN: Center for Global Trade Analysis, Purdue University.

Anderson, K. and Strutt, A. (1999). Impact of East Asia's growth interruption and policy responses: The case of Indonesia. *Asian Economic Journal, 13*(2), pp. 205-218.

Andriamananjara, S. and Tsigas, M. E. (2003). *Free trade agreements with the United States: What can we learn from 65 simulations?* U.S. International Trade Commission. Washington D.C.

Appleyard, D. R., Field, A. J., and Cobb, S. L. (2006). *International economics* (5th ed.). Boston: McGraw-Hill Irwin.

Arndt, C., Hertel, T. W., Dimaranan, B., Huff, K., and McDougall, R. (1997). China in 2005: Implications for the rest of the world. *Journal of Economic Integration, 12*(4), pp. 505-547.

Arrow, K. J. and Debreu, G. (1954). Existence of equilibrium for a competitive economy. *Econometrica*, *22*(3), 265-290.

Arrow, K. J. and Hahn, F. H. (1971). *General competitive analysis*. Amsterdam: North-Holland.

Baier, S. L. and Bergstrand, J. H. (2001). The growth of world trade: Tariffs, transport costs, and income similarity. *Journal of International Economics, 53*(1), pp. 1-27.

Balassa, B. (1965). Trade liberalisation and "revealed" comparative advantage. *The Manchester School, 33*(2), pp 99-123.

Balassa, B. (1978). Exports and economic growth: Further evidence. *Journal of Development Economics, 5*(2), pp. 181-189.

Balassa, B. (1985). Exports, policy choices, and economic growth in developing countries after the 1973 oil shock. *Journal of Development Economics, 18*(1), pp. 23-35.

Baldwin, R. E. (1997). The causes of regionalism. *The World Economy, 20*(7), pp. 865-888.

Barro, R. J. and Sala-i-Martin, X. (1992). Convergence. *The Journal of Political Economy, 100*(2), 1992.

Baumol, W. J. (1986). Productivity growth, convergence, and welfare: What the long-run data show. *The American Economic Review, 76*(5), 1986.

Behravesh, N. (2009). *Spin-free economics: A no-nonsense, nonpartisan guide to today's global economic debates*. New York: McGraw-Hill.

Bhagwati, J. (1958). Immiserizing growth: A geometrical note. *The Review of Economic Studies, 25*(3), pp. 201-205.

Bhagwati, J. (1992). Regionism versus multilateralism. *The World Economy, 15*(5), pp. 535-556.

Birks, S. (2001). Economic growth in New Zealand. In S. Chatterjee & S. Birks (Eds.), *The New Zealand economy: Issues and policies* (4th ed., pp. 103-120). Palmerston North, NZ: Dunmore Press.

Bosworth, B. P. and Collin, S. M. (2003). The empirics of growth: an update. *Brookings Papers on Economic Activity, 2003*(2), 113-206.

Brockmeier, M. (2001). *A Graphical Exposition of the GTAP Model*. GTAP Technical Paper no. 8. Center for Global Trade Analysis, Department of Agricultural Economics. Purdue University. West Lafayette, IN.

Brown, D. K., Kiyota, K., and Stern, R. M. (2005). *Computational Analysis of the U.S FTAs with Central America, Australia, and Morocco*. Discussion Paper

No. 527. Gerald R. Ford School of Public Policy, The University of Michigan. Ann Arbor, Michigan.

Brown, L. R. (1996). Who will feed China? *The Futurist, 30*(1), 14-18.

Bussolo, M., De Hoyos, R. E., Medvedev, D., and Van der Mensbrugghe, D. (2008). *Global growth and distribution : are China and India reshaping the world*. UNU-WIDER Research Paper No. 2008/29. World Institute for Development Economics Research, United Nations University. Helsinki. Retrieved from www.wider.unu.edu/publications/working-papers/research-papers/2008/en_GB/rp2008-29/

Caetano, J. and Caleiro, A. (2010). To protect or serve? On the economic side of the argument. In B. Hahn & C. Jaeger (Eds.), *Trade liberalization and protectionism: Trade issues, policies and laws* (pp. 175-192). New York: Nova Science Publishers.

Cai, F. and Wang, M. (2004). How fast and how far can China's GDP grow? In Institute of World Economy and Politics (Ed.), *China: An Economics Research Study Series* (Vol. 3). Singapore: Eastern Universities Press.

Chang, J. (1991). *Wild swans: Three daughters of China*. London: HarperCollins.

Chang, J. and Halliday, J. (2005). *MAO: The unknown story*. London: Jonathan Cape.

Chatterjee, S. (2001). International trade structure and policy. In S. Chaterjee & S. Birks (Eds.), *The New Zealand economy* (4th ed., pp. 274-297). Palmerston North, NZ: Dunmore Press.

Chirathivat, S. (2002). ASEAN-China free trade area: Background, implications and future development. *Journal of Asian Economics, 13*(5), 671-686.

Chow, G. C. (2007). *China's economic transformation* (2nd ed.). Oxford: Blackwell Publishing Ltd.

Chow, G. C. and Li, K. (2002). China's economic growth: 1952–2010. *Economic Development and Cultural Change, 51*(1), pp. 247-256.

Chow, G. C. and Lin, A. (2002). Accounting for economic growth in Taiwan and Mainland China: A comparative analysis. *Journal of Comparative Economics, 30*(3).

Debreu, G. (1959). *Theory of value : An axiomatic analysis of economic equilibrium*. New York, NY: Wiley.

Démurger, S. (2000). *Economic opening and growth in China*. Paris: OECD.

Department of Statistics. (1972-80). *External trade of New Zealand*. Wellington: Department of Statistics.

Department of Statistics. (1980-87). *Report and analysis of external trade*. Wellington: Department of Statistics.

DFAT Australia. (2011). Australia-China Free Trade Agreement Negotiations. Retrieved 10 May 2011, from www.dfat.gov.au/fta/acfta/

Diao, X. and Somwaru, A. (2000). An inquiry on general equilibrium effects of MERCOSUR: An intertemporal world model. *Journal of Policy Modeling, 22*(5), 557-588.

Dimaranan, B., Ianchovichina, E., and Martin, W. (2007). *China, India and the future of the world economy: Fierce competition or shared growth?* Policy Research Working Paper, WPS4304. World Bank. Retrieved from http://siteresources.worldbank.org/INTDEBTDEPT/Resources/468980-1206974166266/4833916-1206974192224/PRWP4304.pdf

Dollar, D. (1992). Outward-oriented developing economies really do grow more rapidly: Evidence from 95 LDCs, 1976-1985. *Economic Development and Cultural Change, 40*(3), pp. 523-544.

Edwards, S. (1993). Openness, trade liberalization, and growth in developing countries. *Journal of Economic Literature, 31*(3), pp. 1358-1393.

Emery, R. F. (1967). The relation of exports and economic growth. *Kyklos, 20*(4), pp. 470-486.

Feder, G. (1983). On exports and economic growth. *Journal of Development Economics, 12*(1-2), pp. 59-73.

Feyrer, J. (2009). *Trade and income: Exploiting time series in geography*. NBER Working Paper 14910. NBER. Cambridge, MA.

Frankel, J. A. and Romer, D. (1999). Does trade cause growth? *The American Economic Review, 89*(3), pp. 379-399.

Freund, C. (2010). Third-country effects of regional trade agreements. *The World Economy, 33*(11), pp. 1589-1605.

Fuller, F., Beghin, J., and Rozelle, S. (2007). Consumption of dairy products in urban China: Results from Beijing, Shanghai and Guangzhou. *The Australian Journal of Agricultural and Resource Economics, 51*(4), 459-474.

Fuller, F. H., Huang, J., Ma, H., and Rozelle, S. (2006). Got milk? The rapid rise of China's dairy sector and its future prospects. *Food Policy, 31*(3), 201-215.

Garner, J. (2005). *The rise of the Chinese consumer : Theory and evidence*. Hoboken, NJ: Wiley.

Gehlhar, M. J., Hertel, T. W., and Martin, W. (1994). Economic growth and the changing structure of trade and production in the Pacific Rim. *American Journal of Agricultural Economics, 76*(5), pp. 1101-1110.

Green, M. (2003). Three decades of diplomatic relationships: Expectations and outcomes. In J. Kember & C. Paul (Eds.), *China and New Zealand : A thriving relationship thirty years on*. Auckland: New Zealand Asia Institute, University of Auckland.

Harberger, A. C. (1962). The incidence of the corporation income tax. *The Journal of Political Economy, 70*(3), 215-240.

Hertel, T. W. (1997). Introduction (to GTAP). In T. W. Hertel (Ed.), *Global trade analysis : Modeling and applications*. Cambridge, UK: Cambridge University Press.

Hertel, T. W., Verma, M., Bouet, A., Cranfield, J. A., and Preckel, P. V. (2007). *Global nutrition impacts of rapid economic growth in China and India*. Paper presented at the Tenth Annual Conference on Global Economic Analysis, Purdue University, June 7-9, 2007, West Lafayette, IN. www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2484

Hoekman, B. M. and Kostecki, M. M. (1996). *The political economy of the world trading system: From GATT to WTO*. New York: Oxford University Press.

Hope, S. (1999). *Applied microeconomics*. New York, NY: John Wiley.

Huff, K., McDougall, R., and Walmsley, T. L. (2000). *Contribution input-output tables to the GTAP data base*. GTAP technical paper No. 1. Center for Global Trade Analysis. Purdue University. West Lafayette, IN.

Huff, K. M., Hanslow, K., Hertel, T. W., and Tsigas, M. E. (1997). GTAP behavioral parameters. In T. W. Hertel (Ed.), *Global trade analysis: Modeling and applications*. Cambridge, UK: Cambridge University Press.

Ianchovichina, E., Ivanic, M., and Martin, W. (2008). *The growth of China and India: implications for the countries in the Middle East and North Africa*. World Bank. Wahington D.C. Retrieved from https://www.gtap.agecon.purdue.edu/resources/download/3761.pdf

Ianchovichina, E., Ivanic, M., and Martin, W. (2010). The growth of China and India: Implications and policy reform options for Malaysia. *Asian-Pacific Economic Literature, 24*(2), pp. 117-141.

Ianchovichina, E., McDougall, R., and Hertel, T. W. (1999). *China in 2005 revisited: The implications of international capital mobility*. GTAP Working Paper No. 12. Purdue University. West Lafayette, IN. Retrieved from www.gtap.agecon.purdue.edu/resources/working_papers.asp

Johansen, L. (1960). *A multi-sectoral study of economic growth*. Amsterdam: North-Holland.

Johnson, H. G. (1951). Optimum welfare and maximum revenue tariffs. *The Review of Economic Studies, 19*(1), pp. 28-35.

Johnson, H. G. (1954). Optimum tariffs and retaliation. *The Review of Economic Studies, 21*(2), pp. 142-153.

Johnson, H. G. (1958). *International trade and economic growth : Studies in pure theory*. London: Allen & Unwin.

Johnson, R. (2001). The structure of the agricultural sector. In S. Chatterjee & S. Birks (Eds.), *The New Zealand economy: Issues and policies* (4th ed., pp. 121-137). Palmerston North, NZ: Dunmore Press.

Jones, C. I. (2002). *Introduction to economic growth* (2nd ed.). New York: W. W. Norton.

Kavoussi. (1984). Export expansion and economic growth : Further empirical evidence *Journal of Development Economics, 14*(1), pp. 241-250.

Kohler, H. (1990). *Intermediate microeconomics : Theory and applications* (3rd ed.). Glenview, IL: Scott, Foresman.

Koo, A. Y. C. and Yeh, K. C. (1999). The impact of township, village, and private enterprises' growth on state enterprises reform: Three regional case studies. In O. Schell & D. Shambaugh (Eds.), *The China reader: The reform era* (pp. 321-334). New York: Vintage Books.

Kormendi, R. c. and Meguire, P. G. (1985). Macroeconomic determinants of growth: Cross-country evidence. *Journal of Monetary Economics, 16*(2), pp. 141-163.

Krugman, P. (1991a). Is bilateralism bad? In E. Helpman & A. Razin (Eds.), *International trade and trade policy* (pp. 9-23). Cambridge, MA: MIT Press.

Krugman, P. (1991b). The move towards free trade zones. In Federal Reserve Bank of Kansas City (Ed.), *Economic Review: November/December 1991*.

Krugman, P. (1995). Growing world trade: Causes and consequences. *Brookings Papers on Economic Activity, 1995*(1), 327-377.

Lattimore, R. and Amor, R. (1998). *World dairy policy and New Zealand*. Canterbury, NZ: Commerce Division, Lincoln University.

Lejour, A. (2001). *China and the WTO: The impact on China and the World Economy*. Paper presented at the Greater China and WTO International Conference, Hong Kong.

Lerner, A. P. (1936). The symmetry between import and export taxes. *Economica, 3*(11), pp. 306-313.

Levine, R. and Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *The American Economic Review, 82*(4), pp. 942-963.

Lewer, J. J. (2003). How large is international trade's effect on economic growth? *Journal of Economic Surveys, 17*(3), pp. 363-396.

Lewer, J. J. and Van den Berg, H. (2003). How large is international trade's effect on economic growth. *Journal of Economic Surveys, 17*(3), 363-396.

Lin, J. Y., Cai, F., and Li, Z. (2003). *The China miracle: Development strategy and economic reform*. Hong Kong: China University Press.

Ma, H., Rae, A., Huang, J., and Rozelle, S. (2004). Chinese animal product consumption in the 1990s. *The Australian Journal of Agricultural and Resource Economics, 48*(4).

MacKerras, C., Taneja, P., and Young, G. (1998). *China since 1978* (2nd ed.). Harlow: Longman.

Maddison, A. (1998). *Chinese economic performance in the long run*. Paris, France: Development Centre of the OECD.

MAF. (2009). *Meat: The Future - opportunities and challenges for the New Zealand sheep meat and beef sector over the next 10 to 15 years*. Wellington: Ministry of Agriculture and Forestry.

Mai, Y., Adams, P., Fan, M., Li, R., and Zheng, Z. (2005). *Modelling the potential benefits of an Australia-China free trade agreement*. Working Paper No. G-153. Centre of Policy Studies, Monash University. Clayton, AUS.

Mankiw, N. G., Romer, D., and Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics, 107*(2), 407-437.

Mansfield, E. and Yohe, G. (2000). *Microeconomics* (10th ed.). London, UK: W. W. Norton.

Markusen, J. R. (1975). International externalities and optimal tax structures. *Journal of International Economics, 5*(1), pp. 15-29.

McDougall, R. A. (2008). Disaggregation of input-output tables. In B. G. Narayanan & T. L. Walmsley (Eds.), *Global trade, assistance, and production: The GTAP 7 data base*. West Lafayette, IN: Center for Trade Analysis, Purdue University.

McKenzie, L. W. (1959). On the existence of general equilibrium for a competitive market. *Econometrica, 27*(1), 54-71.

McKibbin, W. J. and Wilcoxen, P. J. (1999). The theoretic and empirical structure of the G-Cubed model. *Economic Modelling, 16*(1), pp. 123-148.

McKinnon, J. (1999). Breaking the mould: New Zealand's relations with China. In B. Brown (Ed.), *New Zealand in world affairs: 1972-1990*. Wellington: Victoria University Press.

Medema, S. G. and Samuels, W. J. (2003). Leon Walras. In S. G. Medema & W. J. Samuels (Eds.), *The history of economic thought : A reader*. New York: Routledge.

Michaely, M. (1977). Exports and growth: An empirical investigation. *Journal of Development Economics, 4*(1), pp. 49-53.

Michalopoulos, C. and Jay, K. (1973). Growth of exports and income in the developing world : A neoclassical view. *A.I.D. Discussion Paper No. 28.* Retrieved 29 May 2011, from http://babel.hathitrust.org/cgi/pt?id=mdp.39015007218301;page=root;view=image;size=100;seq=1

Ministry of Foreign Affairs and Trade. (2008). *Free trade agreement between the government of New Zealand and the government of the People's Republic of China*. Wellington, NZ: Ministry of Foreign Affairs and Trade.

Mitra-Khan, B. H. (2008). *Debunking the myths of computable general equilibrium models*. SCEPA Working Papers. Schwartz Center for Economic Policy Analysis. New York.

Mukherji, A. (1990). *Walrasian and non-Walrasian equilibria : An introduction to general equilibrium analysis*. Oxford, UK: Clarendon Press.

New Zealand Ministry of Foreign Affairs and Trade & China Ministry of Commerce. (2004). *A joint study report on a free trade agreement between China and New Zealand*. Wellington: MFAT.

New Zealand Treasury. (1984). *Economic management*. Wellington: The Treasury.

New Zealand Treasury. (2008). *New Zealand's productivity performance*. Wellington: New Zealand Treasury.

Nicholson, W. and Snyder, C. (2008). *Microeconomic theory* (10th ed.). Mason, OH: Thompson South-Western.

NZIER. (2000) *New Zealand's economic growth: Why has it been so low?* Working Paper 01/02: NZIER.

NZIER. (2009). *Economic progress and puzzles: Long-term structural change in the New Zealand economy, 1953-2006*. Working Paper 2009/6. New Zealand Institute of Economic Research. Wellington.

OECD. (2005). *Economic survey of China*. Paris: OECD.

Ohlin, B. G. (1933). *Interregional and international trade*. Cambridge, MA: Harvard University Press.

Paarlberg, R. L. (1997). Feeding China: A confident view. *Food Policy, 22*(3), 269-279.

Perkins, D. H. and Rawski, T. G. (2008). Forecasting China's economic growth to 2025. In L. Brandt & T. G. Rawski (Eds.), *China's great economic transformation*. New York: Cambridge University Press.

Pugel, T. A. (2003). *International economics* (12th ed.). London: McGraw-Hill.

Rae, A. and Strutt, A. (2004). Doha Proposals for Domestic Payments: Assessing the Priorities. In G. Anania, M. E. Bohman, C. A. Carter & A. F. McCalla (Eds.), *Agricultural policy reform and the WTO : where are we heading?* Cheltenham: Edward Elgar.

Ram, R. (1985). Exports and economic growth: Some additional evidence. *Economic Development and Cultural Change, 33*(2), pp. 415-425.

Ram, R. (1987). Exports and economic growth in developing countries: Evidence from time-series and cross-section data. *Economic Development and Cultural Change, 36*(1), 51-72.

Rana, P. B. (1988). Exports, policy changes, and economic growth in developing countries after the 1973 oil shock : Comment. *Journal of Development Economics, 28*(2), 261-264.

Rivera, S. A. and Tsigas, M. E. (2005). *How does China's growth affect India? An economywide analysis*. U.S. International Trade Commission. Washington D.C. Retrieved from www.gtap.agecon.purdue.edu/resources/download/3590.pdf

Rodriguez, F. and Rodrik, D. (2001). Trade policy and economic growth: A skeptic's guide to the cross-national evidence. In B. S. Bernanke & K. Rogoff (Eds.), *NBER macroeconomics annual 2000*. Cambridge, MA: MIT Press.

Romer, D. (2006). *Advanced macroeconomics* (3rd ed.). New York: McGraw-Hill Irwin.

Sachs, J. D. and Shatz, H. J. (1996). U.S. trade with developing countries and wage inequality. *The American Economic Review, 86*(2), pp. 234-239.

Sachs, J. D. and Warner, A. (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity, 1995*(1), pp. 1-118.

Salvatore, D. (2004). *International economics* (8th ed.). Hoboken, NJ: Wiley.

Scarf, H. E. (1967). On the computation of equilibrium prices. In W. Fellner (Ed.), *Ten economic studies in the tradition of Irving Fisher*. New York: J. Wiley.

Scarf, H. E. and (with the collaboration of T. Hanson). (1973). *The computation of economic equilibria*. New Haven, CT: Yale University Press.

Schell, O. and Shambaugh, D. (Eds.). (1999). *The China reader: The reform era*. New York: Vintage Books.

Scott, J. (1990). Recognising China. In M. McKinnon (Ed.), *New Zealand in world affairs* (pp. pp. 227-252). Wellington: New Zealand Institute of International Affairs.

Shoven, J. B. and Whalley, J. (1972). A general equilibrium calculation of the effects of differential taxation of income from capital in the US. *Journal of Public Economics, 1*, 281-321.

Shoven, J. B. and Whalley, J. (1973). General equilibrium with taxes: A computational procedure and an existence proof. *The Review of Economic Studies, 40*(4), 475-489.

Shoven, J. B. and Whalley, J. (1984). Applied general-equilibrium models of taxation and international trade: An introduction and survey. *Journal of Economic Literature, 22*(3), 1007-1051.

Shoven, J. B. and Whalley, J. (1992). *Applying general equilibrium*. Cambridge, UK: Cambridge University Press.

Smith, L. (2004). *A macroeconomic view of New Zealand*. North Ryde, NSW: McGraw-Hill.

Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarter Journal of Economics, 70*(1), pp. 65-94.

Song, L. (1999). Trade reform and development. In R. Garnaut & L. Song (Eds.), *China: Twenty Years of Economic Reform*. Canberra: NCDS Asia Pacific Press.

Starr, R. M. (1997). *General equilibrium theory : An introduction*. Cambridge, UK: Cambridge University Press.

Statistics New Zealand. (2010). Household economic survey: Year ended June 2010. *Hot Off The Press (25-Nov-2010).*

Swan, T. W. (1956). Economic growth and capital accumulation. *Economic Record, 32*(2), pp. 334-361.

Tan, H. and Cai, L. (2010). Quantitive analysis on the impact of China-New Zealand FTA on both sides' economy. *International Review of Business Research Papers, 6*(6), 132-140.

Taylor, L. and Von Arnim, R. (2006). Modelling the impact of trade liberalisation : A critique of computable general equilibrium models Retrieved from http://www.oxfam.org.uk/resources/policy/trade/downloads/research_trade_liberalisation.pdf?m=234&url=http://www.oxfam.org.uk/resources/policy/trade/downloads/bp92_afghanistan.pdf

The Economist. (1991). Roger's daughter. *320*(August 3, 1991), p. 34.

Thirlwall, A. P. (2002). *The nature of economic growth : An alternative framework for understanding the performance of nations*. Northampton, MA: Edward Elgar Publishing.

Tsigas, M. E. and Wang, Z. (2010). *A general equilibrium analysis of the China-ASEAN free trade agreement*. U.S. International Trade Commission. Washington D.C.

Van Marrewijk, C. (2002). *International trade & the world economy*. New York: Oxford University Press.

Varian, H. R. (1992). *Microeconomic analysis* (3rd ed.). New York, NY: W. W. Norton & Co.

Varian, H. R. (2003). *Intermediate Microeconomics* (6th ed.). New York, NY: W. W. Norton & Co.

Walmsley, T. L. and Hertel, T. W. (2000). *China's accession to the WTO: Timing is everything*. Centre of Global Trade Analysis, Purdue University. West Lafayette, IN.

Watt, L. (1992). *New Zealand and China towards 2000*. Wellington: Institute of Policy Studies.

Winchester, N. (2006). Liberating middle earth: How will changes in the global trading system affect New Zealand? *New Zealand Economic Papers, 40*(1), 45-79.

Winters, L. A. (2004). Trade liberalisation and economic performance: An overview. *The Economic Journal, 114*(493), pp. F4-F21.

Worden, R. L., Savada, A. M., and Dolan, R. E. (1988). China: A country study. Retrieved 16 August, 2010, from http://countrystudies.us/china/87.htm

World Bank. (2010). World Development Indicators & Global Development Finance. , Accessed between 2010-2011, from http://databank.worldbank.org/ddp/home.do

Wu, Z. and Thompson, K. (2003). Changes in Chinese competitiveness in major food products: Implications for WTO membership. *Journal of Chinese Economic and Business Studies, 1*(1), 117-130.

Yang, Y. (1999). Agricultural reform. In R. Garnaut & L. Song (Eds.), *China: Twenty years of economic reform*. Canberra: NCDS Asia Pacific Press.

Yen, S. T., Fang, C., and Su, S. (2004). Household food demand in urban China: A censored system approach. *Journal of Comparative Economics, 32*(3), 564-585.

Young, L. M. and Huff, K. M. (1997). Free trade in the Pacific Rim: On what basis? In T. W. Hertel (Ed.), *Global trade analysis : Modeling and applications* (pp. 235-252). Cambridge, UK: Cambridge University Press.

Yu, X. and Abler, D. (2009). The demand for food quality in rural China. *American Journal of Agricultural Economics, 91*(1), pp. 57-69.

Zhang, H. and Nie, Y. (2008). Goods trade between China and New Zealand: Development and prospect. *Journal of International Trade, 9*(9), pp. 52-57.

Appendices

Appendix One
SELECTED GTAP NOTATION

GTAP Base Data Flows

GOVEXP	Government expenditure
MTAX	Import tax revenue (or subsidy)
NETINV	Net Investment
PRIVEXP	Private household expenditure
SAVE	Savings
TAXES	Domestic tax revenue (or subsidy)
VDEP	Value of depreciation (of capital stock)
VDFA	Value of firms domestic purchases at agents prices
VDFM	Value of firms domestic purchases at market prices
VDGA	Value of government domestic purchases at agents prices
VDGM	Value of government domestic purchases at market prices
VDPA	Value of private household domestic purchases at agents prices
VDPM	Value of private household domestic purchases at market prices
VIFA	Value of firms imports at agents prices
VIFM	Value of firms imports at market prices
VIGA	Value of government imports at agents prices
VIGM	Value of government imports at market prices
VIMS	Value of imports at market prices by source
VIPA	Value of private household imports at agents prices
VIPM	Value of private household imports at market prices
VIWS	Value of imports at world prices by source
VKB	Value of start of period capital stock
VOA (endow)	Output at agents prices of endowments (also EVOA)
VST	Value of exported international trade transportation
VXMD	Value of exports at market prices by destination
VXWD	Value of exports at world prices by destination
XTAX	Export tax revenue (or subsidy)

Variables Analysed

ALLOC	Change in value of allocative efficiency (welfare component)
DQDS	Domestic sales (change)
DQO	Domestic output (change)
DQXS	Bilateral exports by destination and commodity (change)
DTBALi	Trade balance (change)
DTOT	Bilateral exports by destination (change)
ENDW	Change in endowments (welfare component)
IS	Investment-savings effect (welfare component)
pm	Domestic price by commodity (percentage change)
POP	Change in population (welfare component)
pw	World price index (percentage change)
qgdp	Real GDP (percentage change)
qo	Quantity of domestic output (percentage change)
TECH	Change in technology (welfare component)
TOT	Change in value of terms of trade (welfare component)
viwcif	Value of regional imports by commodity (percentage change)
viwcom	Value of world imports by commodity (percentage change)
viwreg	Value of regional imports by destination (percentage change)
viws	Value of imports by source and commodity(percentage change)
vxwcom	Value of world exports by commodity (percentage change)
vxwd	Value of exports by destination and commodity (percentage change)
vxwfob	Value of regional exports by commodity (percentage change)
vxwreg	Value of regional exports by destination (percentage change)
WELFARE	Value of regional welfare change measured in EV terms
yev	Regional income measured in EV terms (percentage change)

Appendix Two
GTAP AGGREGATIONS

TABLE A2.1 – *Regional Aggregations*

Notation	Aggregated Region	Countries
NZL	New Zealand	New Zealand
CHI	China	China
AUS	Australia	Australia
JAP	Japan	Japan
HKT	Hong Kong and Taiwan	Hong Kong Taiwan
SEA	Southeast Asia	Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam, Southeast Asia n.e.c.
IND	India	India
RSA	Rest of South Asia	Bangladesh, Pakistan, Sri Lanka, South Asia n.e.c.
CAN	Canada	Canada
USA	United States of America	United States of America
SCA	South and Central America	Argentina, Bolivia, Brazil, Chile, Columbia, Costa Rica, Ecuador, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela, Central America n.e.c. South America n.e.c.
EU-27	European Union	Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom,

MENA	Middle East & North Africa	Armenia, Azerbaijan, Egypt, Georgia, Iran, Morocco, Tunisia, Turkey, Western Asia n.e.c., North Africa n.e.c.
SSA	Sub-Saharan Africa	Botswana, Ethiopia, Madagascar, Malawi, Mauritius, Mozambique, Nigeria, Senegal, South Africa, Tanzania, Uganda, Zambia, Zimbabwe, Western Africa n.e.c., Central Africa, South Central Africa, Eastern Africa n.e.c., Southern Africa n.e.c.
ROW	Rest of World	Albania, Belarus, Caribbean, Croatia, Kazakhstan, Kyrgyzstan, Korea, Norway, Russian Federation, Switzerland, Ukraine, Oceania n.e.c., East Asia n.e.c., North America n.e.c., EFTA n.e.c., Eastern Europe n.e.c., Europe n.e.c., Soviet Union (former) n.e.c.

TABLE A2.2 – *Sectoral Aggregations*

Notation	Aggregated Sector	Commodities
dairy	Dairy	Raw milk Dairy products
meat	Meat products	Cattle, sheep, goat, horse meat Meat products n.e.c.
wool	Wool	Wool, silk-worm cocoons
o.ani	Other animal products	Cattle, sheep, goats, horses (live) Animal products n.e.c.
hort	Fruit, vegetables, and nuts	Vegetables, fruit, nuts
rice	Rice	Paddy rice Processed rice
cereal	Wheat and grains	Wheat Cereal grains n.e.c.

bevtob	Beverages and tobacco	Beverages and tobacco
o.food	Other foods n.e.c.	Oil seeds Sugar cane, sugar beet Sugar Plant-based fibres Crops n.e.c. Vegetable oils and fat Food products n.e.c.
forest	Forestry products	Forestry
fish	Fish and seafood	Fishing
mmr	Minerals and metals	Coal Oil Gas Minerals n.e.c. Ferrous Metals Metal n.e.c.
tcf	Textiles, clothing, and footwear	Textiles Wearing apparel Leather products
wood	Wood and paper products	Wood products Paper products, publishing
mmp	Mineral and metal products	Petroleum, coal products Chemical, rubber, plastic products Mineral products n.e.c. Metal products
o.man	Other manufactures	Electronic Equipment Motor vehicles and parts Transport equipment n.e.c. Machinery and Equipment n.e.c. Manufactures n.e.c.
service	All services	Electricity, gas, and water distribution (3) Construction (1) Trade (1) Transport (3) Communication (1) Financial and business services (3) Public Administration (1) Dwellings (1) Other Services (1)

Appendix Three
SELECTED GTAP DATA

List of Tables

TABLE A3.1 *– Changes in Production and Trade Volumes in China under various growth scenarios*

	DQO China Output				DQXS China Exports				DQXS China Imports			
	3%	**6%**	**9%**	**12%**	**3%**	**6%**	**9%**	**12%**	**3%**	**6%**	**9%**	**12%**
Dairy	1167	2675	4679	7509	-8	-13	-12	3	180	410	688	943
Meat	5345	11980	20319	31290	-60	-110	-155	-26	254	574	985	1405
Wool	1037	2345	4061	6608	-18	-29	-38	-43	369	858	1562	2519
O. Animal	27331	60246	99703	147118	-200	-367	-519	-599	709	1646	2917	4502
Hort	28044	60232	98684	145190	-369	-634	-849	-911	367	831	1435	2113
Rice	10445	21869	35023	50204	19	39	49	71	54	115	192	274
Cereal	4775	10657	17876	27054	-77	-139	-193	-212	569	1301	2260	3351
Bev & Tob	13296	29326	48827	72137	143	317	536	851	100	206	317	418
O. Food	25269	55032	90286	133910	217	300	38	50	4531	10229	17694	27087
Forestry	12303	27454	45319	65832	-26	-67	-100	-118	1232	3790	9139	19557
Fisheries	8903	19356	31263	44928	-322	-590	-817	-961	135	347	723	1335
MMR	63174	142435	238157	356041	-2071	-4655	-7622	-10114	27882	70556	139361	248973
TCF	96802	220642	389581	635721	33792	75130	131446	216691	3844	7668	11036	12998
Wood	52244	121111	212571	333622	7530	16383	27151	39784	2196	4772	7707	11169
MMP	313263	735950	1314219	2119560	28072	62430	107106	168628	25184	54775	88728	126692
O. Manu	405066	978581	1813057	3062798	142899	344934	652048	1151040	56705	118672	179510	228294
Services	605274	1400715	2417082	3679226	14238	34186	64134	114047	10927	22647	34039	43237

SOURCE: GTAP simulation; values based on constant base-year prices and exclude any subsequent price effects.

TABLE A3.2 *– China's Self-Sufficiency by Commodity under various growth scenarios*

SUFFICIENCY	BASE	3%	6%	9%	12%
Dairy	0.894	0.884	0.877	0.875	0.882
Meat	1.029	1.008	0.993	0.982	0.979
Wool	0.794	0.767	0.746	0.727	0.717
O. Animal	0.997	0.991	0.986	0.983	0.980
Hort	1.012	1.004	0.999	0.995	0.993
Rice	1.003	1.001	1.000	0.999	0.998
Cereal	0.943	0.930	0.921	0.913	0.910
Bev & Tob	1.004	1.002	1.001	1.000	1.000
O. Food	0.964	0.935	0.910	0.887	0.869
Forestry	0.934	0.928	0.915	0.896	0.871
Fisheries	1.022	1.009	1.001	0.995	0.993
MMR	0.800	0.765	0.730	0.691	0.649
TCF	1.446	1.433	1.420	1.416	1.429
Wood	1.066	1.070	1.070	1.068	1.065
MMP	0.955	0.958	0.961	0.966	0.972
O. Manu	1.056	1.091	1.129	1.180	1.253
Services	1.000	0.999	1.000	1.002	1.007

SOURCE: GTAP simulation

TABLE A3.3 *– Allocation of China's Additional Imports from Each Region under the high-growth scenario*

DQXS	NZL	HKT	AUS	JPN	IND	USA	CAN	EU_27	SSA	SC_AMER	MENA	SE_ASIA	STH_ASIA	ROW	Total
Dairy	242.7	1.9	47.9	1.8	1.7	84.3	7.7	248.6	1.3	4.8	9.5	11.1	0.4	23.9	687.7
Meat	78.1	12.2	94.0	1.1	0.2	270.1	86.4	181.6	4.2	222.4	6.6	11.5	0.1	16.3	984.9
Wool	209.9	1.1	1019.8	0.9	5.3	25.8	7.3	160.6	3.0	34.5	13.5	0.2	4.9	75.1	1561.7
O. Animal	195.2	69.4	434.7	34.6	2.0	996.5	196.4	750.1	17.9	27.7	10.4	83.5	0.3	98.0	2916.6
Hort	35.5	8.0	18.2	4.3	15.9	180.3	16.7	32.7	19.4	78.0	49.8	871.7	2.0	102.7	1435.2
Rice	0.0	0.2	0.0	0.4	1.8	0.1	0.0	0.7	0.5	0.7	0.6	185.1	0.8	1.3	192.3
Cereal	0.0	0.0	494.1	0.0	2.2	887.8	814.5	39.9	3.5	1.0	6.5	0.8	0.0	9.3	2259.7
Bev & Tob	0.7	45.7	5.2	7.6	0.4	24.7	3.6	170.0	3.0	18.5	3.6	19.2	0.1	14.6	316.8
O. Food	109.6	137.9	175.3	263.0	234.9	5556.3	496.4	702.1	557.6	5099.3	93.8	2882.7	42.4	1342.3	17693.8
Forestry	264.7	38.4	109.3	12.6	16.2	532.4	90.8	537.9	1400.7	27.6	9.7	2308.3	6.9	3783.9	9139.4
Fisheries	1.6	7.9	17.8	13.5	1.4	14.0	27.5	41.2	11.2	21.0	6.8	124.0	6.5	428.5	722.8
MMR	167.3	3913.5	9757.7	7937.3	6453.4	4802.0	3505.9	8709.1	17399.5	16233.4	30385.0	10185.9	142.2	19768.4	139360.8
TCF	26.8	3214.0	60.7	2076.0	197.0	429.4	57.9	1334.0	16.8	311.2	59.5	710.9	374.3	2167.4	11035.7
Wood	88.1	842.9	65.6	678.6	15.0	1437.0	692.4	1472.7	28.8	560.5	14.5	1170.5	0.4	640.2	7707.2
MMP	74.3	14919.9	375.1	16657.0	866.9	8476.6	1346.4	12523.0	238.1	1305.8	3283.2	10822.9	19.1	17819.3	88727.6
O. Manu	27.1	25930.5	174.7	40826.9	353.6	16881.3	982.2	35964.8	108.0	1404.8	458.8	29848.0	9.9	26539.7	179510.3
Services	96.6	7224.4	284.6	1191.1	322.7	4499.6	647.6	14359.6	327.2	684.7	1307.0	1128.4	81.0	1884.9	34039.4
Total	**1618.1**	**56367.8**	**13134.6**	**69706.7**	**8490.8**	**45098.3**	**8979.7**	**77228.4**	**20140.8**	**26036.0**	**35718.8**	**60364.8**	**691.2**	**74715.7**	**498291.7**

SOURCE: GTAP simulation; values based on constant base-year prices and exclude any subsequent price effects.

TABLE A3.4 *– Share of China's Additional Imports from Each Region under the high-growth scenario*

DQXS	NZL	HKT	AUS	JPN	IND	USA	CAN	EU_27	SSA	SC_AMER	MENA	SE_ASIA	STH_ASIA	ROW	Total
Dairy	35.3%	0.3%	7.0%	0.3%	0.3%	12.3%	1.1%	36.1%	0.2%	0.7%	1.4%	1.6%	0.1%	3.5%	100.0%
Meat	7.9%	1.2%	9.5%	0.1%	0.0%	27.4%	8.8%	18.4%	0.4%	22.6%	0.7%	1.2%	0.0%	1.7%	100.0%
Wool	13.4%	0.1%	65.3%	0.1%	0.3%	1.7%	0.5%	10.3%	0.2%	2.2%	0.9%	0.0%	0.3%	4.8%	100.0%
O. Animal	6.7%	2.4%	14.9%	1.2%	0.1%	34.2%	6.7%	25.7%	0.6%	0.9%	0.4%	2.9%	0.0%	3.4%	100.0%
Hort	2.5%	0.6%	1.3%	0.3%	1.1%	12.6%	1.2%	2.3%	1.4%	5.4%	3.5%	60.7%	0.1%	7.2%	100.0%
Rice	0.0%	0.1%	0.0%	0.2%	0.9%	0.1%	0.0%	0.4%	0.3%	0.3%	0.3%	96.3%	0.4%	0.7%	100.0%
Cereal	0.0%	0.0%	21.9%	0.0%	0.1%	39.3%	36.0%	1.8%	0.2%	0.0%	0.3%	0.0%	0.0%	0.4%	100.0%
Bev & Tob	0.2%	14.4%	1.6%	2.4%	0.1%	7.8%	1.1%	53.6%	1.0%	5.8%	1.1%	6.1%	0.0%	4.6%	100.0%
O. Food	0.6%	0.8%	1.0%	1.5%	1.3%	31.4%	2.8%	4.0%	3.2%	28.8%	0.5%	16.3%	0.2%	7.6%	100.0%
Forestry	2.9%	0.4%	1.2%	0.1%	0.2%	5.8%	1.0%	5.9%	15.3%	0.3%	0.1%	25.3%	0.1%	41.4%	100.0%
Fisheries	0.2%	1.1%	2.5%	1.9%	0.2%	1.9%	3.8%	5.7%	1.6%	2.9%	0.9%	17.2%	0.9%	59.3%	100.0%
MMR	0.1%	2.8%	7.0%	5.7%	4.6%	3.4%	2.5%	6.2%	12.5%	11.6%	21.8%	7.3%	0.1%	14.2%	100.0%
TCF	0.2%	29.1%	0.5%	18.8%	1.8%	3.9%	0.5%	12.1%	0.2%	2.8%	0.5%	6.4%	3.4%	19.6%	100.0%
Wood	1.1%	10.9%	0.9%	8.8%	0.2%	18.6%	9.0%	19.1%	0.4%	7.3%	0.2%	15.2%	0.0%	8.3%	100.0%
MMP	0.1%	16.8%	0.4%	18.8%	1.0%	9.6%	1.5%	14.1%	0.3%	1.5%	3.7%	12.2%	0.0%	20.1%	100.0%
O. Manu	0.0%	14.4%	0.1%	22.7%	0.2%	9.4%	0.5%	20.0%	0.1%	0.8%	0.3%	16.6%	0.0%	14.8%	100.0%
Services	0.3%	21.2%	0.8%	3.5%	0.9%	13.2%	1.9%	42.2%	1.0%	2.0%	3.8%	3.3%	0.2%	5.5%	100.0%
Total	**0.3%**	**11.3%**	**2.6%**	**14.0%**	**1.7%**	**9.1%**	**1.8%**	**15.5%**	**4.0%**	**5.2%**	**7.2%**	**12.1%**	**0.1%**	**15.0%**	**100.0%**

SOURCE: GTAP simulation and authors calculations; values based on constant base-year prices and exclude any subsequent price effects.

TABLE A3.5 *– Percentage Change in Value of Exports resulting from high China Growth*

vxwfob	NZL	CHN	HKT	AUS	JPN	IND	USA	CAN	EU_27	SSA	SC_AMER	MENA	SE_ASIA	STH_ASIA	ROW	vxwcom
Dairy	2.3	-12.8	-3.2	-10.5	9.6	15.7	10.2	5.0	1.5	-7.1	1.3	-2.0	0.0	13.1	-4.8	1.0
Meat	-6.8	-9.6	4.6	-15.9	0.6	26.3	8.0	6.7	1.6	-11.6	2.9	-4.6	-11.2	25.7	-4.7	0.5
Wool	145.9	-64.7	170.8	63.2	199.5	110.5	83.5	257.9	109.2	27.1	64.4	67.2	21.8	131.6	105.3	71.3
O. Animal	35.9	-20.2	31.7	36.6	38.2	7.3	35.0	15.5	6.7	1.2	2.3	0.3	9.0	4.9	7.7	10.1
Hort	3.6	-20.3	8.0	0.6	11.0	8.0	4.5	0.6	1.0	-2.7	0.9	0.1	25.0	6.7	6.2	1.6
Rice	-0.2	8.9	-8.6	-7.6	3.8	7.9	3.6	-0.7	0.9	-1.2	1.4	-1.8	1.1	11.4	-1.5	3.2
Cereal	-1.2	-27.9	-7.0	5.3	5.4	18.0	8.5	21.4	2.7	-1.9	1.4	0.2	-3.8	11.9	-0.5	5.9
Bev & Tob	-1.9	26.8	8.8	-5.1	-0.2	1.8	-0.2	-0.7	-0.8	-2.4	-1.3	-1.2	-1.2	0.8	-1.8	-0.7
O. Food	2.8	-0.6	0.1	-3.8	11.0	12.5	17.4	4.6	1.3	-3.4	9.3	-2.7	3.7	8.9	1.9	4.3
Forestry	62.1	-68.7	175.3	129.5	107.1	37.7	45.7	35.0	30.3	107.5	26.7	19.8	157.8	40.9	116.7	79.2
Fisheries	13.7	-43.8	20.6	20.1	33.2	20.9	11.8	9.1	6.9	8.9	12.7	7.0	22.2	26.3	20.9	8.9
MMR	26.6	-41.0	44.2	20.2	119.5	96.8	40.1	14.4	26.0	11.5	19.9	13.1	20.8	45.3	12.0	17.2
TCF	-31.0	73.7	-13.7	-30.8	5.2	-19.0	-24.6	-22.1	-20.6	-34.6	-26.2	-24.9	-25.8	-11.8	-18.6	1.4
Wood	-9.0	81.6	6.1	-12.7	6.7	3.9	-0.4	-7.1	-2.5	-14.1	-5.7	-9.1	-9.2	3.2	-8.8	1.5
MMP	-5.7	79.2	22.1	-10.4	10.3	-1.2	0.6	-3.7	-0.6	-10.5	-4.9	-9.8	2.1	0.0	-0.1	4.2
O. Manu	-19.6	143.6	1.6	-23.9	-7.8	-12.2	-8.2	-15.5	-8.6	-22.6	-16.6	-20.8	-4.0	-4.2	-7.7	5.0
Services	-0.5	71.3	-0.2	-8.3	4.2	5.5	1.8	2.1	2.4	-6.0	1.0	-2.3	-0.3	6.2	0.5	3.4
vxwreg	-0.8	102.9	3.7	1.5	-1.0	2.4	-1.5	-4.2	-2.8	0.3	-1.9	-0.2	-1.4	-4.1	0.1	5.0

SOURCE: GTAP simulation

TABLE A3.6 *– Percentage Change in Value of Imports resulting from high China Growth*

viwcif	NZL	CHN	HKT	AUS	JPN	IND	USA	CAN	EU_27	SSA	SC_AMER	MENA	SE_ASIA	STH_ASIA	ROW	viwcom
Dairy	-0.5	144.2	5.9	8.8	-0.7	-9.4	-2.6	-2.2	-1.8	5.7	-1.1	2.3	1.1	-11.4	2.3	0.9
Meat	-1.3	121.7	7.5	13.4	-1.6	-10.1	-4.3	-2.1	-2.1	8.1	-0.8	2.5	5.4	-10.0	0.9	0.5
Wool	25.1	217.5	-11.8	42.2	-7.6	-35.2	-0.3	-1.0	-0.2	-13.4	-12.2	-21.2	-12.6	-17.7	-19.5	70.6
O. Animal	-6.2	155.5	-3.1	2.3	-1.5	-6.0	-2.1	0.1	-1.4	2.0	-0.4	0.3	-0.1	-5.6	-4.3	9.8
Hort	1.4	154.9	2.6	3.3	-1.9	-6.4	-0.2	-0.2	-1.6	1.8	-0.2	0.1	3.8	-6.0	0.7	1.5
Rice	0.2	82.7	-2.7	6.9	0.5	-10.0	-2.7	0.3	-1.7	2.7	0.3	1.0	5.3	-5.9	0.9	2.9
Cereal	3.2	143.4	-0.5	8.7	0.4	-8.8	0.1	4.2	-1.4	2.2	0.8	-0.2	2.4	-4.8	-0.5	5.8
Bev & Tob	0.2	58.6	3.2	3.1	-0.3	-3.5	-1.6	-1.7	-1.9	2.3	-0.8	0.6	0.3	-4.5	0.0	-0.7
O. Food	1.2	107.6	2.4	5.2	0.1	-7.3	-1.9	-0.9	-2.2	2.6	0.3	0.7	0.4	-7.2	0.8	4.6
Forestry	4.9	434.0	9.3	6.9	-4.1	-15.7	-1.9	-8.5	-4.1	8.5	-5.2	-5.6	10.5	-15.3	22.8	78.4
Fisheries	6.3	306.9	6.1	4.5	2.5	-5.7	3.1	4.9	0.4	2.1	3.9	2.3	5.0	-5.0	9.7	7.8
MMR	0.0	240.0	11.6	5.8	1.9	5.5	-2.1	1.9	0.9	2.3	3.3	1.8	5.4	-0.4	2.5	17.1
TCF	1.6	39.0	10.1	7.2	9.0	8.7	3.1	-4.3	-1.5	6.8	-0.5	-3.3	-7.1	-4.2	-2.3	2.1
Wood	3.0	58.7	7.5	7.0	5.2	-5.7	2.2	-2.4	-2.0	3.1	-2.7	0.4	-1.1	-5.6	2.0	2.1
MMP	-0.3	76.6	6.6	5.0	3.9	-0.3	0.2	-2.8	-2.0	2.2	-0.6	1.4	0.5	-2.1	1.8	4.5
O. Manu	1.5	65.0	2.7	5.5	14.2	1.0	3.7	-4.4	-1.0	4.2	-2.2	0.7	-2.0	-3.2	0.6	5.4
Services	1.1	56.0	6.3	5.9	0.8	-4.8	-1.8	-2.5	-1.9	4.8	-0.7	2.8	1.6	-5.9	1.8	1.3
viwreg	1.0	88.8	5.3	5.7	5.8	1.3	1.4	-3.2	-1.4	3.7	-1.0	1.0	-0.3	-3.8	1.3	5.3

SOURCE: GTAP simulation

TABLE A3.7 *– Percentage Change in Domestic Output resulting from high China Growth*

qo	NZL	CHN	HKT	AUS	JPN	IND	USA	CAN	EU_27	SSA	SC_AMER	MENA	SE_ASIA	STH_ASIA	ROW
Dairy	1.5	122.4	-0.6	-2.7	0.3	-0.2	0.5	0.8	0.8	-1.0	1.3	0.4	0.4	-0.1	0.3
Meat	-4.8	102.9	-1.1	-7.8	0.4	10.4	0.7	2.9	1.1	-0.3	0.8	0.1	-0.7	2.1	-0.3
Wool	46.9	103.4	115.7	34.5	2.6	1.9	44.1	24.4	57.9	2.6	10.0	-8.7	-0.1	5.5	5.9
O. Animal	2.8	96.2	1.0	0.4	0.8	-0.1	2.0	5.0	1.8	1.4	1.0	0.5	0.8	-0.4	0.4
Hort	1.9	80.5	-0.4	-0.7	0.6	0.6	1.2	0.8	1.2	0.5	1.1	0.5	3.9	0.7	0.5
Rice	0.9	75.8	-1.4	-3.4	-0.1	0.3	2.8	0.5	1.3	-1.2	1.1	-0.9	0.4	0.8	-0.2
Cereal	2.0	95.1	-2.1	1.5	1.3	0.5	4.7	16.6	1.7	0.3	1.9	0.2	-0.5	2.5	0.3
Bev & Tob	-0.1	104.6	1.1	-1.3	0.2	-0.1	0.2	0.5	0.5	0.9	0.3	0.6	0.6	0.0	0.3
O. Food	0.9	81.8	-0.5	-1.1	0.2	0.7	2.2	2.8	0.8	-1.0	3.0	-0.2	1.0	1.3	0.2
Forestry	12.4	126.1	31.8	7.2	1.9	2.2	3.5	-0.6	3.7	12.8	0.6	2.0	18.6	1.2	22.2
Fisheries	2.1	81.3	2.0	1.8	1.8	0.0	1.8	2.7	1.2	1.0	2.1	1.0	2.1	0.6	3.7
MMR	10.1	115.9	12.0	7.3	22.3	12.6	5.8	5.8	11.3	4.6	7.4	3.8	6.1	8.9	4.5
TCF	-20.7	131.1	-16.9	-20.1	-10.6	-8.1	-11.1	-15.3	-8.9	-18.8	-12.1	-18.4	-20.1	-7.9	-16.7
Wood	-3.9	155.8	-2.6	-3.8	-1.2	0.1	-0.6	-3.4	-0.4	-6.4	-2.2	-3.3	-7.0	1.7	-4.6
MMP	-2.9	162.3	5.5	-5.5	0.0	-1.6	-1.3	-2.5	-0.2	-6.2	-1.7	-6.9	-2.0	-0.1	-2.4
O. Manu	-8.4	199.9	-2.2	-11.9	-5.5	-5.0	-4.5	-10.4	-4.5	-11.1	-8.3	-13.2	-3.0	-3.6	-6.5
Services	0.6	138.7	0.4	0.6	0.6	-0.2	0.4	0.7	0.4	0.0	0.6	0.5	1.0	0.4	0.7
CGDS	3.1	112.4	8.0	4.4	3.7	-0.5	2.7	2.2	2.6	7.8	1.4	3.7	6.4	0.4	2.8

SOURCE: GTAP simulation

TABLE A3.8 *– Welfare Effects resulting from NZ-China FTA under the Chinese High-Growth Scenario*

WELFARE	Total	1 alloc_A1	5 tot_E1	6 IS_F1
NZL	415.1	57.6	359.8	-2.3
CHN	-31.7	75.8	-100.9	-6.6
HKT	-25.3	-3.3	-24.7	2.7
AUS	-84.7	-0.2	-81.7	-2.8
JPN	-17.0	-2.1	-20.6	5.7
IND	-7.9	0.0	-6.6	-1.3
USA	-50.6	-5.7	-30.9	-14.0
CAN	3.5	-1.4	4.1	0.8
EU_27	-94.4	-61.1	-37.6	4.3
SSA	1.1	0.1	0.7	0.4
SC_AMER	-15.3	-9.4	-10.0	4.1
MENA	-1.8	-2.3	-1.9	2.4
SE_ASAIA	-28.3	-4.0	-27.2	2.9
STH_ASIA	-11.3	-1.5	-6.9	-2.8
ROW	-23.2	-12.7	-17.1	6.5
Total	**28.1**	**29.6**	**-1.5**	**0.0**

SOURCE: GTAP simulation

TABLE A3.9 *– Welfare Effects resulting from CER-China FTA under the Chinese High-Growth Scenario*

WELFARE	Total	1 alloc_A1	5 tot_E1	6 IS_F1
NZL	218.8	42.6	177.2	-1.1
CHN	312.6	794.6	-292.0	-190.0
HKT	-125.3	-1.1	-139.6	15.4
AUS	1907.2	445.0	1365.4	96.8
JPN	-306.5	-96.0	-249.8	39.3
IND	-151.9	-52.2	-90.0	-9.7
USA	-185.2	-18.5	-101.7	-65.0
CAN	27.7	0.2	22.3	5.2
EU_27	-468.4	-221.6	-268.5	21.7
SSA	-32.8	-3.1	-32.0	2.3
SC_AMER	-44.6	-14.3	-52.7	22.4
MENA	-7.5	-4.5	-19.0	16.0
SE_ASAIA	-184.0	-21.6	-183.4	21.0
STH_ASIA	-66.2	-8.9	-41.3	-16.0
ROW	-73.0	-15.9	-98.5	41.4
Total	**820.9**	**824.8**	**-3.8**	**-0.2**

SOURCE: GTAP simulation

Appendix Four
INDUSTRY SUMMARY DATA

List of Tables

Simulations

Simulation 1 Chinese High Growth (9%)

Simulation 2 NZ-China FTA (GTAP base)

Simulation 3 NZ-China FTA (growth base)

Simulation 4 Chinese High Growth plus NZ-China FTA

Simulation 5 Australia-China FTA (growth base)

Simulation 6 CER-China FTA (growth base)

Simulation 7 Chinese High Growth plus CER-China FTA

Simulation 8 Indian High Growth (9%)

Simulation 9 NZ-India FTA (GTAP base)

Simulation 10 NZ-India FTA (growth base)

Simulation 11 Indian High Growth plus NZ-India FTA

Simulation 12 China and India High Growth (9%)

Simulation 13 NZ-China and NZ-India FTA (growth base)

Simulation 14 China and India High Growth plus NZ-China and NZ-India FTA

***TABLE A4.1** – New Zealand Dairy Industry*

	EXPORTS TO CHINA			EXPORTS TO INDIA			TOTAL EXPORTS			OTHER CHANGES			
	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Output Change	Price Change	Revenue Change	Terms of Trade
Sim 1	183	426	133.3%	*n*	*n*	*n*	3389	3468	2.3%	1.5%	0.2%	1.7%	89.7
Sim 2	183	356	94.9%	*n*	*n*	*n*	3389	3444	1.6%	0.6%	0.8%	1.4%	25.6
Sim 3	426	813	90.6%	*n*	*n*	*n*	3468	3605	4.0%	1.5%	1.7%	3.2%	60.0
Sim 4	183	813	344.7%	*n*	*n*	*n*	3389	3605	6.4%	3.2%	1.9%	5.2%	149.7
Sim 5	426	407	-4.4%	*n*	*n*	*n*	3468	3512	1.3%	1.0%	-0.3%	0.7%	-9.2
Sim 6	426	801	87.9%	*n*	*n*	*n*	3468	3712	7.1%	4.0%	1.0%	5.0%	36.4
Sim 7	183	801	338.3%	*n*	*n*	*n*	3389	3712	9.5%	5.7%	1.2%	7.0%	126.1
Sim 8	*n*	*n*	*n*	1.7	2.2	28.3%	3389	3370	-0.6%	-0.2%	-0.3%	-0.5%	-1.2
Sim 9	*n*	*n*	*n*	1.7	15.7	823.9%	3389	3377	-0.4%	-0.4%	0.2%	-0.2%	5.4
Sim 10	*n*	*n*	*n*	2.2	20.0	818.2%	3370	3338	-0.9%	-0.9%	0.3%	-0.6%	10.1
Sim 11	*n*	*n*	*n*	1.7	20.0	1078.1%	3389	3338	-1.5%	-1.4%	0.0%	-1.4%	8.9
Sim 12	183	406	122.4%	1.7	1.6	-4.4%	3389	3441	1.5%	1.1%	-0.1%	1.0%	85.9
Sim 13	406	772	90.0%	1.6	14.0	764.0%	3441	3550	3.2%	0.7%	1.9%	2.6%	64.1
Sim 14	183	772	322.5%	1.7	14.0	725.9%	3389	3550	4.8%	1.7%	1.8%	3.6%	150.0

SOURCE: GTAP simulation and author's calculations (US$ millions); *n* = not directly relevant

***TABLE A4.2** – New Zealand Meat Industry*

	EXPORTS TO CHINA			EXPORTS TO INDIA			TOTAL EXPORTS			OTHER CHANGES			
	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Output Change	Price Change	Revenue Change	Terms of Trade
Sim 1	74	152	106.2%	*n*	*n*	*n*	3245	3025	-6.8%	-4.8%	0.2%	-4.6%	81
Sim 2	74	165	123.9%	*n*	*n*	*n*	3245	3185	-1.8%	-1.6%	0.8%	-0.8%	24
Sim 3	152	322	111.2%	*n*	*n*	*n*	3025	2888	-4.5%	-3.8%	1.7%	-2.1%	50
Sim 4	74	322	335.5%	*n*	*n*	*n*	3245	2888	-11.0%	-8.2%	1.96%	-6.4%	132
Sim 5	152	146	-4.3%	*n*	*n*	*n*	3025	3092	2.2%	1.5%	-0.3%	1.2%	-9
Sim 6	152	318	108.9%	*n*	*n*	*n*	3025	3031	0.2%	-0.5%	1.0%	0.5%	29
Sim 7	74	318	330.7%	*n*	*n*	*n*	3245	3031	-6.6%	-5.0%	1.21%	-3.9%	110
Sim 8	*n*	*n*	*n*	1.1	1.1	-1.4%	3245	3145	-3.1%	-1.8%	-0.3%	-2.1%	0
Sim 9	*n*	*n*	*n*	1.1	4.2	288.5%	3245	3212	-1.0%	-0.6%	0.2%	-0.4%	5
Sim 10	*n*	*n*	*n*	1.1	4.1	285.2%	3145	3083	-2.0%	-1.2%	0.3%	-0.9%	10
Sim 11	*n*	*n*	*n*	1.1	4.1	279.9%	3245	3083	-5.0%	-3.3%	0.03%	-3.2%	10
Sim 12	74	146	97.4%	1.1	0.9	-20.9%	3245	2917	-10.1%	-6.7%	-0.1%	-6.8%	75
Sim 13	146	305	109.1%	0.9	3.0	249.8%	2917	2756	-5.5%	-4.3%	1.9%	-2.5%	53
Sim 14	74	305	312.7%	1.1	3.0	176.6%	3245	2756	-15.1%	-10.8%	1.83%	-9.1%	128

SOURCE: GTAP simulation and author's calculations (US$ millions); *n* = not directly relevant

***TABLE A4.3** – New Zealand Wool Industry*

	EXPORTS TO CHINA			EXPORTS TO INDIA			TOTAL EXPORTS			OTHER CHANGES			
	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Output Change	Price Change	Revenue Change	Terms of Trade
Sim 1	65.8	283.5	330.8%	*n*	*n*	*n*	147	362	146%	46.9%	2.8%	51.1%	13
Sim 2	65.8	309.2	369.9%	*n*	*n*	*n*	147	365	148%	49.9%	3.3%	54.8%	8
Sim 3	283.5	828.1	192.1%	*n*	*n*	*n*	362	862	138%	69.7%	7.7%	82.7%	45
Sim 4	65.8	828.1	1158.6%	*n*	*n*	*n*	147	862	485%	156.3%	10.7%	183.8%	58
Sim 5	283.5	62.5	-77.9%	*n*	*n*	*n*	362	197	-46%	-25.7%	-2.2%	-27.3%	-6
Sim 6	283.5	305.1	7.6%	*n*	*n*	*n*	362	395	9%	4.6%	1.5%	6.2%	6
Sim 7	65.8	305.1	363.7%	*n*	*n*	*n*	147	395	169%	58.0%	4.4%	65.0%	19
Sim 8	*n*	*n*	*n*	4	25	500.3%	147	185	25%	8.3%	0.1%	8.4%	-1
Sim 9	*n*	*n*	*n*	4	23	450.1%	147	161	9%	3.7%	0.3%	4.1%	1
Sim 10	*n*	*n*	*n*	25	123	390.1%	185	262	42%	17.0%	1.2%	18.4%	3
Sim 11	*n*	*n*	*n*	4	123	2842.2%	147	262	78%	26.9%	1.3%	28.5%	2
Sim 12	65.8	284.5	332.5%	4	19	349.2%	147	385	161%	51.7%	2.7%	55.8%	14
Sim 13	284.5	812.8	185.6%	19	46	144.3%	385	893	132%	68.5%	7.9%	81.9%	48
Sim 14	65.8	812.8	1135.2%	4	46	997.5%	147	893	506%	162.6%	10.8%	191.1%	62

SOURCE: GTAP simulation and author's calculations (US$ millions); *n* = not directly relevant

***TABLE A4.4** – New Zealand Forestry Industry*

	EXPORTS TO CHINA			EXPORTS TO INDIA			TOTAL EXPORTS			OTHER CHANGES			
	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Base Exports	Simulated Exports	Change	Output Change	Price Change	Revenue Change	Terms of Trade
Sim 1	57	346	505.7%	*n*	*n*	*n*	496	804	62.1%	12.4%	7.5%	20.9%	63
Sim 2	57	57	-0.9%	*n*	*n*	*n*	496	492	-0.9%	-0.6%	0.3%	-0.3%	2
Sim 3	346	343	-1.0%	*n*	*n*	*n*	804	796	-1.0%	-0.9%	0.4%	-0.6%	3
Sim 4	57	343	499.8%	*n*	*n*	*n*	496	796	60.4%	19.8%	7.92%	29.2%	66
Sim 5	346	348	0.5%	*n*	*n*	*n*	804	807	0.4%	0.2%	-0.1%	0.1%	-1
Sim 6	346	345	-0.3%	*n*	*n*	*n*	804	800	-0.5%	-0.6%	0.3%	-0.4%	2
Sim 7	57	345	503.8%	*n*	*n*	*n*	496	800	61.2%	20.1%	7.79%	29.5%	65
Sim 8	*n*	*n*	*n*	33	135	303.4%	496	579	16.8%	4.0%	1.7%	5.7%	-9
Sim 9	*n*	*n*	*n*	33	42	25.5%	496	501	1.0%	0.1%	0.3%	0.4%	1
Sim 10	*n*	*n*	*n*	135	166	23.3%	579	601	3.7%	0.7%	0.7%	1.5%	4
Sim 11	*n*	*n*	*n*	33	166	397.3%	496	601	21.1%	6.5%	2.42%	9.1%	-5
Sim 12	57	336	488.0%	33	122	263.8%	496	871	75.5%	14.9%	9.4%	25.7%	79
Sim 13	336	327	-2.7%	122	149	22.7%	871	878	0.9%	-0.5%	0.9%	0.4%	8
Sim 14	57	327	471.9%	33	149	346.4%	496	878	77.0%	25.1%	10.35%	38.0%	87

SOURCE: GTAP simulation and author's calculations (US$ millions); *n* = not directly relevant