External Influences on New Zealand's Economic Potential

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Abstract

This paper discusses a range of external influences on New Zealand external growth.

JEL CLASSIFICATION O1 - Economic Development

KEYWORDS Long-term growth, Potential growth, Environment

Contents

Executive summary

New Zealand's economic prospects will be shaped by external developments. This note considers international thinking on future external economic trends. The discussion considers the range of channels though which external events influence domestic growth prospects through a stylised model of growth convergence. Exercises in projecting economic events over long time frames have many pitfalls. The discussion may provide some useful context to inform long-term fiscal decisions.

Five years after the financial crisis spread through developed economies, economic output remains well-below potential. The next several years will likely see a continued period of slow economic growth, high unemployment and constrained credit in most developed economies. The build-up in leverage in advanced economies is proving to have long-lasting effects on economic output. But over a longer time frame, historical evidence suggests that even large financial crises do not cause permanent reductions in the pace of economic growth.

We may be entering a period of greater international economic volatility. In the near term risks to economic and financial stability remain elevated as countries try and manage down high private and public debt levels without damaging growth. Policy responses are constrained by uncertainty and a mix of technical and political constraints. Recent events are a reminder that financial crises are a reoccurring event and that economies have become more tightly linked. While the financial crisis is the immediate concern, some of the fragilities in advanced economies reflect longer-run pressures for structural change in response to the integration of large emerging economies into the global economy. This process of continued integration of developing economies is likely to continue to shape changes in trade, markets for natural resources, markets for capital and multilateral institutions.

Strong long-term growth in developing countries, particularly in Asia, is expected to remain a feature for decades to come. However, history suggests that a smooth process of catch-up is the exception for developing economies. The process of economic growth will be subject to shocks and reversals for some countries. The speed of development and size of India and China imply that developments in these economies have an increasingly large influence on global markets.

Strong income growth in emerging markets will support demand for natural resources. This will help underpin demand for New Zealand's exports. Some of the improvement in the terms of trade seen since the 2000s is likely to be long-lasting. Emerging markets are likely to become an increasingly important source of trade and investment for New Zealand. As these economies develop the nature of demand will change.

Sustained growth will likely increase pressure on a range of scarce natural resource and the environment. Much of the 20th century saw real prices of natural resources decline despite large increases in demand. The economic relationships that determine the interaction of scarcity and demand growth are substitution possibilities and technological progress. The beginning of the new millennium saw demand increase sharply and there were large increases in relative prices for natural resources.

There was building evidence of environmental pressures, and a strengthening consensus about the need to take preventative measures to slow climate change.

Although there are major uncertainties, our best guess is that resource and environmental constraints will have a moderate dampening influence on growth prospects. Attempts to quantify the constraint conclude that over a 50 year period per capita growth could slow by around 1/5th due to constraints on resources. Estimates of the welfare effect of doubling the atmospheric concentration of greenhouse gases are a few percentage points of GDP. [1] To put this in perspective, it is equivalent to around one year's growth in GDP. While this is a central scenario, the processes of climate change are deeply uncertain and the potential for more abrupt climate change and larger economic impacts cannot be ruled out.

The pace of technological change is central to economic growth prospects. The long-run historical record is one of generally stable productivity for the United States – the country at the technology frontier. The period from immediately before World War II to the early 1970s was characterised by exceptionally strong productivity growth, perhaps as a result of long-lasting but temporary effects from reorganising economic activity around the great inventions of the late 19th century: electric light, electric motors and the internal combustion engine.

The most likely scenario is that technological progress continues at much the same pace since the 1970s. Estimates of future US labour productivity growth cluster around 1.5 percent per annum. Some economists consider that future productivity growth may slow given the lack of general purpose technology breakthroughs in recent decades. ICT technology is the closest to a generally applicable technology with scope for widespread effects on productivity. However, there are different views on whether this broad set of technologies will result in sustained and material improvements in productivity throughout the economy. Technological change in information and communications, transportation, capital markets and management has had a major influence on the globalisation of economic activity.

The post-WWII period saw an unprecedented increase in economic integration. World trade and investment flows increased markedly. Financial markets and production networks became increasingly integrated across economies. The recent financial crisis has raised concerns about the future of globalisation, the costs and benefits of further financial and economic integration, and the effectiveness of regional and multilateral arrangements. Alternative scenarios suggest that a material reduction in integration could substantially reduce world growth prospects.

Economic integration and technological innovation have changed the nature of trade; and influenced patterns of specialisation and the location of economic activity. 'Trade in tasks' emphasises the trend for greater specialisation and spatial separation of production across borders. The potential for a deepening in the tradability of services across borders has been predicted for some time, but in practice services trade integration remains limited. Economists have sought to understand how

[1] This does not suggest any conclusion regarding climate change abatement policies or invalidate incurring costs now to prevent a permanent reduction of welfare lasting into the indefinite future.

a reduction in trade costs and changes in the nature of economic activity influence the location of activity. A key question is whether, over time, these changes leads to greater geographic concentration of economic activity in core countries. How these trends interact and evolve over time is difficult to predict.

The world is in the midst of a fundamental demographic transition. The world population is projected to stabilise by the middle of this century. There will also be more elderly and fewer young. Existing evidence suggest that this will potentially constrain growth in world GDP growth and growth in GDP per capita. If historical associations hold, projected demographic change would result in slower GDP growth (perhaps by as much as ½ a percent by 2050), and lower saving and investment. These estimates are likely to be an upper bound as they make no allowance for changes in individuals' savings and labour supply behaviour or policy changes. Policy responses might potentially include removing disincentives to labour supply for older workers and women, fostering a higher savings and capital accumulation (including public savings), and improving productivity.

Implications for New Zealand

The effect of external influences on New Zealand's economic potential will depend on the characteristics of the New Zealand economy, the extent of economic integration, and the quality of our institutions and policy settings.

New Zealand is in some ways unique among developing countries. It is a small economy that is distant from major centres of economic activity. It is also heavily indebted, has relatively low levels of economic integration, and production that is weighted towards the primary sector.

Geography and economic distance probably constrain our economic potential materially. Although estimates of the size of this constraint suggest there remains significant scope for New Zealand to grow faster than advanced countries over the next 50 years and close the income gap with other advanced countries.

Future international developments will influence the scope for greater economic integration. Some factors are likely to support growth and living standards in New Zealand. These include higher terms of trade for an extended period, faster growth in trading partner incomes as we shift our trade towards Asia, and our location in a region with strong long-term growth prospects. At the same time, the environment will be more challenging along some dimensions.

The prospects for an extended period of economic volatility have risen. As a small nation New Zealand relies on an open transparent and rules-based international system. It is uncertain how effectively these institutions will respond to increased volatility and changes in the international distribution of economic power. New Zealand's size, high levels of private external debt and exposure to commodity price changes make us vulnerable to a period of greater volatility.

Renewable resources – land, water, marine resources and the environment – play an important role in economic activity in New Zealand. As the price for these resources increases the returns from managing them effectively increase. The economic impact of increased demand for resources and environmental constraints will

depend on how domestic institution deal with greater scarcity. Better mechanisms for signalling scarcity can lead to more efficient use within limits. More importantly, prices provide the incentive for innovation to increase the productivity of resource use.

Over long timeframes the quality of underlying institutions is central to longer-term economic growth prospects. Institutional quality refers to broad concepts such as secure property rights, broad opportunities for economic participation, and the effectiveness of institutions in responding to economic change. Objective measures of institutional quality tend to rate New Zealand as among better-performing developed economies, although in the past we have taken some time to adapt to changed circumstances.

Empirical relationships across countries on the determinants of growth emphasise some common themes. Macroeconomic stability, human capital, investment and capital market development, infrastructure, and the quality of product market and regulatory indicators all appear consistently. But these equations do not provide a recipe for growth. Countries can and do use a range of alternative institutions and policies to deliver good economic performance.

Scenarios of long-run growth provide a 'thought experiment' about the broad direction of New Zealand's economic prospects. They suggest that per capita growth over the next 50 years might be somewhere between 1.5% and 2.0% per annum. Growth per capita of greater than 1.5 percent per annum implies that over time the gap in GDP per capita with the leading country (the US) will close over time. Most projections suggest that this gap closes only slowly. Relatively large gaps in income per capita with the frontier would remain in 50 years time. Such an outcome would still represent a significant improvement in economic performance compared with the past 50 years.

The discussion above highlighted a number of trends that may influence economic prospects over the next 40 years. We are certain that the above list will miss some important elements. In addition, the economy is still in the process of slowly recovering from two major shocks and it will continue to be buffeted by shocks in the years ahead. A broad range of outcomes are possible (because our economic performance is dependent on many things) and much will depend of how effectively domestic settings react to changed circumstances.

Thoughts on policy direction

The uncertainties involved inherent in this exercise caution against drawing strong policy conclusions. The recent financial crisis has reinforced that we are far from a reasonable understanding of economic prospects over much shorter time frames. How New Zealand responds to the inevitable shocks that arise will play an important role in longer-term potential growth.

Preserving New Zealand's institutional quality will remain critical to economic performance over long time periods. Institutions that support broad economic participation and ensure effective checks and balances will be critical.

The international environment may be more volatile than we have experienced in the recent past. New Zealand will remain highly exposed to external volatility,

including through our stock of external debt and high exposure to commodity markets. In general, our institutions and policies have been robust to the large shocks of the past 5 years. The period ahead will require a sustained period of adjustment to restore resilience.

Preserving the flexibility in domestic labour and product markets, and strengthening the public and national balance sheet over time would position us to weather future shocks. We need to build on lessons from the crisis and incorporate these into the way the government manages risk. This would include changes in wider settings around financial markets, savings and investment flows, and domestic markets that build resilience to shocks.

Despite significant near-term adjustment and uncertainty there are reasons to be relatively optimistic about New Zealand's long term growth prospects. There is substantial scope for faster growth in New Zealand that would see convergence in per capita incomes with better-performing economies over time. There is no simple policy prospection that can provide a compelling explanation for how to accelerate this convergence; although the following factors are likely to contribute:

- Policies that encourage the accumulation and reward the application of human and physical capital
- Policies that support competitive product, capital and labour markets, including those that facilitate structural change, innovation and technological change
- Policies that support economic integration – cross-border flows of capital, trade and knowledge

Geographic constraints to growth have been a key theme of analysis of New Zealand's economic prospects. Rapid improvements in transport and communications have influenced but not eliminated these issues. Views differ as to the importance attached to this factor as constraint for New Zealand. Our best understanding is that geography may limit New Zealand's scope to completely close the per capita income gap, but that at present we are far from such limits. Economic policies - ranging from how to better manage economic cycles to microeconomic policies that help address the impact of geographical constraints on productivity – could play a role in mitigating these impacts.

Introduction

1. **This note summarises the main external influences on the outlook for New Zealand economic performance over the next several decades.** Such assessments are necessarily challenging and cannot be used to directly inform policy. However, they can provide some context to inform long-term growth assumptions that underpin analysis of fiscal choices.

2. **This note is intended to provide some additional economic context for consideration of New Zealand's long-term fiscal challenges**. It is not an in-depth review of New Zealand policy settings or a comprehensive assessment of the contribution of policy to economic prospects.

3. **Most exercises in thinking about the future suffer from common biases in human thinking.** A crucial bias is that key judgements about the frequency of an event are often based too heavily on how easy it is to recall similar instances. It is important to recognise that this note will suffer from this bias. In particular, the key changes discussed in this note represent the evolution of trends that have already had a material effect on world and New Zealand prospects. It seems improbable that these are the only issues that will be important over such a long time frame.

4. **In order to inform out thinking we draw on the range of available commentary to identify longer-term external trends.** While subject to a wide range of uncertainties, many of these discussions emphasise broadly the same set of factors. These trends are discussed briefly with a view to setting the broad context for New Zealand's future economic prospects.

5. **The challenge is to build a picture of how these trends might influence future growth prospects in New Zealand.** We use a simple model of growth convergence to help think about which influences are likely to be most important and how they may affect New Zealand economic prospects. We supplement this with highly stylised quantitative estimates of New Zealand's long-run growth prospects.

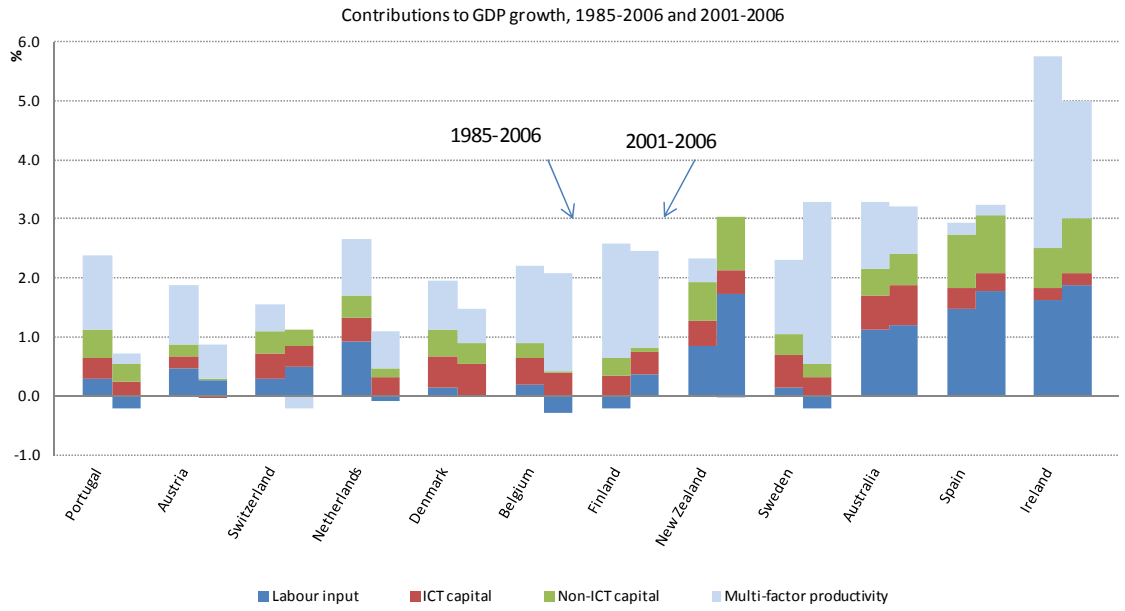
A stylised framework: convergence

6. **Growth accounting provides a framework for understanding the proximate factors underpinning growth.** It attempts to separate growth into contributions from (i) labour inputs; (ii) capital inputs per hour worked; and (iii) multifactor productivity (or the efficiency with which labour and capital are combined). Figure 1 provides a decomposition of output growth into its components for a subset of advanced economies.

7. **The contribution to growth from technological progress is large.** While factor accumulation (human and physical) is closely tied to growth in some cases, growth accounting exercises suggest that the around half of all growth is due to technological progress (Easterly and Levine, 2002). Alternative models of economic

growth all emphasise the central role of technological progress. However, they differ in their explanations of the 'mechanism' that drives technological progress.[2]

Figure 1: Sources of productivity growth



Source: OECD Productivity database

8. **Convergence (or catch-up) provides a framework for considering the key channels through which external influences will impact on New Zealand economic performance.** Convergence models seek to explain how economic growth is transmitted across countries.[3] At its simplest level, it assumes that countries with lower levels of economic output grow faster and so converge to the most productive countries. Figure 2 provides a summary of convergence across OECD countries since the 1970s.

9. **In convergence models the pace of growth in New Zealand will depend on the pace of growth in the technology leader and how quickly we are able to make up the current gap with the most productive countries.** Absolute convergence suggests that countries converge to the same steady state level of output. Conditional convergence allows for the steady-state level of output to differ across countries depending on fundamental factors, including the protection of property rights, quality of institutions and level of government spending (see box 5 for a discussion of the conditions for convergence).

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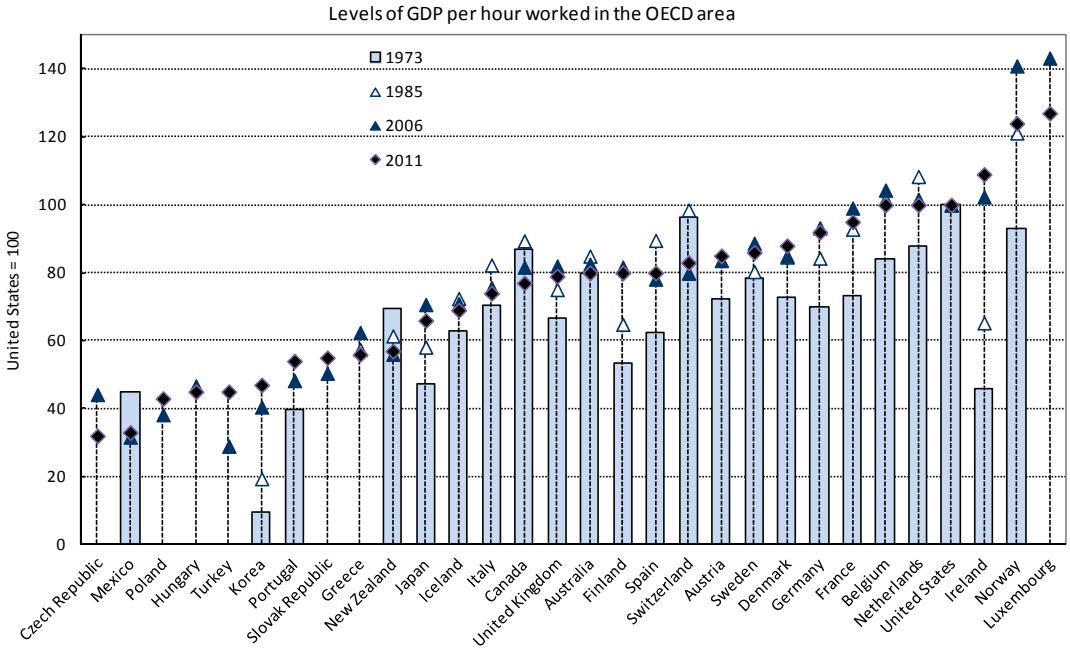
[2] The initial approach was to model the rate of technological progress as exogenous – or not formally modelled as a result of deliberate economic decisions within the growth process. Later growth models seek to understand the rate of technological progress (or economic growth) as a function of the process of economic development itself - technological progress becomes a function of a range of different mechanisms that overcome diminishing returns to capital investment. Common approaches to incorporating technological progress include assuming increasing returns to specific factors (such as spillovers from investment in human capital or knowledge), or the nature of the production process (product varieties). See Stiroh (2001) for a concise summary.

[3] Convergence is a property of exogenous growth models and is a feature of some endogenous growth models.

Figure 2: Labour productivity catch-up



Source: OECD Productivity database

10. **The process of convergence is driven by the accumulation of capital and catch-up to the technology leaders.** The intuition is that knowledge from the most productive countries is able to be adopted and imitated by other countries. This process of adoption is also facilitated by flows of capital driven by the ability to secure higher returns to capital investment in less productive countries. In theory at least, less productive countries have a higher marginal productivity of capital.

11. **The process of convergence for a particular country is determined by the broad quality of domestic policies and institutions.** Policies and institutions determine how effectively countries are able to absorb and adapt technological innovation. The literature discusses the following key aspects of policies and institutions that influence the speed of convergence:

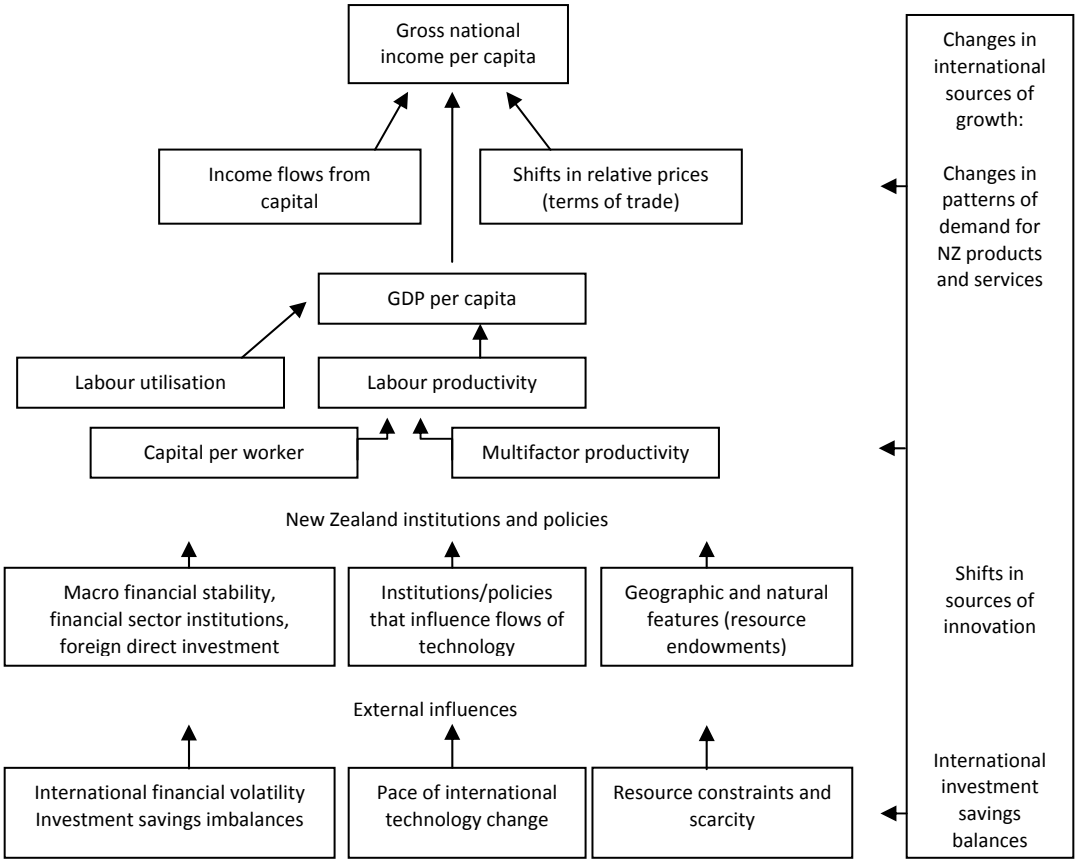
- Macroeconomic and financial stability. Macroeconomic and financial stability provide a stable environment for the accumulation of physical and human capital. On average across countries this factor appears important. Although the relationship appears to be partly a result of poor performance in countries with very unstable macroeconomic settings (Easterly and Levine, 2002).

- The degree of integration, which is often proxied by trade intensity. Integration affects the economies' ability to intermediate and absorb new ideas and technology. Flows of new ideas are often considered as partly embodied in flows of capital and trade.

- Levels of human capital. Human capital levels influence the capacity to understand, adopt and apply external sources of new technology and innovations.

- Quality of domestic institutions, for example institutions that define and secure returns to investment and growth and encourage competition. Regulatory and product market settings are an important focus as they affect the incentives on domestic firms and individuals to invest and innovate.

12. **The diagram below provides a stylised description of external influences on material living standards.** GDP and productivity is based on a growth accounting framework. The framework also traces influences on national income from net income flows from overseas investment, and the relative price of traded goods and services. The external environment influences the pace of capital accumulation, the rate of change of multifactor productivity, and the price of inputs into production. The way in which the external changes influence New Zealand growth prospects are intermediated by institutions and policy choices.



International trends

13. We have organised the discussion by scanning the international literature. This section summarises the several broad themes and identifies several key judgements.

- ***Post-crisis recovery.*** The financial crisis has led to an extended period of slow economic growth, high unemployment and financial repair in most developed economies (IMF World Economic Outlook 2012). A key question is the length of the process of deleveraging, the potential for lasting damage to longer-term growth prospects, and the implications for global trade and investment flows.

- ***Emerging economies.*** Strong long-term growth in developing countries, particularly in Asia, is expected to remain a feature for decades to come. History suggests that this in not inevitable and that it would be unusual to experience a period of widespread sustained convergence in incomes of emerging countries (Rodrick, 2012). Growth prospects in the largest emerging markets have become central to world and New Zealand growth prospects. Key questions involve the pace and sustainability of growth, the impact on supply and demand for key commodities, investment flows, and the competitive impact of large increases in world labour supply.

- ***Pressures on natural resources.*** Growth will increase pressure on a range of scarce natural resources. Much of the 20th century saw real prices of natural resources decline despite large increases in demand (McKinsey Global Institute, 2012). The beginning of the new millennium saw large increases in relative prices for natural resources, building evidence of environmental pressures, and a strengthening consensus about the need to take preventative measures to slow climate change. A key question is the extent to which these pressures constrain growth.

- ***Technological change.*** Growth prospects will be shaped by the future of technological change and its role in driving productivity. Technological change also plays a key role in managing natural resource constraints and in driving changes in prospects for trade and economic integration. There are large uncertainties about the nature of the process of technological change. A central issue is whether the process of innovation and technological change continues at a relatively steady pace or whether there are credible reasons to think that the pace of innovation will slow in the future (Cowen, 2010).

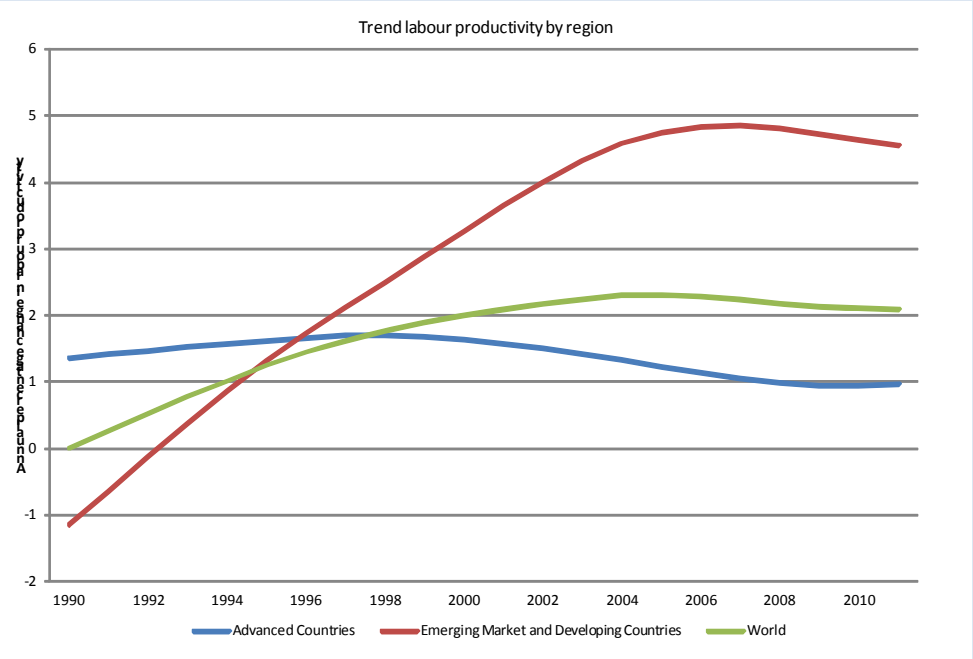
- ***Economic integration.*** The pace of economic integration and its scope has been a defining feature of the economic landscape for the last 50 years (Spence, 2011). Changes in technology and policy have led to significant increases in trade and financial flows. Trade and financial flows have facilitated the changing nature and location of economic activity. The changes have altered demand and prices for natural resources, influenced price developments of many manufactured goods, lifted overall world growth rates, and changed returns to labour within industrial countries. Key questions about economic integration include the risks to the pace of international integration, changes in the nature of trade and specialisation that are likely to result from continued integration, and the environment for international capital, savings and investment.

- ***World demographic transition.*** World population growth is decelerating. By mid-century population in developed economies will be static. By the end of the century world population growth approaches zero. Historical associations between variables suggest the projected demographic change will result in slower GDP growth, and lower saving and investment. Estimates suggest that per capita GDP growth could be lower by as much as ½ a percent compared with a scenario in which the demographic structure remained the same as in 2000. This is likely to overestimate the likely effect of demographic change as it makes no allowance for behavioural changes in the supply of labour or savings and investment.

Box 1: Productivity growth worldwide post-1990

The global financial crisis led to a material slowdown in productivity growth in advanced countries (Chen and others, 2010). The evolution of productivity during the crisis recovery is uneven across countries. Most advanced countries have seen a sharp slowdown in measured productivity as output fell below potential. The exceptions include the United States and Spain where productivity improved in the immediate post-crisis period as employment fell sharply.

Figure 3: World labour productivity post-1990



Source: Conference Board total economy database; Author's calculations; trend extracted using a HP filter

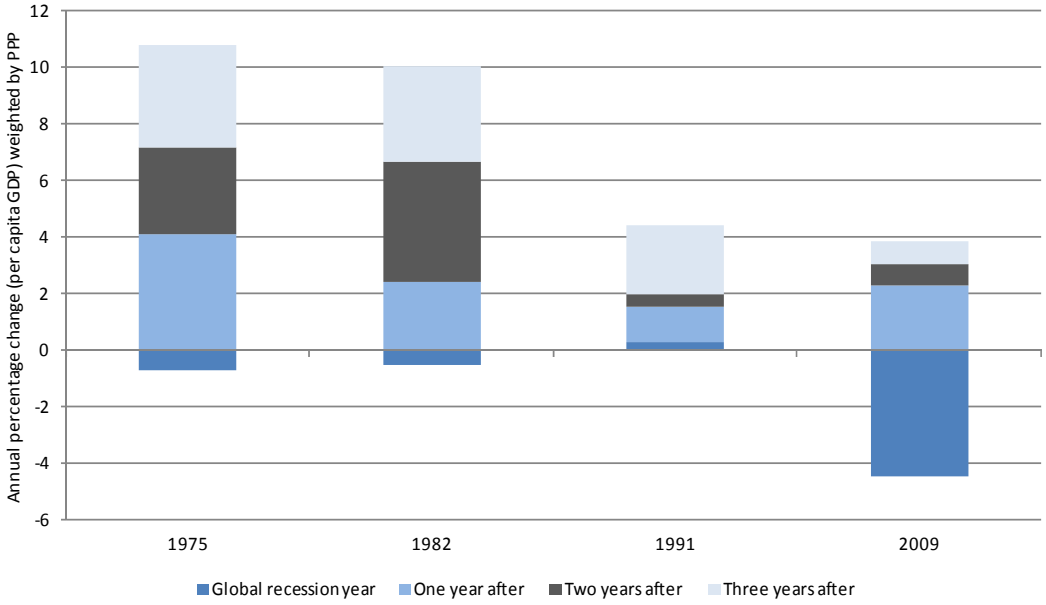
The long-term trend worldwide over the past three decades has been toward faster productivity growth (see figure 3). This is mainly due to emerging and developing economies that have rapidly taken over leadership in productivity growth since the early 2000s. The improvement in productivity growth is a key factor behind the resurgence in growth in emerging markets and a narrowing of income gaps with the advanced countries.

The slow-down in productivity in advanced countries appears to begin in 2000 and pre-dates the global financial crisis. The cause of the slow-down in productivity growth remains the subject of ongoing debate. Some commentators link the slowdown in productivity to cyclical factors – and in particular imbalances that were building pre-crisis. Others argue that the slowdown in advanced country productivity reflects structural impediments to faster productivity growth in many European economies (OECD, 2012) or more fundamental factors related to a slowdown in the pace and returns to technological change (Gordon, 2012).

Post-crisis recovery in advanced economies

14. **Five years after the financial crisis economic output remains well below potential in most developed economies**. Figure 4 compares the current recovery with previous recoveries after global recessions. Output per capita in advanced economies is only slight above pre-crisis levels. Unemployment remains high in many developed economies. Economic forecasts project a continued weak outlook for most of the largest advanced economies (IMF, 2012).

Figure 4: Advanced economies: comparison with previous recoveries



Source: IMF World Economic Outlook April 2010

15. **The large build-up in leverage prior to the financial crisis is central to understanding the long and slow recovery.** Traditional explanations of the crisis focus on the role played by poor financial sector practice and regulatory failures. The initial financial sector crisis led to increased concerns about private sector debt levels. The private sector increased savings and reduced demand sharply in response to falling asset prices and greater uncertainty about income and job prospects.

16. **The public sector began to run larger fiscal deficits to offset this fall in demand.** In the case of some European economies, this has led to elevated concerns about public sector and private sector solvency. The legacy of the crisis has led to an extended period of economic adjustment. Private debt has been reduced marginally, but remains at historically unprecedented levels. Public debt and deficits remain high across most advanced economies.

17. **Some commentators see the underlying causes of the crisis as associated with the longer-term challenge of incorporating larger emerging markets into the global economy.** Various explanations focus on the unbalanced nature of growth with a large build-up in debt and current account deficits in many advanced economies, as a result of increased savings in emerging economies (Bernanke and others, 2011). Others emphasise the role of increases in inequality, partly as a result of structural

changes underway since the 1970s, in driving higher inequality and debt levels (Rajan, 2010).

18. **Even in countries that have managed to restore financial system stability, the recovery from the crisis is slow and GDP remains well-short of long-run trends.** Many advanced economies still face large public deficits and in many cases it will take decades to bring public debt back to pre-crisis levels. Real economic adjustments are also required in response to changes in patterns of demand, exchange rate developments, and rebalancing activity in order to support smaller and more sustainable current account imbalances.

19. **These adjustments will in many cases take decades or more and help shape the external environment facing New Zealand.** The fact that these developments are affecting most advanced economies simultaneously is likely to compound their global effects.

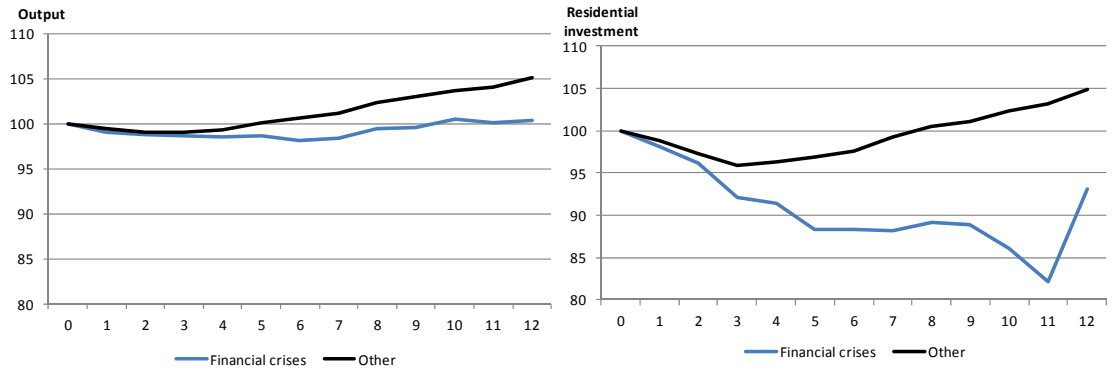
- In the near-term the slow recovery in advanced economies will influence prospects for external demand. In the longer-term, an important question is whether the crisis implies slower growth in the future with implications for pace of longer-term productivity growth in New Zealand.
- The slow and unsteady nature of the recovery to date, and the tension exposed by high debt levels, suggests the potential for more frequent and larger external shocks. The generally stable and benign period of steady growth and low inflation that preceded the crisis may not reoccur.

The uncertain outlook for long-run potential growth

20. **Evidence from past recessions suggests that the fall in output is deeper and recoveries are slower following a financial crisis** (IMF, 2009a). One reason is that financial crises are often associated with a build-up in debt pre-crisis that leads to overheated goods and labour markets, house price booms, and, frequently, a loss of external competitiveness. The recovery is often hindered by efforts to restore balance sheets as a result of the loss of wealth. Damage to the financial sector hinders investment and allocation of capital.

21. **Large adjustments in important asset markets (such as housing) hinder the expansion of sectors that ordinarily are a significant source of economic recovery.** Among advanced countries, the return to potential GDP following recessions associated with financial crises is much longer than the return following other recessions. It takes an average of 9 years for GDP to return to trend following a financial crisis.

Figure 5: Financial crisis recoveries are long and slow



Source: IMF World Economic Outlook, April 2009

Notes: (Median = 100 at t = 0; peak in output at t = 0; data in real terms; quarters on the x-axis)

22. **Recessions that occur at the same time across countries are also longer and deeper, and the subsequent recoveries are weaker and take longer**. Global trade and financial integration have increased the transmission of shocks between countries. The speed and breath of the spread of the crisis between countries through trade and financial channels has been one of the hallmarks of the recent financial crisis. A common adjustment path for a country facing a financial crisis is sharply reduced domestic demand offset by exchange rate adjustment and higher external demand. Such an adjustment path becomes significantly more challenging when demand and output is weak across most developed economies.

23. **The impact of recessions associated with financial crises on output occurs through a combination of lower labour supply, lower capital accumulation and lower multifactor productivity growth.**

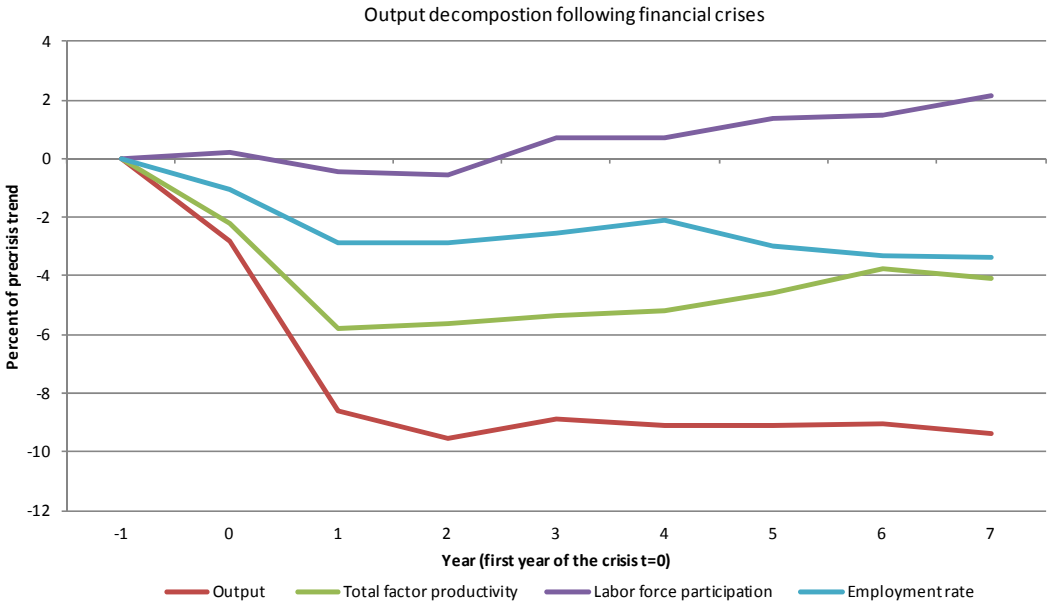
- **Labour supply:** Poor employment prospects can act to discourage labour force participation, while secondary earners may enter the labour market in order to deal with lower income. Underlying structural unemployment may increase if there is a need for substantial reallocation of labour across sectors. Persistently higher long-term unemployment can impair professional and on-the-job skills, making it even more difficult for the long-term unemployed to find jobs (Haugh and others, 2009).

- **Capital accumulation:** Financial crises may slow capital accumulation for a protracted period. Constrained credit supply results from financial sector disruption and is exacerbated by deleveraging, tighter lending standards, and weaker asset prices. Investment may also suffer if the crisis leads to a sustained increase in the cost of capital as a result of uncertainty and higher risk premiums.

- **Productivity:** Theory does not provide clear guidance of the impact on productivity, with some approaches emphasising the potential for positive effect on productivity while others emphasise lower productivity.

24. **Empirical evidence suggests that higher unemployment rates, slower capital accumulation, and lower productivity growth play an important role in explaining medium-term output losses following banking crises.** Output per capita does not recover to its pre-crisis trend because capital per worker, the unemployment rate, and productivity do not typically return to their pre-crisis trends within seven years after the crisis.

Figure 6: Output after a financial crisis (percent of pre-crisis trend)



Source: IMF, 2009

25. **The implications of the crisis for long-term growth rates are less certain.** It is clear that the recovery from the crisis in advanced economies will take an extended period of time. But over a longer time frame the critical question is whether potential growth rates are affected in developed economies.

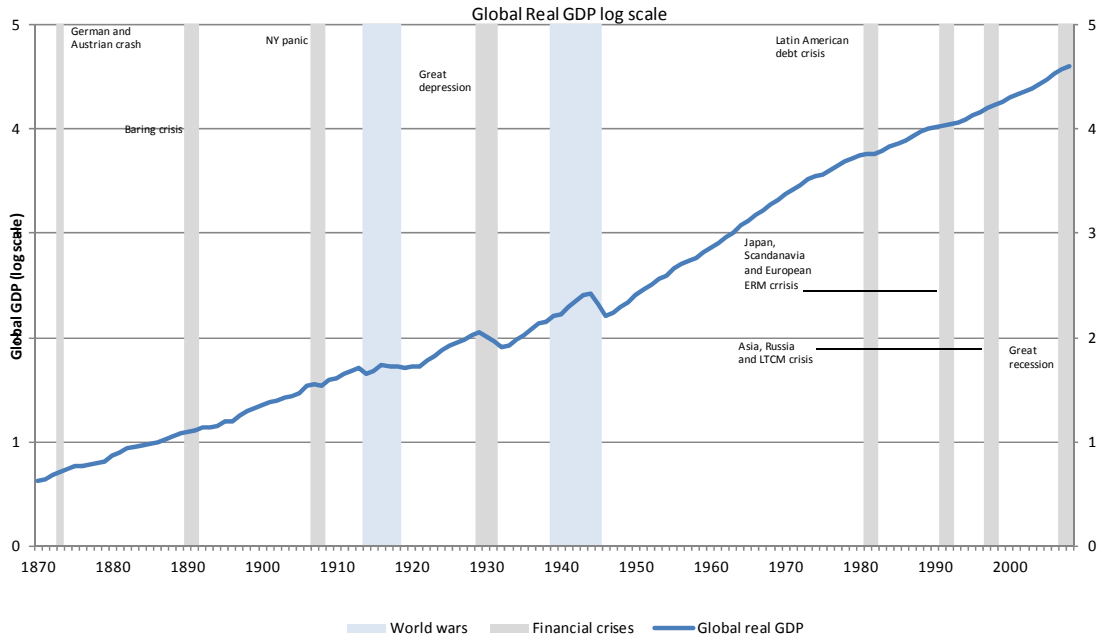
26. **One approach views business cycles as contributing to long-run growth.** Economic cycles are seen as a natural consequence of innovation and business cycles overlapping to create the conditions necessary for economic restructuring that leads to further innovation and growth. This approach suggests that recessions can lead to increases in productivity because innovation offers a higher return than current production in times of low demand. Alternatively, in times of spare capacity the least productive firms exit and resource are reallocated to the more productive surviving firms.

27. **In contrast, other approaches view volatility in output as harming long-term growth potential.** The potential mechanisms include the risk of increased political uncertainty and the loss in productivity improvements when these are determined by learning-by-doing. In the latter cases recessions lead to a decrease in the amount of

resources actually employed and this leads to less 'learning' and lower productivity growth.[4]

28. **Early approaches concluded that long-run productivity growth is very stable (at least in the United States)**. This implies that economic cycles have little impact on long-run growth rates. Evidence from a broader range of countries (Easterly and Levine, 2002) and more in-depth work on the US (Nelson and Plosser, 1982) raised questions about whether business cycles have a more significant detrimental effect on longer-term output.

Figure 7: World output and financial crisis

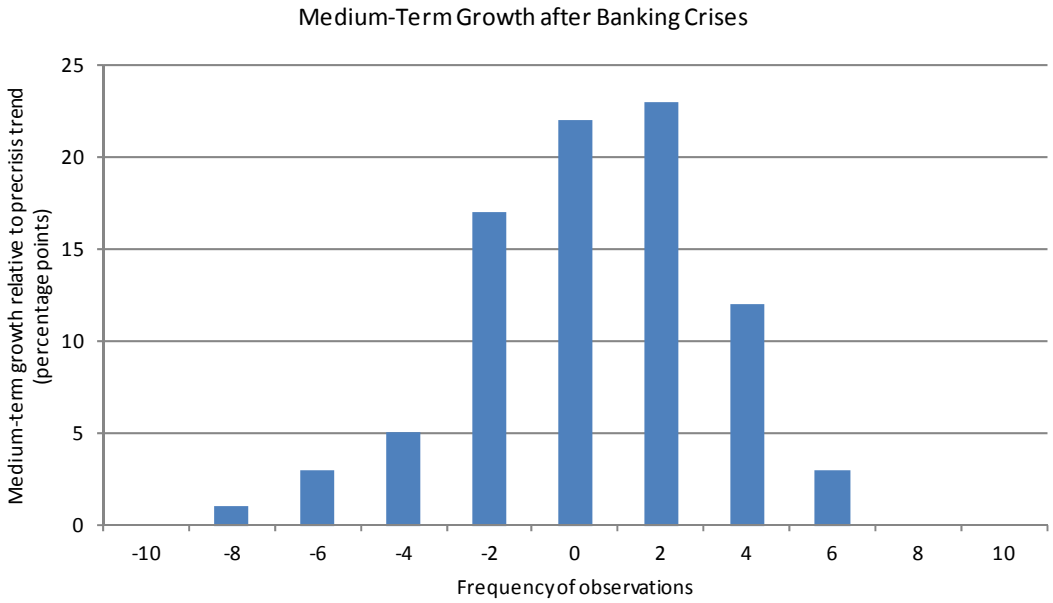


Source: Maddison, Historical studies database; Conference Board total economy database cited in IMF (2009a). Data reflects advanced economies from 1870 and emerging economies from 1950.

29. **Most severe recessions associated with financial crises in advanced countries do not cause permanent reductions in potential GDP growth** (Papell and Prodan, 2011). Potential GDP was restored following the financial crises of 1929 for the United States, 1987 for Denmark, 1989 for Australia, and 1991 for Sweden. The only exception was Finland, where long-run growth was restored – albeit with a reduction in the level of potential GDP following the crisis of 1991. Among emerging markets, in contrast, potential GDP was not restored following recessions associated with financial crises for four of six countries. Figure 8 provides a summary of the distribution of medium-term growth outcomes after a financial crisis.

[4] The key distinction is between models that emphasise that innovation (productivity) is driven by the production of output (firms and individuals 'learn-by-doing') and those that emphasise that innovation (productivity) requires separate resources that are allocated to that purpose. In the first instance lower output reduces productivity (these is less learning because there is less doing) and in the second case a recession can allow faster growth because there are spare resources to more in innovation.

Figure 8: Post-crisis growth



Source: IMF

Note: Medium-term growth is derived as the five-year average growth starting in the fourth year after the crisis.

30. **The overall impact on long-run potential growth will depend partly on the policy response.**

- Evidence suggests that supportive macroeconomic policy responses can impact the path of potential growth in the near-term. To the extent that policy choices result in persistently high public debt levels, this may result in lower growth rates (Kumar and Woo, 2010).
- Analysis suggests that the interaction between macroeconomic shocks and labour and product market rigidities can explain why previous shocks resulted in long-lasting effects on labour supply (Blanchard and Wolfers, 1999). The probability of long-term detrimental effects from the crisis will depend on the extent to which countries are able to address structural policy barriers in labour markets and product markets.
- The timely restoration of better functioning financial markets will impact on capital accumulation and the financing of longer-term technological progress.

A return to a period of greater economic and financial volatility

31. **The decades leading up to the current crisis were characterised by stable output growth and inflation, and higher employment for most advanced economies.** The academic literature struggles to distinguish between the causes of lower volatility (Bean, 2010). One explanation emphasises better macroeconomic policies, supported to some extent by structural reform that led to less rigid price and wage setting. The main innovation was institutional design that allowed credible commitment to more stable prices. The different reaction to similar oil price shocks in the 1970s and 2000s would support this view. The second set of explanations focus

on the role of structural changes (such as the shift towards better inventory management and increased competition or a greater role for services). Both explanations suggest that the reduction in volatility should be long-lasting and permanent. Such explanations, however, don't fully take into account the build-up in debt and financial sector vulnerabilities that became apparent post-crisis.

32. **Alternative explanations attribute the decline in volatility to good luck.** In particular, access to a cheap source of manufactured goods as result of the rapid development of emerging market economies created a terms of trade gain for the advanced countries and a source of downward pressure on prices. Towards the end of the period this led to upward pressure on oil and other commodity prices that preceded the financial crisis. This explanation suggests that the period of stable prices and output may not return.

33. **Stable inflation and output growth helped create the conditions for the subsequent crisis.** Stability in output growth and inflation tended to mask greater levels of financial instability in the post-Bretton Woods era of floating exchange rates and more open capital flows (IMF, 2010). **T**he threats to financial stability during this period were by and large confined to emerging markets, with a series of crisis from the late 1970s (Latin America) through to the early 2000s. There were also important episodes isolated of financial instability in advanced economies.

34. **Over a longer timeframe financial instability occurs at least as often in advanced as developing economies** (Laeven and Valencia, 2012). The decade of 2000s saw a rapid widening of global current account imbalances – and in particular large deficits in the United States and large surpluses in China. There were concerns about whether these imbalances were sustainable or would lead to large and potentially disruptive exchange rate adjustments (Blanchard and others, 2010).

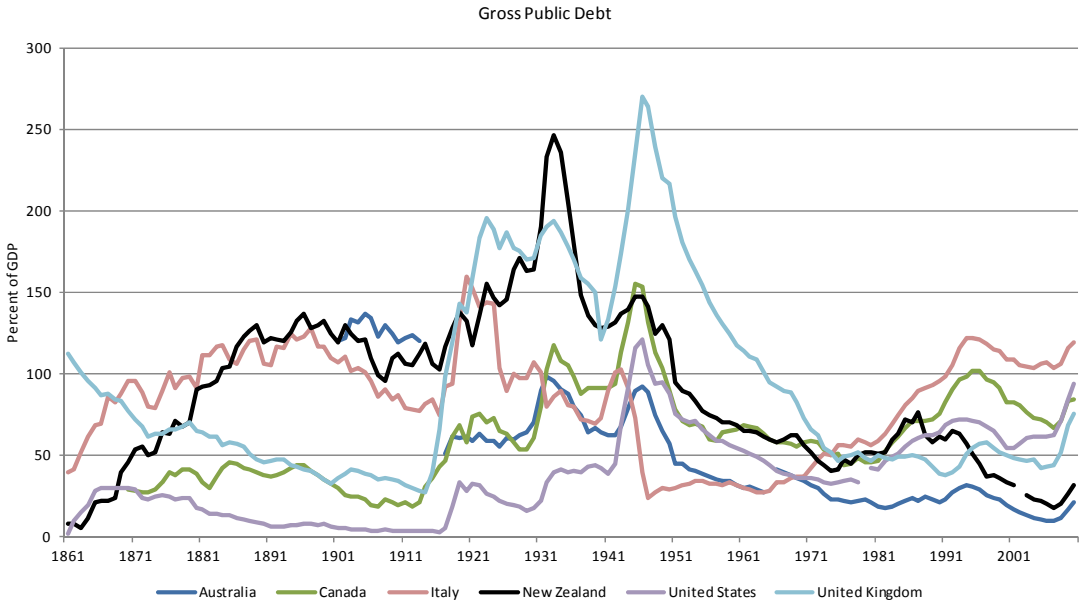
35. **During the post-Bretton Woods period trade and financial markets became highly integrated across borders.** This integration was driven by a more open approach to capital market liberalisation, advances in communications and technology, and financial market innovation. Average trade flows exceeded 50 percent of GDP for most advanced and large emerging economies. Gross capital flows (largely between advanced economies) grew sharply - exceeding almost four times GDP. The degree of integration also had a qualitative dimension. Supply chains for goods and services became more complex and integrated across borders. In finance, particular institutions and markets came to play a central role in facilitating transactions and transferring risk across borders. For example, large investment banks and the market for US government securities were central to the process of risk transfer and financial integration.

36. **The end result is that initial output and financial shocks to the largest economies have had large and lasting repercussions throughout the world** (IMF, 2009a). The period of output stability came to an end with the Great Recession. Measures of financial market volatility remain high four years after the crisis and are subject to periodic bouts of renewed concerns about the health of particular banking sectors and sovereigns in Europe. At the same time, to date there has been little sign of renewed inflation, although this is perhaps not surprising given the large output gaps

across most advanced economies. The following factors are likely to influence the frequency and amplitude of external shocks over the decades ahead.

37. **The scope for macroeconomic policy to respond and cushion new shocks has been reduced**. Public sector debt levels across advanced countries are at unprecedented levels outside war time (see figure 9). Evidence indicates that potential damage to growth from high levels public (Kumar and Woo, 2010) and corporate debt (Cecchetti and others, 2010). In the case of fiscal policy it will take decades in many advanced economies to restore the space for fiscal policy to respond to shocks. The immediate legacy of the crisis has mostly changed the composition of leverage – public sector leverage increased to support demand - rather than reduced leverage as a whole. In addition, monetary policymakers are struggling to adapt their existing frameworks in the face of large shocks and policy interest rates have been close to zero for some time.

Figure 9: Public debt to GDP – selected OECD countries



Source: Abbas and others, 2010, A Historical Public Debt database

38. **History suggests that financial system fragility is a reoccurring issue.** The immediate policy response has helped stabilise advanced country financial systems, with the exception of ongoing concerns in the Euro zone. Levels of capital are being increased, liquidity buffers are being built and regulatory measures are being put in places that are intended to prevent a renewed build-up in systemic risk. Nevertheless, the regulatory solutions remain untested. Some problems – such as financial institutions that are too large to fail – have likely increased in importance and there appear to be few workable policy solutions (IMF, 2011b)

39. **The further integration of emerging markets into the world economy may also become more challenging.** Some projections (Speller and others, 2011) look at the implications for global capital markets and national balance sheets from increased growth and financial market integration of emerging economies. These projections imply significant increases in cross border capital flows and gross balance sheet

exposures. The history of capital market integration suggests that there are large risks of poorly managed transitions.

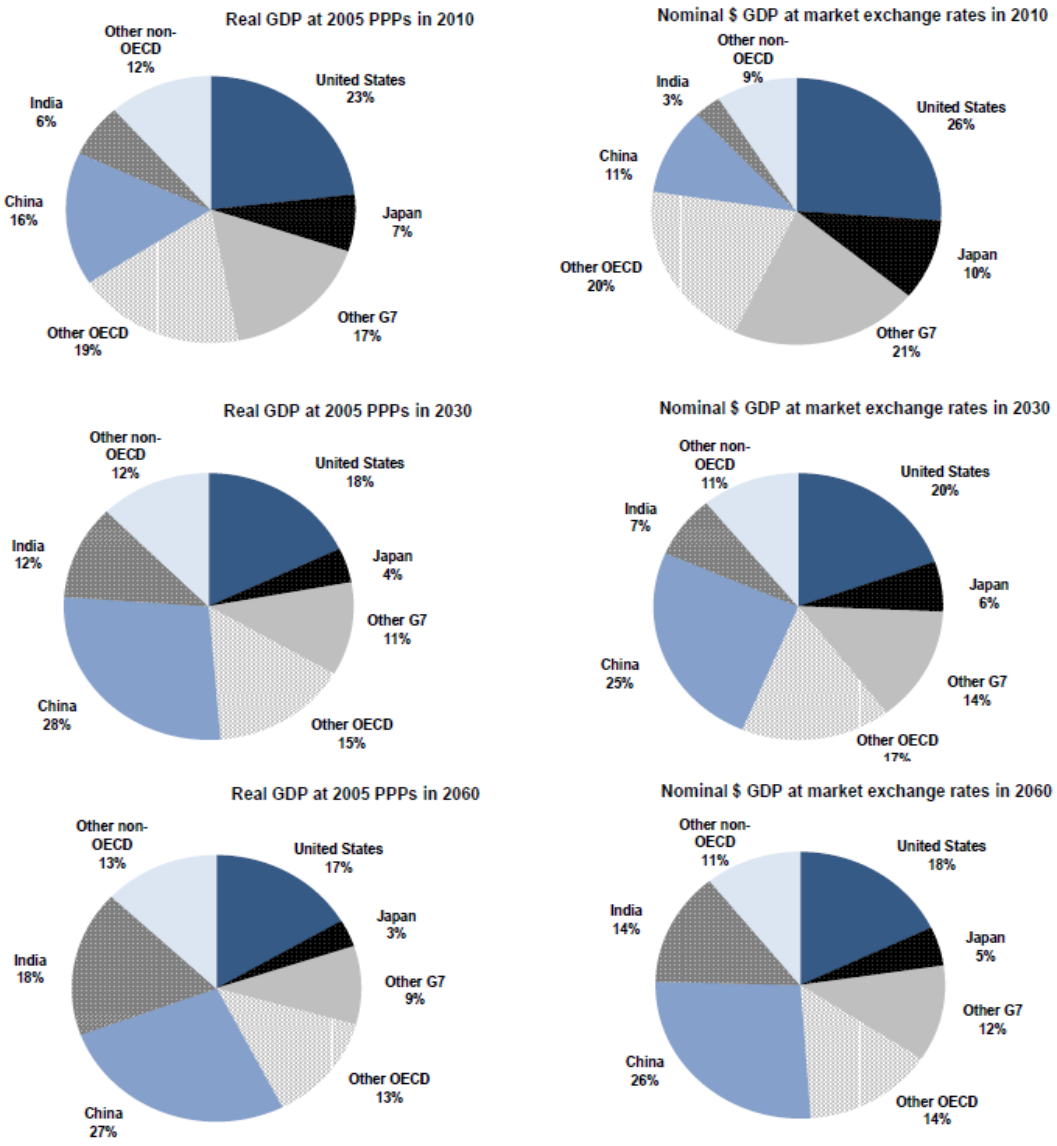
40. **A smooth process of convergence for large emerging markets appears unlikely.** Growth in the larger emerging markets has been remarkably resilient through the crisis. This has been partly the result of cautious policy-setting leading into the financial crisis. However, the future stability of growth in larger emerging markets is far from assured. The history of growth catch-up from developing countries has many instances of periods of faster growth followed by periods of slow growth or stagnation (Rodrik, 2012).

Changing sources of world growth

41. **The financial crisis accelerated the shift in economic weight towards emerging markets – particularly China and India.** Long-run projections of world economic growth assume a continuation of these trends (OECD 2012) although growth slows over longer time frames as demographic changes and as the process of converge slows as income converge.[5] The process of faster growth in emerging economies is broadly consistent with catch-up in output levels as technology is adopted from abroad, economies urbanise and labour is absorbed into the modern economy.

[5] There are a range of projections of long-term growth produced by international agencies and private researchers, Citibank, PWC, McKinsey, Peterson Institute, and others. They generally use a very similar neo-classical approach that assumed a steady long-term growth path for the US (based on historical data), project population and participation for each country and conditional convergence based on historical estimates. The level of steady state income per capita and the pace of catch-up is conditioned on such factors as trade openness, education, product market and regulatory settings.

Figure 10: Changing sources of world growth



Source: OECD 2012

42. **The process of catch up has occurred in the past.** From the 1960s onwards a range of countries in Asia started a growth process that saw relatively rapid convergence to developed country levels of production and productivity. The middle of the 20th century saw a broad process of convergence take place in much of Western Europe.

43. **Two elements stand-out as distinct about the importance of current episode of growth convergence**:

- Even compared with the rapid and unprecedented growth in Japan and Korea, the speed of convergence from China is rapid. To illustrate, the time taken to double per capita GDP was around 33 years in the case of Japan, 16 years in Korea and 12 years in China.

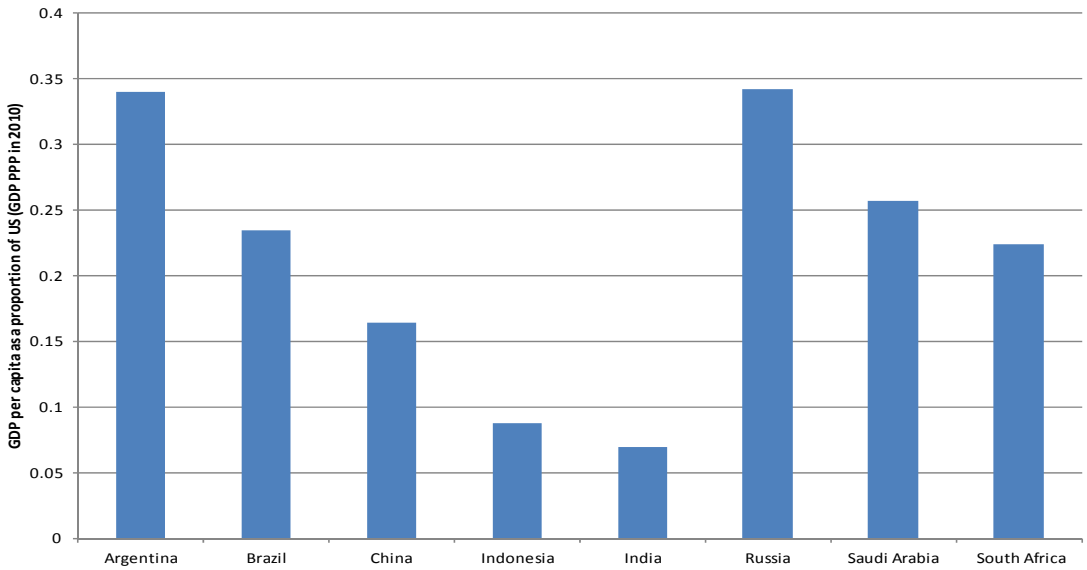
- The size of the countries undergoing convergence. At the beginning of Japan's growth convergence it represented around 3 percent of the world's population. China and India together comprise around 37 percent of the world population (United Nations, 2011).

44. **The scale of the impacts on the global economy has become clearer over the past 10 years.** Emerging markets as a whole have managed to sustain growth through the financial crisis. In the past decade China has played an important role in driving world saving and investment behaviour, with some arguing this played a role in building current account imbalances and debt in key advanced economies. The large increase in low cost labour into the global trading system has played a role in moderating inflation pressures and affected returns to labour in advanced economies. China has become one the largest participants in international trade. Discussions about Chinese exchange rate policy and overall economic strategy have played a key role in discussion about how to coordinate international economic policy (Blanchard and others, 2009).

45. **Strong income growth and high investment levels in fast-growing emerging markets have led to higher commodity prices.** Growth in these countries is more resource-intensive than in other developing countries because output is dominated by investment and manufacturing. In China, investment is being spurred by a rapid process or urbanisation and heavy investment by state and local governments in upgrading infrastructure and housing. Future sustained economic growth in these countries would continue to support demand for resources. The impact on world prices and sustainability is discussed below.

46. **The scope for further strong growth from convergence remains large over the medium-term.** Despite rapid growth in China and India, GDP per capita remains at relatively low levels (see figure 11). As countries develop and approach developed country living standards the pace of growth tends to slow as the easiest gains in productivity and utilisation of resources are secured early in the process.

Figure 11: Scope for catch-up in selected emerging markets



Source: OECD 2012

47. **Most projections of longer-term growth paint a benign scenario of continued convergence**. These conclusions are based on recent experience and improvements in institutions and policies. Many emerging and developing economies have improved their macroeconomic policy - inflation has been more stable, fiscal policies have kept debt levels more manageable than in the past, and financial market stability has improved. Developing and emerging markets have become substantially more open to trade and capital flows over the past three decades. The quality of institutions – what many economist argue ultimately determines growth prospects - has improved with the spread of greater democracy and policy innovations. Lastly, changes in international patterns of production and trade have favoured catch-up by leading to a faster spread of ideas and blueprints.

- **Emerging market growth may be more volatile than in the past.** Successful and sustained convergence tends to be the exception rather than the rule (table 1). The empirical literature on growth has documented that convergence is not automatic. It is conditional on specific policies and institutional arrangements that have proved hard to identify and implement. Indeed, the recipes seem to vary from context to context. The experience of highly successful Asian countries is difficult to transplant to other settings (Rodrik, 2012).

- **The size of China and India imply that constraints on growth may emerge earlier in the convergence process.** For example, China's current account surpluses have raised concerns about sustainability much early in the growth spurt phase than was apparent with previous export-led growth strategies in smaller Asian economies. The impact from higher demand on world resources has a more material effect on prices that in past instances of high growth by a range of smaller countries.

- **China faces some major challenges in engineering a more sustainable growth path.** The Chinese authorities acknowledge the need for more moderate growth that is better balanced between consumption and investment, and gives greater weight to environmental sustainability. Investment in China has reached around 50 percent of GDP in 2011 – much higher than previous countries that have engineered sustained rapid growth (World Bank, 2012). In the longer-term China will face a slowing in population growth and a rapid aging of the population at relatively low income levels. China is rapidly approaching levels at which growth has slowed markedly in other countries – the so-called middle income growth trap (Eichengreen and others 2011)

48. **Addressing these challenges in China is likely to require fundamental changes to the current economic structure** (World Bank 2012). Discussion focuses on the need to address a system that favours export over domestic consumption, state-owned enterprises over private investors and businesses over households. This transition is likely to be quite challenging as it will involve removing privileged access to capital from enterprises closely associated with the state, a greater degree of reliance on financial markets to set exchange rates, interest rates and factor prices, and the establishment of broader social safety nets at a relatively rapid pace. One concern is that such a shift in production and output could significantly slow the process of growth convergence (Rodrik, 2011).

- **India's path to higher growth remains at an earlier stage, although there remain substantial challenges to sustaining growth.** India is less reliant on investment and external demand than China. However, India faces substantial challenges in sustaining growth including a resumption of structural policy reform after a heavy reliance on monetary and fiscal stimulus in the past 5 years, addressing constraints to investment in infrastructure and reform to the financial sector and labour markets.

Table 1: Sustained growth: Countries with more than 4.5 percent growth over a 30 year period

Before 1950			Since 1950					
	Annual GDP growth	Period		Annual GDP growth	Period		Annual GDP growth	Period
Australia	5.8	1823-1853	Italy	5.9	1945-1975	Taiwan	7.2	1946-1976
New Zealand	7.1	1840-1870	Spain	4.9	1949-1980	South Korea	7.3	1965-1995
Venezuela	5.5	1907-1939	Portugal	4.6	1950-1980	Singapore	6.7	1964-1995
			Greece	7.3	1945-1975	Hong Kong	6	1958-1988
			Israel	4.7	1953-1983	Malaysia	5.1	1967-1997
			Yugoslavia	4.9	1952-1982	Indonesia	4.7	1967-1997
			Iraq	5.3	1950-1980	Burma	4.9	1977-2007
			Saudi Arabia	6.1	1950-1980	China	6.7	1976-2007
			Libya	7.4	1950-1980	Botswana	7.3	1960-1991
			Oman	7.4	1955-1985	Cape Verde	5.5	1977-2007
			Japan	7.4	1945-1975	Equatorial Guinea	9.3	1974-2004
			North Korea	4.7	1951-1981	Ireland	4.6	1976-2006

Source: Rodrik (2012)

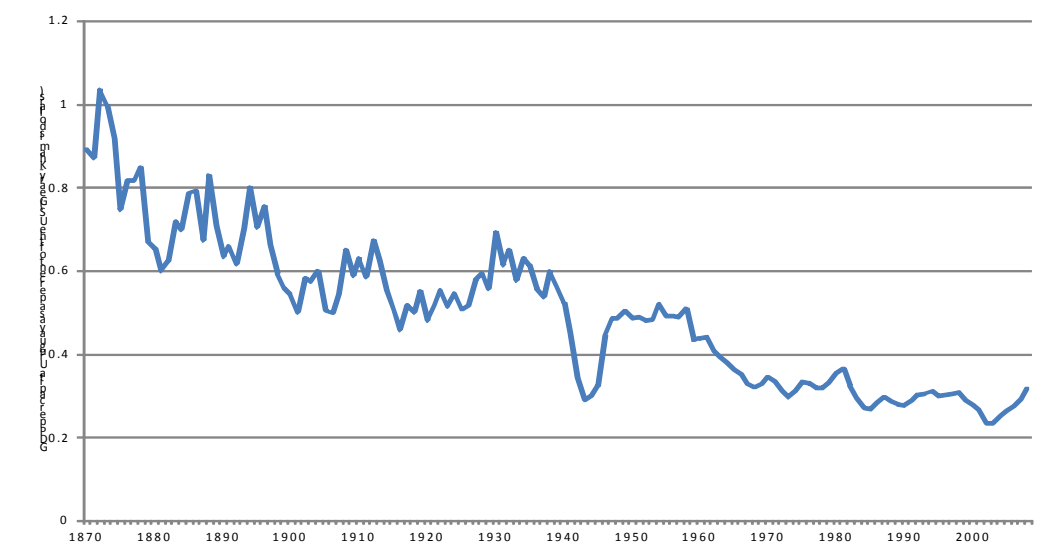
49. **The process of convergence is likely to be uneven.** Some countries will suffer reversals and a smaller number are likely to sustain convergence over a longer time frame. From a global perspective the way in which this plays out in the countries with the largest population matters.[6] China has a history of managing this process well over the past 40 years. The literature on long-run growth emphasises the fundamental importance of institutional quality. On the other hand, China is rapidly approaching income levels at which growth slowed materially in past country convergence episodes. Even if the required policy reforms are implemented well, a shift in the composition of activity towards services and a greater role for markets in resource distribution may a slower pace of growth and potentially greater volatility.

[6] Because of the sheer size of China's economy the contribution to annual growth remains material even as growth is projected to slow over time.

Box 2: Lessons from the losers

Commentary on cross-country economic performance typically focuses learning lessons from better-performing countries. A different approach considers the lessons from countries and regions that have experienced large and sustained divergence from better-performing economies. These include Uruguay, Switzerland, Tasmania, and the Atlantic Provinces of Canada (figure 12).

Figure 12: Per capita GDP in Uruguay as a percent of US



Source: The Conference Board Total Economy database

Indicative lessons from these countries include:

- It is difficult to arrest a extended period of poor performance. Currency union, economic union, fiscal transfers, industry policies and lower cost structures have often failed to turn-around poorly performing regions. Periods of macro instability and/or unsustainable fiscal can trigger long periods of poor performance.
- Lower international integration is associated with poor performance. Countries and regions that have performed poorly have struggled to lift international trade and investment. In some cases, such as Uruguay, a consistently overvalued exchange rate has played an important role in some periods.
- The ability to reach social consensus on the need to adjust and change is important. Social consensus is shorthand for mechanisms that allow choices to be made promptly and without disruption in order to adjust to shocks or take opportunities as circumstances change. For example, in Uruguay vested interests became entrenched and it proved impossible to undertake policy changes that were required as a result of a weak economy. Parliament was ineffective in the face of competing social claims, which spilled over into near civil war and a takeover by the military.

Box 2: Lessons from the losers (continued)

- There is no single recipe for growth. These countries have a diversity of economic settings that reinforce the need to draw careful conclusions. Those with large budgets (Tasmania and Atlantic Canada) can do badly, as can countries with low expenditure ratios (Uruguay). Foreign direct investment is not a panacea. Tasmania and Atlantic Canada's failed experience in trying to attract and keep FDI is instructive. In these instances higher levels of public investment in infrastructure have not led to higher private investment. These regions have adopted variants of policy approaches that have succeeded in other countries. But they have failed to turn around performance in these cases.

* Little, S., Lessons from the losers: what the also-rans can teach us about economic performance, The Treasury Economic Transformation Papers (2001)

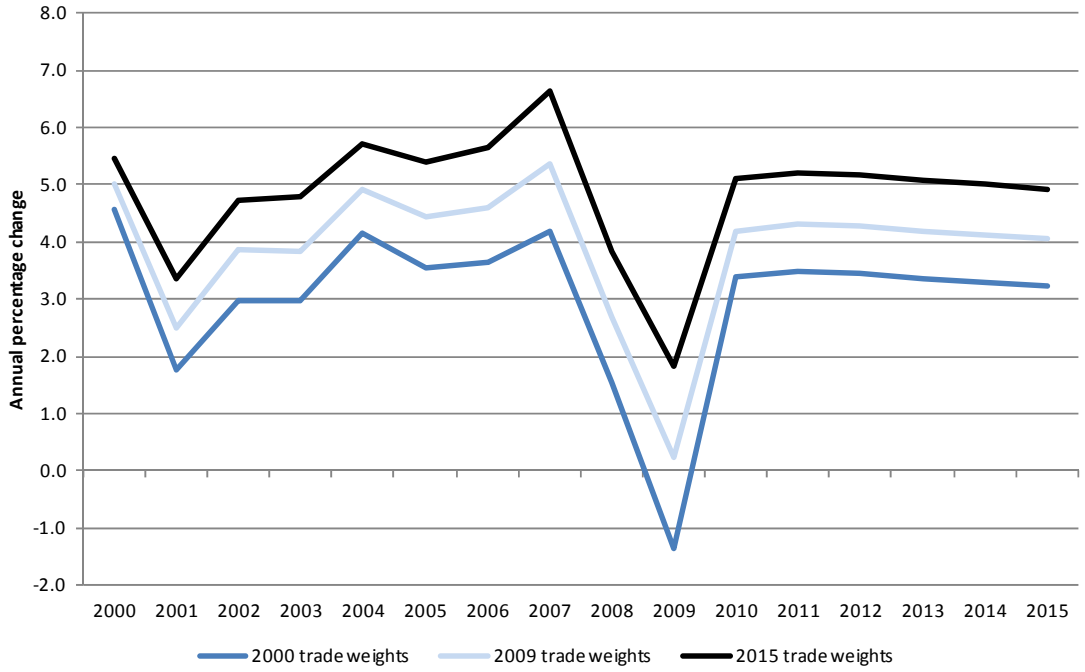
Implications

50. **With developed economies facing a period of stagnation, emerging market developments will play a dominant role determining world growth prospects in the near-term.** In the longer-term, a larger share of world activity in emerging markets will see these countries become a more important factor in global growth prospects, trade and capital markets.

51. **Emerging markets are likely to become an increasingly important source of trade.** Changing patterns of growth and demand have already lead to major changes in trading relationships – with China becoming an increasingly dominant trading partner in Australasia. This change increases exposure of Australia and New Zealand to shocks to growth originating from China and Asia more broadly (Yan, 2010).

52. **Emerging markets have also become more prominent in global investment flows.** Large current account surpluses have been accumulated partly as a consequence of an export led growth strategy in many Asian emerging markets. Pre-dating the financial crisis, these countries began to trial ways in which the stock of saving could be diversified from investment in government securities. In addition, projections suggest that the process of international financial market integration would result in significant increases in the share of emerging markets in cross-border investment (Speller, 2011).

Figure 13: New Zealand trading partner growth and changing trade shares

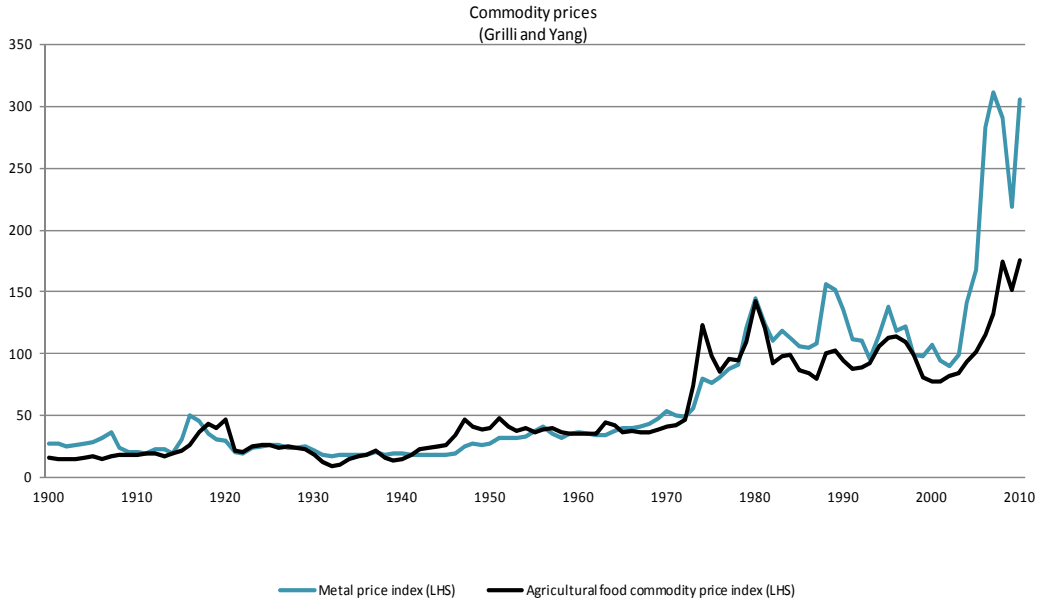


Source: Yan (2011)

53. **High growth rates imply a rapid process of structural change in large emerging markets.** As incomes and wages rise it will strengthen incentives to shift investment and production into goods and services that are less intensive in low cost labour – and more intensive in human capital and innovation. The process of shifting comparative advantage has been a hallmark of the development of other East Asian economies. For decades, Chinese industrial output was split evenly between light industries (which are broadly those producing goods like textiles and clothing) and heavy industries (which broadly produce capital goods, including intermediate inputs). Since the pace of China's economic expansion took-off in the mid-90s, this composition has been changing. While all industries have expanded rapidly, light industrial output has declined relative to the heavy industries. Large changes are also likely in the composition of demand as income rise.

54. **Sustained growth in these economies will support the demand for resources** (figure 14)**.** This would imply continued support for the increase in the level of commodity prices seen over the last decade (see box 3). As these countries develop, demand patterns will alter over time to reflect higher incomes. Some projections suggest that this may favour demand for soft commodities over hard commodities. The ultimate impact on prices and sustainability will depend on the interaction of supply and demand. Higher prices will stimulate additional investment and supply, spur technological change and investment that results in a decrease in the intensity of resource use, and lead to substitution away from higher priced commodities.

Figure 14: Long-run real commodity price index



Source: Pfaffenzeller and others "A Short Note on Updating the Grilli and Yang Commodity Price index."

55. **If sustained, high commodity prices imply a substantial shift in relative prices for commodity producers.** Higher commodity prices (an increase in the terms of trade) imply an increase in the purchasing power of exports and an increase in national income. At the same time, higher terms of trade imply a higher exchange rate. This will have implications for prices and output in countries such as New Zealand that export commodities intensively (see Box 4).

Box 3: The outlook for New Zealand's commodity prices*

The secular decline in New Zealand's commodity prices from 1970s began to reverse in the 2000s. After a fall around the time of the global financial crisis, New Zealand's commodity prices recovered sharply. Most assessments suggest that some material part of the increase in commodity prices is long-lasting, because it is due to underlying demand and represents a structural shift in demand and there are lasting constraints on supply. This will increase New Zealand's terms of trade to a higher level for some time.** An alternative way of thinking about this is that the 1980s and 1990s represented an unusually low level of commodity prices.

Commodity prices have long played an important role in New Zealand growth prospects and external balance (Grimes, 2006). The following factors have driven the rise in New Zealand's commodity prices:

- Rapid growth in wealth and urbanisation in developing Asia that has underpinned higher demand for food. Higher incomes have increased food consumption and changed composition of food demand as incomes increase and population grows - away from rice and towards grains and animal products.
- Policy choices in some countries that have increased the use of land, food and water for energy production

Box 3: The outlook for New Zealand's commodity prices* (continued)

- Constraints on longer-term supply, including relatively modest growth in agricultural productivity and constraints on key inputs (such as land and water) in some regions
- Compounded at certain points by near-term influences that have disrupted supply – weather changes in some regions

Demand for commodities and natural resources is expected to continue to increase in emerging markets as the population continues to grow, migration to cities accelerates, incomes rise, and consumer preferences change. Modelling of commodity demand in fast growing countries looks to draw on past patterns of changes in demand as incomes grew sharply. In Asia, the changing pattern of Taiwan's per capita food consumption over the past half century is an interesting case study. From 1985 to 1990, Taiwan's GNI per capita jumped from USD3,368 to USD8,325 (compared with USD3,427 in China in 2008), and during this period Taiwan's total per capita consumption of rice and vegetables declined, but consumption of meat, milk and fruit all increased substantially.

The supply of agricultural commodities will respond to high prices. However, biological constraints limit the extent to which increased supply can match increasing demand and curb price increases. For example, Fonterra estimates that annual world milk production can grow at around 2-3 percent even with growing production in non-traditional areas. Meanwhile, the increase in supply is also influenced by politics, diminishing sources of arable land and water, investment in new capacity, biological limits and weather. Increased productivity in food production has slowed, perhaps as a result of lower innovation investment in response to a long period of low prices. Nevertheless, supply will increase to meet demand, especially if the price incentive is high. The unknown is how long before supply and demand balance.

Historical experience suggests we should be wary of the risk of a reversal in commodity prices. Such risks could include an increase in productivity or a collapse in demand. There is scope for significant productivity improvement in agriculture simply by applying existing technology and knowledge more widely. Another risk is that the strong income growth in the most populous developing countries slows markedly.

* This discussion is drawn from Sullivan and Aldridge (2010) "The outlook for commodity prices and implications for New Zealand monetary policy", Reserve Bank of New Zealand. For a historical perspective a useful source is Borkin (2006)

** The terms of trade are the relative price of export and imports. Changes in prices of imports are equally important, but given space constraints we have focused on the export side as opposed to a broader discussion of what might happen to fuel and manufacturing good prices.

Box 4: Commodity prices and Dutch disease

Temporary large swings in commodity prices (or temporary discoveries of natural resources) can lead to a sharp increase in the real exchange rate. The higher exchange rate puts pressure on the non-commodity tradable sector and causes it to contract. This contraction reflects in part the need to expand production in other sectors – either in the sector experiencing higher prices or in the sector expanding to meet demand from higher domestic incomes. The concern is that these shifts in resources are costly and may not be easy to reverse should the commodity prices decline sharply or where resources are depleted.

This phenomenon is often referred to as 'Dutch disease' after the experience of the Netherlands following natural gas discovery in the North Sea in the 1960s. The Netherlands experience suggests that the immediate impact on the non-commodity sector may not be long-lasting. Manufacturing exports rebounded as a share of GDP and as a share of total exports from the mid-1980s and reached nearly 40 per cent of GDP and around 70 per cent of total exports in 1997. A newer version of this argument suggests that lower growth may be the result of a loss of output in activities such as manufacturing that are associated with faster technology catch-up and higher productivity growth (Rodrik, 2008).

There is an extensive empirical and theoretical literature on Dutch disease. A recent summary of the empirical work (Magud and Sosa, 2010) suggests large shocks to resource prices lead to real exchange appreciation and a shift in production away from non-commodity trade exposed sectors – namely manufacturing. However, empirical evidence does not find a strong relationship between Dutch-disease type episodes and economic growth, at least in the case of advanced economies.

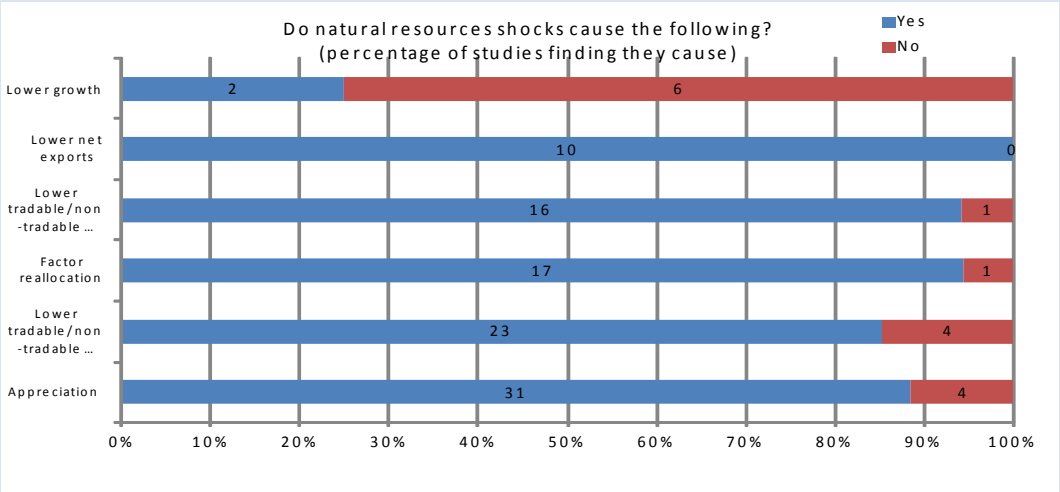
The appropriate policy response to a sharp adjustment in commodity prices may depend on the permanency of the shock and wider economic settings. The level of economic development institutional quality and the functioning of credit and labour markets appear to play a role. Institutional quality appears to be important to escape the consequence of the resource curse – where economic development is retarded by competition among economic actors for the distribution of wealth. Well-functioning markets and institutional settings also appear to be important to the continued accumulation and development of the factors that influence long-term growth.

The appropriate response may also be shaped by whether the relative price increase or resource discovery is expected to be long-lasting or temporary. Mechanisms that attempt to slow the transmission of commodity price shocks on resource allocation are likely to be more costly in circumstances where the shock is likely to be long-lasting.

Countries' policies have also adapted over time to try and minimise the potential impact of large resource discoveries. Although a full accounting is not possible here, some of the responses include: (i) limiting the impact on domestic consumption and the exchange rate by increasing savings in the form of offshore financial assets in the case of a temporary non-renewable resource find (Norway); (ii) setting fiscal policy to counter the cyclical pressures from commodity prices cycles when the resources are non-renewable but long-lasting (Chile); and (iii) trying to capture the rents generated by the resource and investing them in improving future economic capacity (Australia); and (iv)ensuring the domestic environment supports high quality investment environment and removes barriers to higher productivity of the domestic economy.

Box 4: Commodity prices and Dutch disease (continued)

Figure 15: Economic effects of natural resource shocks



Source: IMF (2011b)

56. **The overall impact of higher terms of trade on economic activity is twofold and leads to a shift in economic activity and resources.** The increase in prices for the commodities leads to a reallocation of resources in the economy towards the sectors that have seen a large increase in prices. The second effect is higher domestic consumption in response to the increase in income generated by higher prices. This results in an increase in demand for non-tradable services, attracting labour and capital away from the trade-exposed non commodity sector. Where capital can be imported and the labour intensity of commodity production is low the spending effects may dominate (Australian Commonwealth Government, 2010). This has raised concerns about the potential detrimental impact on the non-commodity tradable sector – including manufacturing and tourism exports.

57. **Concerns that large positive resource or terms of trade shocks have negative effects on long-run growth are likely to be overstated** (see Box 4). Developed countries have in general managed large shocks without detrimental growth impacts.

Box 5: What factors influence convergence in developing countries?

Simple and highly stylised neoclassical models predict that countries with lower output levels will grow faster and converge towards countries with higher output. The evidence suggests that this process of convergence is the exception rather than the rule. For developing countries as a whole the gap in incomes per capita remains as large today as it was in 1950 (Rodrik). However, the past decade saw growth rates in developing economies substantially exceed those in developed economies

Development economics is the study of the persistent puzzle of why convergence hasn't been faster and more widespread. The literature has for quite some time confirmed that convergence is conditional. However, there remains significant debate about the conditions themselves.

Box 5: What factors influence convergence in developing countries? (continued)

One group of explanations focuses on the links in the data through regressions linking growth to certain factors. The common list of conditions for convergence includes the investment rate, education or schooling, the share of trade in GDP, and credit to GDP, and various measures of macroeconomic stability and policy settings. The above approach has been criticised because the factors identified in growth regressions are not stable once the very poor performers are removed from the analysis (Easterly 2005).

Another set of explanations focuses on the importance of underlying institutions – secure property rights and relatively even access to economic resources - that support growth (Acemoglu, Johnson and Robinson, 2005) Institutions are critical because they shape the incentives to investment in physical and human capital and technology, and the efficient organization of production.

Political institutions and the allocation of resources shape the degree to which economic institutions support growth. Political institutions that favour growth place checks on the use of power and provide for broad participation and investment opportunities. They tend to emerge when there are limited rents that power holders can extract from the rest of society. These studies look for evidence in natural experiments – for example, the economic performance of South and North Korea who shared most initial starting conditions post-war, but have fundamentally different growth performance since then.

The last set of explanations notes the important role of framework polices – such as economic integration, stable macroeconomic policy and good institutions. However, it suggest that there is no single set of policies that generally map to these objectives – but that different countries have achieved these conditions in different ways. More importantly, this approach emphasises that while these elements are necessary, they are not sufficient to explain why some country can sustain convergence.

This approach emphasises that, in addition to supportive framework conditions, convergence in productivity tends to be much faster in manufacturing (and in some versions the explanation includes 'modern' services to reflect India's experience) than in other activities. Support for this view of development is made with reference to the experience of countries that deliberately support resource flows into manufacturing sectors with the largest potential for catch-up productivity gains. This is achieved through undervalued exchange rates and a range of more deliberate measure to ensure privileged access to capital, infrastructure, labour and influence over a broader range of policies.

The empirical support for this last explanation is mixed. Some elements – such as the costs of an overvalued exchange rate or the relative speed of technology and productivity growth in manufacturing - have strong support, at least in developing countries. The credibility of the explanation depends heavily on how you interpret the evidence. Such policies appear to be relatively widespread in developing countries that have engineered sustained convergence. At the same time there appear to be at least as many examples of countries where such an approach has not resulted in sustained growth. Much seems to depend on the how such policies are implemented.

Pressures on natural resources

58. **A reoccurring concern is that long-run growth will slow, or even stall, as the use of natural resources reaches some limit.** An early contribution to this debate was from Malthus who emphasised constraints on population growth posed by the limits to expanding food production. The 1970s saw these debates renewed as growth slowed, energy prices rose sharply, and concerns strengthened about environmental issues such as air and water quality.

59. **Some of the more dire predictions of the limits to growth have not come to pass.** During much of the 20th century the real prices of many non-renewable resources fell. New sources of resources were discovered and the resource intensity of production fell. Where prices did rise at particular points in time, innovation appeared to respond and substitutes appeared. Price declines took place during a period where the global population increased four-fold and global GDP increased 20-fold.

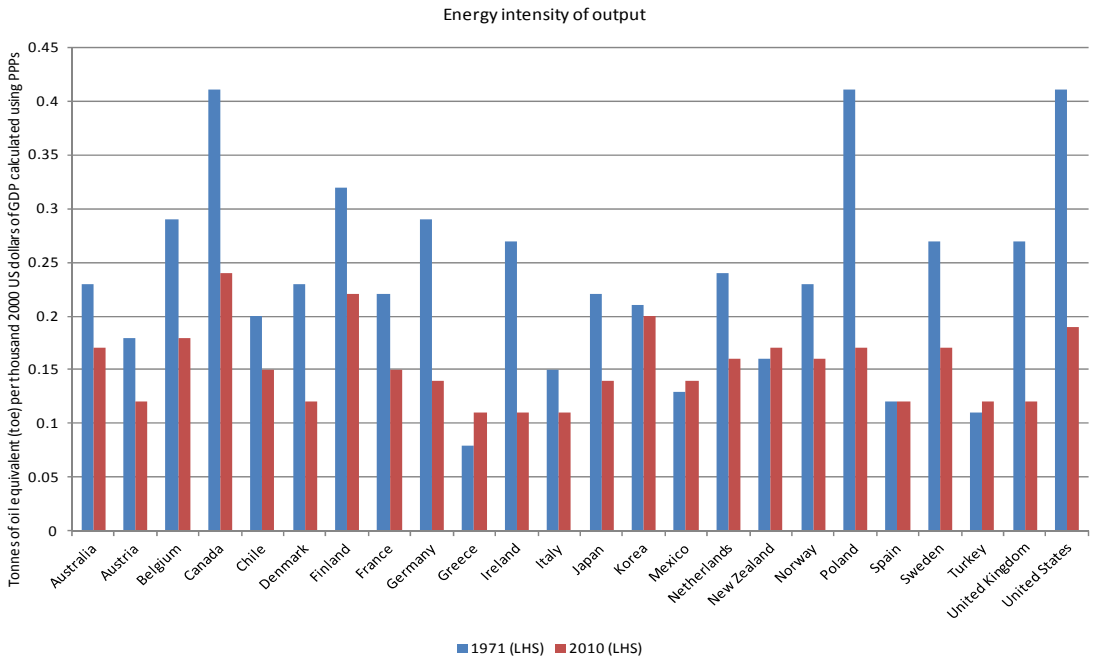
60. **Productivity growth did slow materially from the 1970s onwards, but non-renewable resource limits don't appear to play a central role in this slowdown.** Studies suggest that "depletion" is responsible for around one-quarter percentage point a year of the 1.5 percentage point slowdown in labour productivity from 1948-73 to 1973-80. No estimates exist for the most recent period, but the role of depletion is likely to be considerably smaller, given the decline in energy prices (Nordhaus, 2004).

61. **The main economic processes that determine the interaction of scarcity and growth are substitution possibilities and technological progress**. Much of the early attention was focused on the implications on growth of non-renewable resources. Early approaches emphasised the ability to substitute man-made capital inputs for the scarce resource and alleviate scarcity (see Krautkraemer 1998 for a summary).

62. **Market mechanisms play a key role in providing incentives for substitution as resource prices rise.** The first approach to thinking systematically about the role of resources and growth potential was to extend the neoclassical growth model. While substitution alleviates the drag on growth from resource scarcity, capital investment remains subject to diminishing returns. Growth is then only sustained by the presence of ongoing technological change that is exogenously determined. The rate of technological change has to be large enough to offset falling returns to capital accumulation.

63. **Evidence to date has tended to support the view that substitution and technological change are fundamental to understanding the link between scarce non-renewable and economic growth.** Energy use per unit of production has declined in industrial countries over a very long period of time (see figure 16). The rate of technological change is found to be significant, and comprise a large proportion of growth. Modelling suggests that **t**he relative contribution of technological progress to welfare far dwarfs limits from non-renewable resources. Weitzman (1997) finds that around 40 percent of income is due to technological change, compared with 1.5 percent of income that would be generated by assuming an unlimited supply of non-renewable resources at current costs.

Figure 16: Energy intensity across the OECD



Source: OECD Factbook 2012

64. **The 1970s saw attention shift from non-renewable resources to broader environmental resources – water, soil, fisheries and biological stocks.** These resources pose a different set of economic challenges. While these resources are renewable, they impact directly on welfare and some have characteristics of public goods or lack functioning markets and prices. This last consideration is critical. Without a functioning market, prices do not rise to encourage substitution or provide an incentive for technological change to reduce resource-use intensity. In the absence of appropriate regulation and price signals, technological change can actually act to speed-up resource use.[7]

65. **Empirical investigation of the link between environmental scarcity and growth focuses on whether scarcity increases in the early stages of development and then falls beyond a certain point**.[8] There are significant uncertainties involved with these studies because of poor data and a reliance on cross-country effects over relatively short time frames. For certain environmental resources, such as water quality and dimension of air quality, such an inverted relationship holds. In other cases, for example deforestation, the findings are uncertain. While in other cases, such as waste and carbon dioxide emissions, a reduction in use is not observed as incomes increase.

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[7] Technological change that increases resource productivity has an ambiguous effect as it raises income (and so demand for resources) as well as increasing incentives to conserve resources for future use (substitution effect)

[8] This is called the "Environmental Kuznets Curve". Kuznets posited that there was an inverted u relationship between inequality and growth as countries developed.

66. **Endogenous growth models have attempted to explore the implications of scarce natural resources.**[9] In general, most attempts to model the impact of environmental limits conclude endogenous technological change may substantially reduce the costs in terms of foregone growth from imposing environmental limits (Carraro and others, 2001)

- The size of natural resource endowments has an ambiguous effect on the rate of innovation. Higher endowments raise the returns to innovation, which increases the productivity of the resource because of scale effects, but also increase the relative returns to labour from production rather than innovation.
- Poorer substitution possibilities (between natural and man-made capital) shifts the direction of technical change towards resource intensive sectors. Technical change therefore can ease the constraints caused by low substitution possibilities.
- The extent to which innovation responds to ease resource constraints depends on whether resource markets exist and function reasonably well. In the absence of these markets innovation can potentially speed-up the process of resource depletion and environmental costs.

67. **However, it is hard to be confident that endogenous models are a good guide to the interaction between growth and natural constraints.** The mechanisms that underlie technological change are poorly understood**.** This makes it extremely challenging to add additional complex elements such as economy-environment linkages. In terms of informing policies, the results from these models depend heavily on the way in which technological change is modelled.

68. **Given the uncertainties involved, any quantification of the implications of resource scarcity for growth should be treated with caution.** Nevertheless, serious attempts at assessing the impact of specific resources constraints can give some indication of magnitudes of potential outcomes. Nordhaus provides an example drawing on an assessment of the constraints to growth from resource scarcity. This approach attempts to compare a baseline free of resource scarcity with growth under constrained resources. The difference between these two estimates is the likely impact on potential growth. The general conclusion is that over the next half century growth per capita could slow by around 1/5th (0.33 percentage points) due to the constraints on resources (see table 2).[10] This compares with an estimated growth in output per capita of around 1.5 percent over the last century in industrial countries.

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[9] These approaches attempt to explain economic growth as a result of deliberate economic decisions or as a result of specific economic features. One mechanism is to model production as a function of the deliberate accumulation of knowledge or innovation (in addition to capital and labour).

[10] While estimates represent the best attempts to quantify these constraints on growth. They do not foresee future technological developments and leave out significant ecological problems, such as deforestation, plagues or genetic depletion.

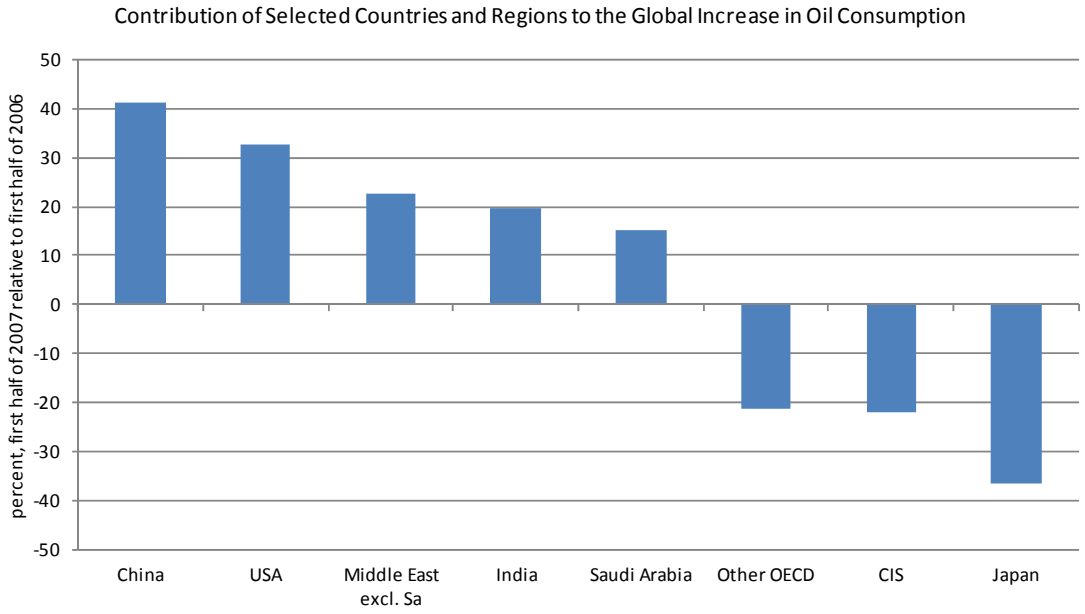
Table 2: Estimates of the impact of resource scarcity and growth

	Impact on world output in 2050 percent	Impact on world growth rate 1980-2050 (percentage points)
Market goods		
Non-renewable resources		
Energy fuels	10.30	0.155
Nonfuel minerals	2.00	0.029
Renewable resources		
Land	3.60	0.052
Environmental goods		
Greenhouse emissions	2.00	0.029
Local pollutants	3.00	0.044
Total	20.90	0.309

Sources: Nordhaus (1992)

69. **The estimates pre-date the surge in commodity prices over the last decade.** Since around 2000, commodity prices have increased sharply – reversing some of the reduction in real prices seen through the 20th century. These increases have been coincident with sustained unprecedented growth rates in the two most populous countries in the world – China and India. Both countries remain in the early stages of a process of growth convergence which, if sustained, imply a substantial increase in incomes and implied demand for natural resources (see figure 17).

Figure 17: Sources of energy demand



Source: IMF 2007 World Economic Outlook, April 2007

70. **Assessments project continued strong increases in demand for resources** (McKinsey Global Institute, 2012). Such projections are subject to significant uncertainty. They assume a continuation of the pattern of strong growth in incomes in China and India. Assessments of demand are based on projections from past development experiences (for example, Korea and Japan) after making allowances for a less-resource intensive development path due to improvements in technology.

- **Energy.** Projections suggest energy demand may increase by around 30 percent over the next 20-30 years. The main driver of increased demand – around 60 percent - is expected to come from China and India. In developed countries, demand is likely to moderate driven by improved energy productivity and continued structural change away from energy intensive goods. Small difference in assumptions would make a large difference to these projections. In particular, they are very sensitive to the assumed improvements in energy intensity in key countries – such as China. Energy is particularly important because it is a large share of the cost of other resources.

- **Land.** Rising demand for food due to population growth and more calorie-intensive diets in developing countries is expected to increase demand for food. Coupled with relatively moderate productivity growth in agriculture – assumed at about 1 percent per annum – these trends lead to an increase in demand for cropland (McKinsey Global Institute, 2012). Factors that could add further pressures would include productivity losses due to land degradation, urbanisation and climate change, and an increase in demand for the use of crops for energy.

- **Water.** Incremental demand for water is expected to come largely from additional demand from agriculture. The pressures associated with water scarcity are felt most intensively in specific local regions – affecting areas within a country or specific water basins. Traditional sources of water – surface and ground water - are facing depletion in many areas. The challenge of meeting additional supply is made more costly by the absence of tradability between regions and the steep rise in marginal costs associated with non-traditional source of water. International agencies predict that by 2030 more than half the world's population will live in regions that are water stressed (Water Resources Group, 2009).

71. **There are complex interdependencies between resource pressures**. There is some evidence that in the last decade, the price and volatility of different resources has become more tightly linked. Technological and policy changes have encouraged the use of agricultural products for energy production. The energy intensity of water use has been rising as water is transported greater distances and there is increased use of desalinisation.

72. **The transition to a higher level of demand is complicated by factors that constrain the responsiveness of supply – particularly in the near-term.** Near-term constraints on the responsiveness of supply for key natural resources have translated into sharply higher prices. Long-run costs for additional resource supply also appear to be increasing for some key commodities. New supplies are often in more inaccessible locations and have higher costs of exploration and extraction. For example, the average cost of new oil wells has doubled over the past 10 years (McKinsey Global Institute, 2011).

73. **Projections suggest that supply increases would need to be significant without improvements in the productivity with which resources are used (McKinsey Global institute 2011).** The largest supply increases are required to meet additional demand for water and land for food production. Assessments suggest that these increases will be challenging to deliver. The scale of investment in infrastructure is large and there are significant difficulties associated with political stability, the allocation of property rights, and potential limitations posed by the sustainability of resource use for the environment.

Box 6: The economic impact of climate change

The debate on climate change has stimulated work to model economic impacts over long time periods. Greenhouse gas emissions are fundamental both to the world's energy system and to its food production. The uncertainties about climate change are vast—indeed, so vast that the standard tools of decision making under uncertainty and learning may not be applicable. Tol (2009) provides an overview of the estimates.

Two broad approaches have been followed. The first estimates the physical effects on climate change, attempts to assign prices to these effects and aggregate them. The effects of climate change that have been quantified and monetized in this way include the impacts on agriculture and forestry, water resources, coastal zones, energy consumption, air quality, and human health. The second attempts to look at the variation in welfare across countries and time due to climate variation and extrapolate these across time. The first approach has the advantage of relying on realistic evidence of physical impacts, although it has the significant disadvantage that it assumes no behavioural change. The statistical method has the advantage of relying on real world data on climate and income, but suffers from the assumption that all the differences in income are due to climate.

These studies find that the welfare effect of a doubling of the atmospheric concentration of greenhouse gas emissions on the current economy is a few percentage points of GDP. This kind of loss of output can look large or small, depending on context. From one perspective, the estimated welfare costs are roughly equivalent to a year's growth in the global economy. Over a century or so this loss looks small. On the other hand, the damage is not negligible. A permanent reduction of welfare, lasting into the indefinite future, would justify steps to reduce such costs. Estimates of the economic cost have declined over the last 20 years as projections of future climate change have become less severe and models have increasingly incorporated assumptions about adaption.

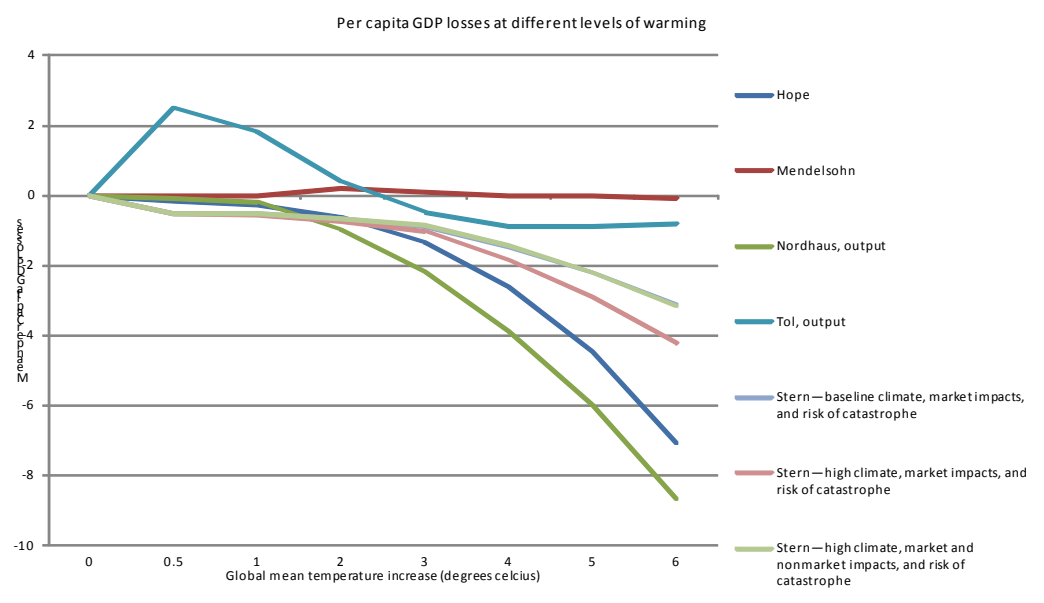
Uncertainty is vast and probably skewed towards larger effects on growth. Most studies are based on a benchmark warming of 2.5°C. More recent work has attempted to compare welfare effects of different abatement scenarios (Nordhaus, 2010). Although the differences in global welfare are fairly large absolute dollar values, the effects are relatively modest as a proportion of net present value estimates of global welfare – the difference between and optimal policy and a base case of unconstrained emission is around 1/3rd of 1 percent. The losses in welfare are largest for the poor countries close to the equator. This is because the physical effects of warming in an already hot climate carry higher costs and because these countries are typically less well-placed to adapt to climate change.

Box 6: The economic impact of climate change (continued)

The standard approach to modelling climate change is to use a standard neoclassical optimal growth model. Population growth and technological change are exogenous whereas capital accumulation is determined by optimizing the flow of consumption over time. Output is determined using a Cobb–Douglas production function with capital, labour, and carbon-energy as inputs. Technological change takes two forms: economy-wide technological change and carbon-energy-saving technological change.

There remains a question of whether climate change has any permanent effects on economic growth rates. The models of economic impacts do not capture such an effect. If there is a negative impact on growth it would likely be an order of magnitude larger than any existing estimate of climate change (Dell and others, 2008). One possible scenario is that low-income countries, which are already poor to some extent because of climate, will suffer more from rising temperatures and have less ability to adapt, thus dragging their economies down further. Other authors have suggested an impact through: (i) increased conflict caused by resource scarcity; (ii) the effects on population health from wider dispersion of tropical disease; or (iii) the potential impact on labour productivity of higher temperatures – which will have material effects in warmer regions and little effect in temperate zones. None of these potential channels have been modelled in a way that provides much confidence in the results.

Figure 18: Estimated economic effects of climate change



Source: Various sources cited in IMF WEO 2009

Box 6: The economic impact of climate change (continued)

Why are the estimates of the economic impact of climate change so different? The Mendelsohn analysis is based on relatively narrow sector coverage and assumes a relatively high capacity for adaptation. Nordhaus and Stern include estimates of wider nonmarket effects, and at higher levels of warming their results are driven largely by more extensive allowance for the risks and costs of catastrophic impacts and economic disruptions. At higher levels of warming, similar distributional effects persist, although economic effects become universally negative (but with the range of uncertainty becoming wider). Allowing for the distributional aspects of climate change results in larger effects than when the analysis focuses only on total output. Differing choices of discount rate also have a powerful affect the size of the assessments that emerge from aggregating over time.

Technological change

74. **Technological change and innovation underpins long-run economic growth.** Despite progress in understanding and measuring economic growth, there remain large gaps in our understanding of what drives such change. Alternative theoretical models provide several different ways of understanding how technology influences economic growth.

75. **Technological change encompasses the full range of improvements in ways in which economies are organised.** Examination of the history of economic growth suggests the importance of major institutional changes that supported the improvements and spread of new ideas; and changes that improved the certainty that individuals' would benefits from long-lived investments in capital (i.e. personal security, freedom and property rights).

76. **Solow growth models assume a steady stream of innovations which feed through into higher productivity.** However, this approach provides no insight into what drives these innovations. Some researchers argue that this approach can provide a reasonable description of reality once it is supplemented with the contributions to growth from higher levels of human capital. The question about what drives these innovations remains unanswered.

77. **Growth accounting estimates suggest that improvements in technology play a critical role in driving growth.** These estimates try and identify the growth in output that remains after allowing for the contribution of the quantity and quality of labour, capital and land. There is significant controversy in quantifying the contribution of technological progress to growth. Although better measurement of inputs (including understanding the quality of capital and labour) and alternative specifications of the production function (Jorgenson and Yip, 1999) still imply a significant contribution to growth for technology improvement.

78. **Models that seek to explain the technology 'black-box' emphasise the importance of investment in knowledge and ideas** (Blakeley and others, 2004). These models seek to explain the process of technological change through the decisions taken to devote resources to generating new ideas. Or by proposing alternative mechanisms that imply that additional capital investment at the margin does

not result in diminishing returns (Romer, 1986). No single model really fits the historical experience very well (Jones, 1995). However, this class of models has reinforced the importance of focusing on a broad range of technology improvements and the potential to secure higher growth through investment in knowledge.

79. **Evolutionary approaches to understanding economic growth emphasise the uncertainties of technological progress, and the importance of the search process and the importance of "routines" in these searches (**Nelson and Winter, 1982**).** These models reinforce the importance of the process of competition, and better understanding the activities of firms and the networks between firms and other institutions that shape how firms innovate and change.

80. **The historical record reinforces the need to look beyond the proximate sources of growth (capital and labour accumulation and technology) to understand the ultimate drivers of growth.** The political and institutional environment is important to understanding many of the puzzles of economic growth. These approaches emphasise the way in which the political and historical background either aids or prevents the adoption of institutions that support growth.

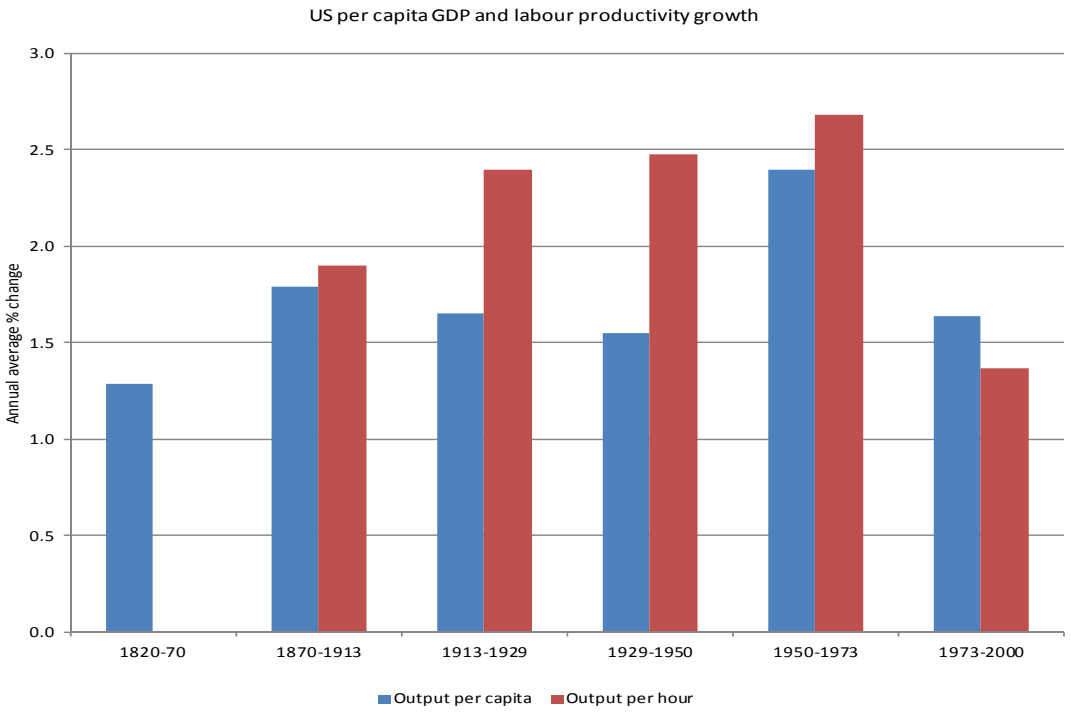
81. **Long-run growth models have limited ability to predict future growth prospects and are highly stylised abstractions of reality.** They should therefore not be used to derive forecasts of future technological progress or long-run growth. The long-run implications of many growth models are also sensitive to the choice of the specific relationship between variables in the model (or to put it more technically variations on the specification of the production function). More fundamentally, there are fundamental obstacles to identifying which approach best 'explains' growths (Temple, 2004).

82. **In the absence of better information it is probably reasonable to expect that the future trends will bear some resemblance to the past.**

83. **The long-run historical record is one of generally stable productivity growth.** The United States over a long period (the country at the productivity frontier consistently since the start of the 20th century) has relatively consistent growth in GDP per capita. What stands out most about the performance over long periods is the strong productivity for the period 1938-50 and 1950-73. As a whole this period has been labelled as "One Big Wave" that academics have linked to the long-lasting but temporary effect of reorganising economic activity around the great inventions of the late 19th century – electric light, electric motors and the internal combustion engine. [11]

[11] Underlying the growth process is a large increase in the stock of physical capital and human capital. Between 1820 and 2000 the stock of capital to GDP increased by 16 fold (Maddison, 1999) and years of formal education of those employed increase 11-fold.

Figure 19: Long-run growth in the United States



Source: Gordon, 2000

84. **Productivity slowed in the 1970s in the US (and most other advanced economies).** Potential explanations include the impact of oil shocks (Nordhaus, 2004), a growing share of services where output is harder to measure (Giriliches, 1994), lower savings and investment, and the exhaustion of the effects of the technology boom around World War II. Others emphasise the constraining role of government regulatory policy. The exact balance of these factors remains a matter of debate. It appears that changes in the rate of diffusion of previous technological progress were at least partly to blame.

85. **From 1995 onwards the United States experienced a revival in productivity growth – albeit it one characterised by distinct volatility.** The revival led to a long debate on the sources of productivity, the contribution of ICT and the role of corporate restructuring and globalisation. Productivity growth surged between late 2001 and mid-2004 but was much more moderate during 2004-07. Explanations focus on two key elements. The surge in 2001-03 was associated with an unusual degree of downward pressure on profits that led to aggressive cost cutting by business firms. A second explanation was the role of intangible capital that contributed a source of lagged response of productivity growth to the ICT boom of the late 1990s.

86. **Long-run projections of per capita growth and multi-factor productivity are fraught with difficulty.** The factors driving the productivity revival discussed in the academic literature appear to be mostly temporary. This would suggest a possible reversion to moderate labour productivity growth of perhaps around 1.5 percent per annum (Gordon, 2000a). These estimates are broadly consistent with those of other productivity experts, including Jorgenson and Vu (2008) and Maddison (2009).

87. **More pessimistic assessments suggest that the technological changes in future may not lead to the large productivity gains that were experienced during the 20th century.** The innovations of the late 19th century took a significant time (40-50 years) to have an effect on productivity as they required significant time to reorganise production, management and infrastructure (David, 1990). One concern is that the sorts of improvements in productivity and changes associated with these innovations can only happen once – urbanisation, improved transport speed, indoor plumbing (Gordon, 2012).

88. **There may be scope for continued productivity growth as the scope for the application of ICT innovations is exploited.** The evidence suggests that the uptake of ICT played some role in the revival of productivity (at least in the US) from the mid-1990s. However, there are divergent views on the extent to which this broad set of technologies will result in sustained and material improvements in productivity across the economy (Cowen, 2010).

89. **Some approaches consider the pace of innovation as a function of population size** (Jones, 2009). In this version of the world the pace of technological change depends in part on the number of brains available to be applied to problems. Projections suggest that during the next 100 years there will a halt in overall population increases for the first time since the advent of the era of modern economic growth. In the absence of improvements in the way in which technological changes takes place, or the allocation of more resources to innovation, the pace of technology improvements may slow.

90. **Improvements in technology are critical to understanding the patterns of global economic activity.** Improvements in information and communications technology, transportation, capital markets and management have influenced the location of economic activity. These changes have interacted with changes in policies towards economic integration and facilitated the sharp increase in integration we observe at present. Technological changes have also increased the complexity of production networks across borders – particularly in manufacturing industries.

91. **Attempts to predict specific future technology change have significant limitations.** However, they do provide a sense of the range of longer-term challenges facing society. Future technology predictions (see Box 7) appear to be orientated to addressing concerns about:

- the sustainability of current patterns of resource and energy use
- the challenges posed by an aging population and health care costs
- future demands on sustainable food production

92. **For countries behind the technological frontier (like New Zealand), there remains significant scope for improved economic growth by catching-up to the frontier.**

Box 7: Technology predictions - An example

The history of technology predictions is characterised by failure. There appear three reasons for this failure. Technology is highly non-linear with no clear progression path. Rather than being the result of intelligent design and planning, the innovation process appears mostly driven by trial and error. Lastly, predictions reflect the biases of the current situation which lead to predictions that focus too narrowly on technologies that may address current challenges.

The value of technology projections can be illustrated by looking at prominent examples. As an illustration we consider scenarios developed for disruptive innovation – those innovations that have the potential to replace/reorganise existing markets; as well as creating new markets. The US National Intelligence Council (NIC, 2008) identified the following potentially disruptive technologies:

- Biogerontechnology: Advancement of the science and technology underlying the biological aging process has the potential to extend the average natural lifespan and postpone many of the costly and disabling conditions that humans experience in later life. This would create a longevity dividend that would have far-reaching economic and social implications.
- Energy Storage Materials: Prospects for significant advancement in energy storage. The biggest level of disruption could occur should these technologies lead to a large shift away from fossil fuels.
- Bio fuels and Bio-Based Chemicals: Crop-based bio fuels are already in wide use. A large scale transition towards energy-efficient bio fuels could ultimately have far-reaching impacts on world energy markets.
- Clean Coal Technologies: Clean coal technologies and an array of related technologies offer the potential to improve electrical generation efficiency, lower emissions of harmful pollutants, and provide fuels and chemical feedstock from available coal resources.
- Service Robotics: Robots have the potential to replace humans in a variety of applications. Although a great deal of development is still required in terms of intelligence for robots, many of the building blocks for potentially disruptive robot systems are either already in place, or will be by 2025. Human segmenting technology could have major implications for technological change in the services sector.
- The Internet of 'Things': Internet nodes may reside in ordinary products allowing individuals to remotely control, locate, and monitor even the most mundane devices and articles. These changes could fundamentally alter supply chains and reduce dependence on labour.

Several common economic challenges emerge from these exercises. Issues of energy generation and efficiency are commonly based on concerns about the sustainability of current energy use patterns. Advances in biotechnology are seen as part of the response to addressing challenges of aging populations and rising health care costs. Other trends are generally seen as shaping the challenge in advanced countries of applying technology to improve the productivity of services industries – many of which have lower scope for labour saving technology improvements. An updated list might include the prospect for advances in

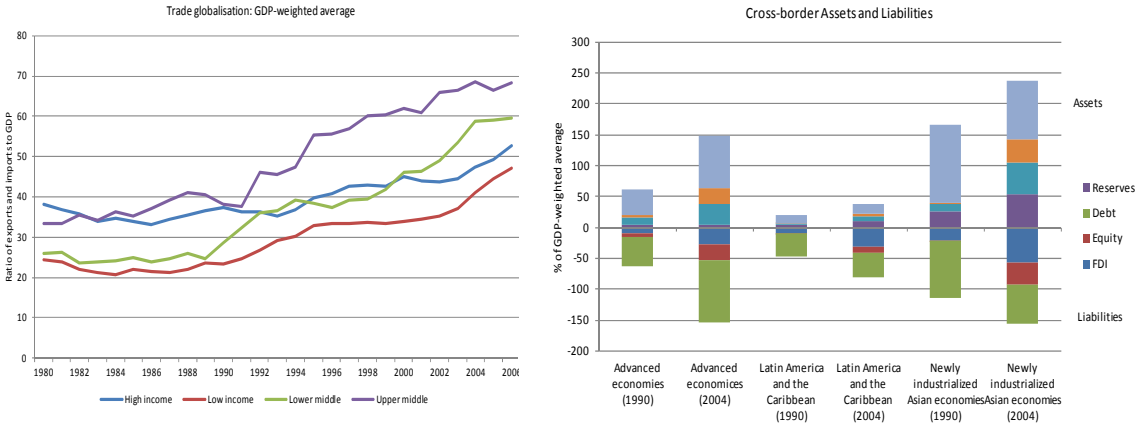
biotechnology to deliver fundamental changes in the productivity of food production – to address building pressures on land and water resources.

Economic integration and globalisation

93. **The post-WWII period has seen an unprecedented increase in world trade and investment flows** (see figure 20). Most discussions attribute the growth in trade to deliberate policy decisions to facilitate external trade; changes in transport, communications and management technology that favoured increased trade; and the process of ongoing convergence in income levels. This process of convergence shifted over time from Europe (1950) to Japan and East Asia (1960 and 1970) to China (1970) and India (1990s). Reviews of the nature of globalisation and its implications for New Zealand can be found in Stevens (2007) and Blakeley and others (2009).

94. **Trade integration has contributed to the spread of technology and new ideas (figure 18).** Technology adoption has played a powerful role in driving economic growth in emerging markets. Financial integration has also increased markedly. Much of this integration has been between advanced economies to date. The overall contribution to growth remains a matter of dispute. Concerns have escalated that the regulation and management of capital flows were one casual factor behind the global financial crisis.

Figure 20: Trade and financial integration



Source: IMF

95. **The recent financial crisis has raised concerns about the future of globalisation.** At the height of the financial crisis trade and financial flows slowed abruptly. Although these flows rebounded rapidly in the immediate aftermath of the crisis, concerns have arisen that an extended period of low world growth – particularly in advanced economies - could lead to a reversal of trade integration. To date trade protection measures have increased, although there have been few signs of a large reversal (World Trade Organisation, 2011). However, there has been limited progress on further multilateral liberalisation in the WTO now for decades.

96. **The current challenges within the Euro zone have also lead to some reappraisal of the costs and benefits of economic integration.** The European Union represents perhaps the most ambitious attempt at economic integration in recent history. It is now widely acknowledged that some important elements of economic

integration were perhaps less advanced than necessary – fiscal, financial and structural – which has led to severe strains within the European Union.

97. **Several factors may mute protectionist pressures.** The process of globalisation has changed incentives of domestic constituencies for economic integration. Countries today are far more interdependent than in the past, being connected through supply chains. Export lobbies now wield more power. Producers for domestic markets are more reliant on imported inputs and production chains connect global markets through a web of trade in parts and components. Explanations of trade liberalisation trends identify the importance of societal preferences, democratisation, and the role of international institutions (Milner, 1999).

98. **Assessing the future prospects for global trade flows and integration is challenging**. An example (Economist Intelligence Unit, 2006) may help illustrate the implications of different scenarios. The scenarios are illustrative as there are few details of the underlying assumptions. The baseline is one of 'controlled globalisation'. It assumes a slowing pace of liberalisation that is constrained by security concerns and escalating concerns regarding the effects of globalisation in developed countries. In general though, policy remains supportive of globalisation. Two alternative scenarios are presented:

- In the first alternative scenario, protectionist sentiment increases in reaction to insecurity, concerns over food safety, health concerns, economic weakness and higher unemployment and the contribution of outsourcing to unemployment. The scenario envisages a material and large reduction in world growth rates of 1 percent per annum.
- The second scenario envisages a large-scale retreat from economic integration in a replay of events during the Great Depression. Restrictions on trade, migration and investment lead to a retreat from economic integration as countries effect barriers to cross border trade and capital movements. This substantially reduces potential growth, lowers consumption and leads to lower innovation. Under this scenario global growth falls to a little over 1 percent – implying stagnant per capita incomes in advanced economies.

99. **Economic integration and technological innovation have changed the nature of trade with implications for patterns of trade and specialisation.** There remains significant uncertainty about the implications of these changes for economic activity:

- An increase in trade in tasks
- Changes in costs and benefits of agglomeration
- Increases in the intensity of trade in services

100. **Globalisation has increased importance of trade in tasks as opposed to final goods.** The process of production has been broken down into more specialised activities across borders (OECD, 2011). Increasingly, elements of value-added are performed in different locations. Improvements in communications, transportation and management have weakened the link between labour specialisation and location. This process of off-shoring components of the production process has led to concerns about

the implications for wages. It also increased competition in what had previously been considered 'high-value' services components.

101. **At face value the trade in tasks has a positive impact on specialisation, competition and productivity.** The overall impact can be thought of as similar to trade in other intermediate inputs – it improves productivity and induces shifts within firms and sectors in a similar way. It leads resources to shifting towards high-skill, information-intensive occupations on the one hand and low-skill occupations where assisting and caring for other people are important on the other hand – and away from manual routine tasks.

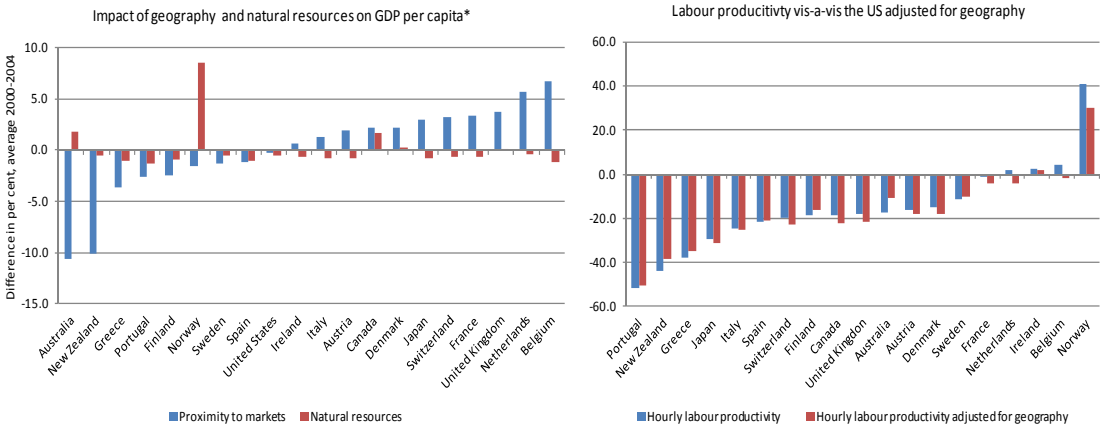
102. **The implications of trade in tasks has to date been concentrated in particular sectors.** This process has been most apparent in consumer electronics and in industries that rely heavily on basic information gathering and processing. Tradability of task is not only influenced by physical and communications constraints, but also by the transactions costs involved and the economies of scope involved in performing activities together.

103. **Economic activity tends to be highly concentrated geographically.** Economists have sought to understand whether a reduction in trade costs (perhaps due to liberalisation or lower transport costs) leads to an increased concentration of economic activity or does it lead to greater dispersion of activity? In an environment of increasing returns to scale (or due to some form of externality that in positively related to economic scale and scope) lower trade costs leads to more activity being located in the larger country (or the core). However, this tends to increase the price of labour and capital in the core and at some point results in limits to the concentration of activity (Krugman and Venables, 1995).

104. **Agglomeration of productive economic activity may lead to a divergence in incomes between regions.** The process may be cumulative, although subject to limits as factor prices rise. There is a large body of evidence for agglomeration effects on productivity operating at the national level (Crawford 2006). McCann (2009) suggests that strengthening agglomeration forces (associated with agglomeration and policy decisions to foster economic integration with Australia) are a key reason why New Zealand's productivity levels have not converged with Australia.

105. **Evidence suggests that distance from economic activity does lower productivity levels in New Zealand.** Cross-country estimates suggest that distance explains only a part of New Zealand's relatively weak productivity performance among OECD countries (see figure 21 right panel). An important issue for New Zealand is whether agglomeration forces have strengthened over time and whether this process is cumulative.

Figure 21: The effect of distance and natural resources on output and productivity



Source: OECD (2009)

* Taking New Zealand and proximity to markets as an example, the chart should be read as follows: compared to the average country in the sample, the distance to markets of Australia contributes to lowering its GDP per capita by 10.1 % on average over the 2000-2004 period.

106. **A combination of closer economic integration and large effects of agglomeration on productivity could limit potential growth for a small distant country.** The evidence we have is indicative that distance may lower the level of economic output at the margin. However, there is little evidence that suggests powerful agglomeration effects will lower potential growth.[12] In fact, the existing evidence suggests that an effect of distance does not change much over time. For New Zealand the effects were a little stronger at the end of the period than at the beginning (Boulhol and others, 2008).

107. **More developed economies tend to have a higher share of employment and output in the services sector (Jensen and others 2008).** The services sector is diverse collection of activities and the general pattern above hides large variations (Eichengreen and Gupta, 2000). Advanced economies have seen traditional services – trade, transport and storage, public administration and defence – fall as a share of output. Services mainly consumed by households – education, health, accommodation and restaurants – have seen their share in output rise slowly over time. The largest increase in the share of output was due to the increased importance of the modern sector – finance, business services (for example legal technical and computer services), and communications.[13]

[12] Because agglomeration models admit multiple equilibrium (initial effects are magnified due to cumulative effects) they are inherently difficult to verify. Versions of new geography trade models have been developed that incorporate endogenous growth. Ottaviano and others (2002) note that much work remains to verify theoretical insights against actual experience.

[13] Some of this is simply a measurement effects reflecting increased contracting and outsourcing of business services.

108. **Services have traditionally been considered to be non-tradable because of the importance of proximity.** Technological change – improved information and communications technology and lower transport costs - have contributed to reducing costs to providing services at some distance. Trade agreement frameworks (notably the General Agreement on Trade in Services) have identified and begun to remove impediments to services trade. However, compared with trade in goods, barriers to trade in services (these include barriers to all modes of cross-border service trade[14]) remain pervasive. Barriers to services trade remain material even among countries that have made most progress on economic integration (Eurostat, 2011).

109. **Although there has been significant technological change and some reduction in trade barriers, there has been no major transformation in the intensity of services trade.** Despite significant increases as a share of output in most countries over the past 50 years, trade in services increased only slightly as a proportion of total trade (Lipsey, 2006)**.** Total trade has increased more rapidly than output over this period. Trade in services is more difficult to define and measure than trade in goods. As a consequence, its size and growth are much less certain.[15]

110. **In the context of the US, economists have identified significant potential for increased services trade across borders** (Jensen, 2005). The approach is to define the tradability of services by the extent that service activity is geographically concentrated within the US.[16] This work finds considerable employment shares in tradable service industries and occupations. Employment shares in tradable professional and business service industries are higher than in tradable manufacturing industries. Tradable service sectors have higher skills and significantly higher wages than non-tradable services.

111. **The potential for increased trade in services would provide a largely services-based economy (like New Zealand) with significant scope for greater international integration.** The extent to which this will be realised remains uncertain. Exposure to greater competition in service may provide scope for increased productivity growth in currently sheltered services sectors.

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[14] Service trade is categorised into: (i) cross-border; (ii) commercial presence (can service providers establish a business in the market): and (iii) presence of natural persons (are service providers allowed to work in market).

[15] Classification of services exports depends on the provision to non-residents. Unlike goods exports there is no physical transfer at the border to be recorded. Measurement is further complicated by incentives associate with taxes to distort prices – particular for transactions across borders but within the same firms.

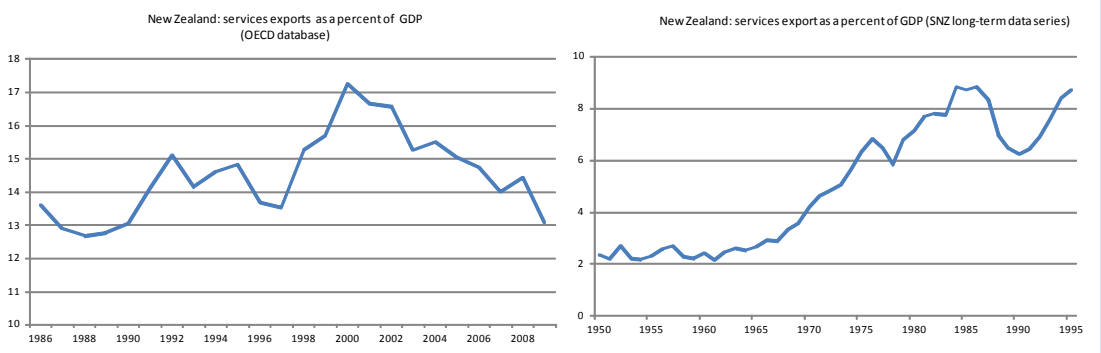
[16] The intuition is that services concentration within a country reflects that the fact that it can be traded without being physically present. Adjustments are made to reflect the fact that concentrated services production may simply reflect concentrations of demand.

Box 8: New Zealand services exports

Since the 1950s the intensity of services exports has increased significantly in New Zealand. Over the last two decades the picture is more mixed (figure 22).

The period since 2000 has seen a marked reduction in the importance of services exports in output. Some of this reversal is likely due to exchange rate movements – with services trade particularly sensitive.

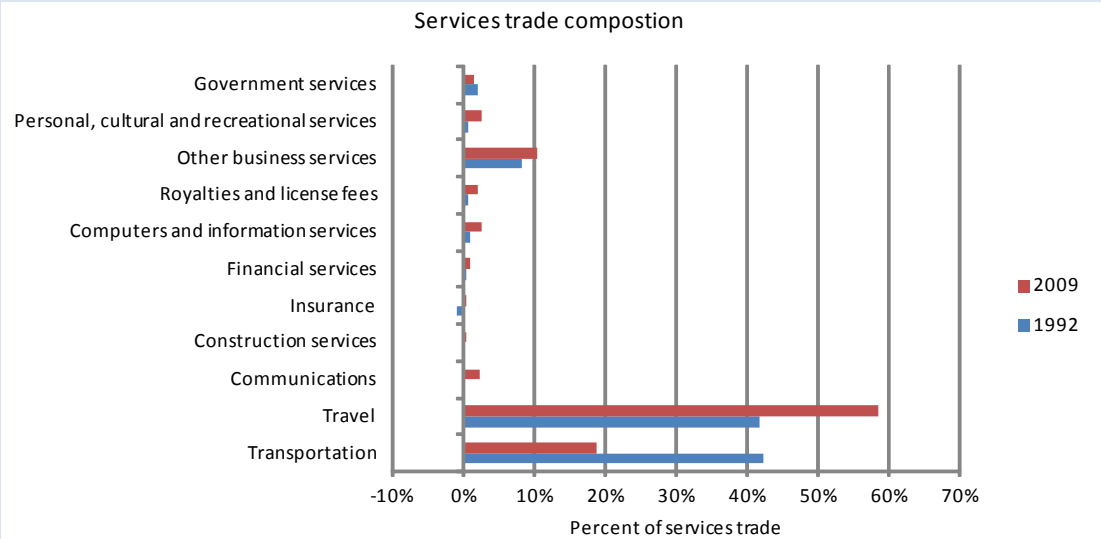
Figure 22: Service export intensity



Source: SNZ Long-term data series; OECD trade database

The rise of travel and tourism, due to rising incomes and a fall in travel and transportation costs, is a key factor behind the increased service trade. More recently there are signs of greater diversification in export services. In particular, there has been an increase in the contribution of commercial services (services exports excluding travel, transportation, government and insurance services) and a reduction in the contribution of transportation services (figure 23).

Figure 23: Changes in the composition of services exports



Source: OECD trade database

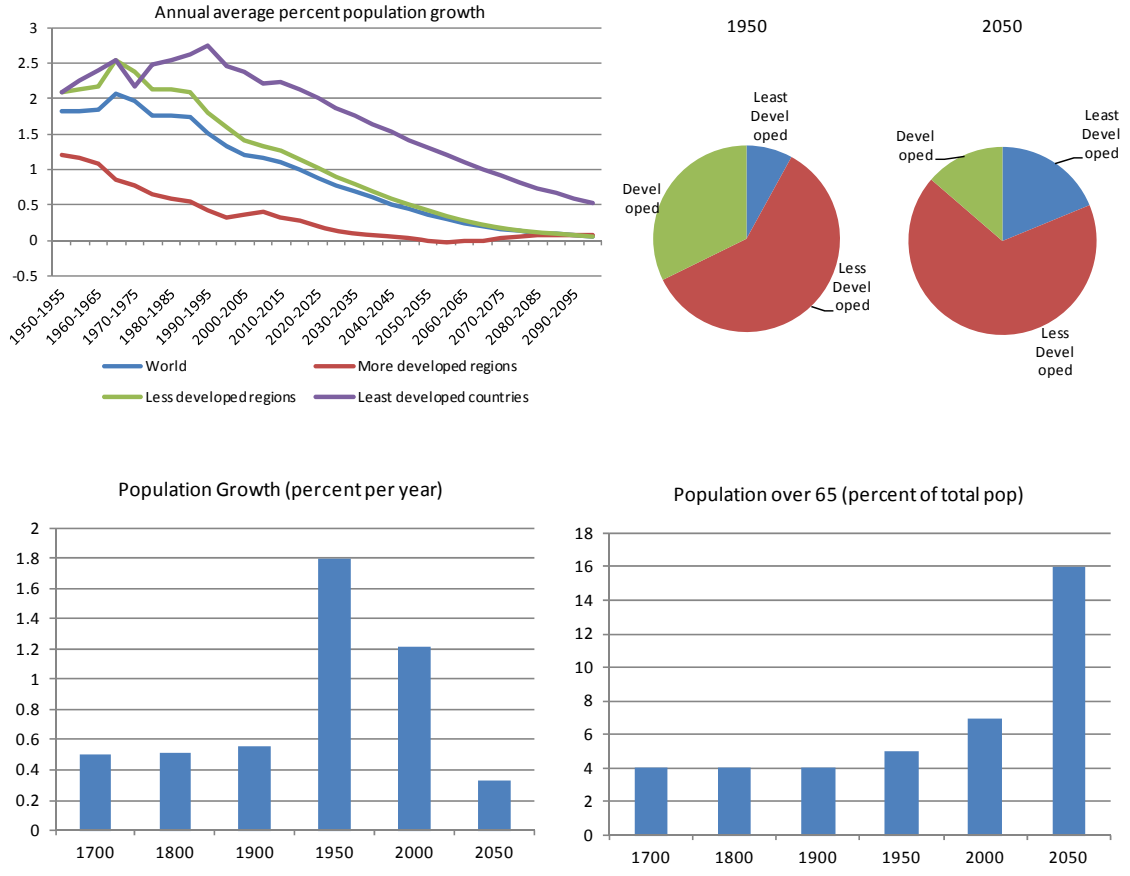
Exports of commercial services were the key driver of the growth in New Zealand's total services exports over 2005-2011. The top four commercial service exports by value included management fees between related parties; computer services; and merchandising and other trade-related services, and architectural engineering and other technical services.

World-wide demographic change

112. **The world is in the midst of a major demographic transition.** The pace of world population growth is slowing (figure 24). The structure of the world population is also changing – with a greater proportion of elderly and a falling share of the young. The changes are already underway in most advanced economies and populations in these countries will be relatively static or decline in some case.

113. **The share of working age population has begun to fall in advanced economies, but will continue to increase in many developing economies.** Most of the additional 3 billion people from now to 2100 will enlarge the population of developing countries. Several emerging markets, including Russia, much of Eastern Europe and China, will begin a demographic transition earlier. While these changes are unprecedented in historical experience, there have been attempts to understand the implications for world economic prospects.

Figure 24: World population growth, age and location



Source: United Nations: World Population Prospects: The 2010 Revision

114. **Econometric analysis suggests that per capita GDP growth responds positively to the relative size of the working age population** (Bloom and others, 2011). These results do not imply causation. The effects on growth reflect the direct impact of a larger labour force; and a higher savings ratio which finances higher investment and boosts output. The extent to which demography affects growth partly depends on the strength of the institutional and policy settings in place. This is thought

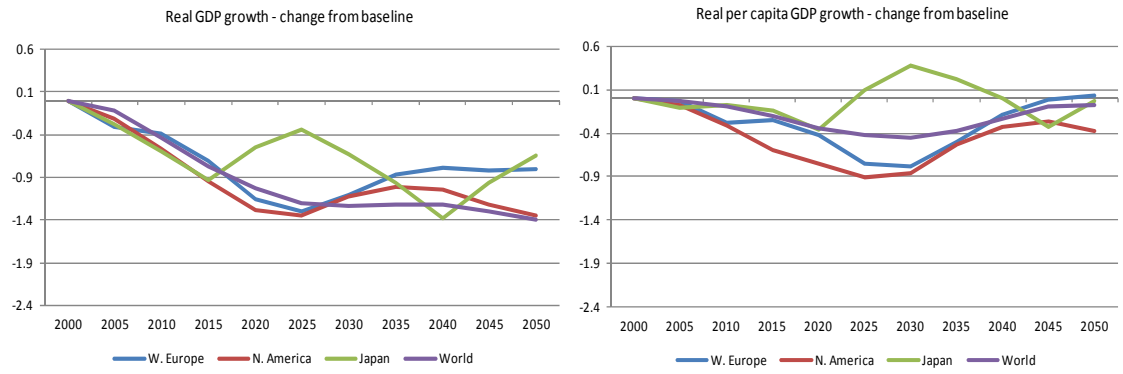
to explain why some countries (in East Asia for example) have reaped a demographic dividend, while others have not.

115. **Demography also has an influence on other economic variables.** Saving rises with an increase in the share of working-age population and declines with an increase in the elderly share. Current account balances decrease when the elderly dependency ratio rises.

116. **The demographic changes ahead could have a material effect on economic growth**. If the historical association between variables holds then the projected demographic change would results in slower GDP growth, and lower saving and investment. Estimates suggest that per capita GDP growth could be around ½ a percent lower than if the demographic structure remained the same as in 2000 (see figure 25).

117. **Modelling of the impact of demographic change shows the estimated impact on growth varies widely by region.** In addition, the effects on GDP growth are larger than on GDP per capita because per capita rates are influenced by the slow or declining population in some regions.

Figure 25: Model-based estimates of the effect of demography on growth



Source: IMF World Economic Outlook 2004

118. **Other assessments caution against a reliance of past experience.** They conclude that past experience will generally overestimate the impact of aging on growth (Bloom and others 2011). They emphasise:

- Simple macroeconomic estimates assume constant age-specific behaviour with respect to labour supply and savings behaviour. Behaviour is likely to change in response to both policy and changes in wages and interest rates.
- Rough estimates of the magnitude of the effect of population aging on the rate of labour force participation, and the concomitant effect of changes in labour force participation on economic growth are, for most countries, of modest size.
- Income per capita is not a welfare measure. Nordhaus (2003) estimates that over the twentieth century improvements in longevity made a contribution to increasing welfare in the United States of roughly the same magnitude as the rise in consumption levels.

119. **Theoretical models emphasise a range of alternative potential channels and with different implications for growth:**

- A shift in demand towards more labour-intensive services from an older set of consumers. This may change the structure of the economy towards activities that have inherently lower productivity growth potential – mostly services. This may lead to lower future productivity growth (van Groezen 2005).
- A shift in the age structure to a greater proportion of workers past prime age where labour returns suggest human capital begins to decline. Such a shift is consistent with the observed relationship in aggregate data. However, the link between growth and age many not necessarily reflect human capital and other mechanisms, such as savings behaviour and demand, may also be important. (Lindh and others, 2007).
- Endogenous growth models that link rate of technological change to the size of the population would imply a reduction in overall productivity growth from a smaller population. However, it would be fair to say that the link proposed in these endogenous models remain uncertain and controversial.

120. **The impact of aging on economic growth is likely to be determined in large part by how policies and institutions adapt.** Key dimensions of adaption discussed in the literature include:

- **Policies that facilitate increased labour supply.** Increased female labour participation has been partly as a result of the demographic change. Years of healthy life-expectancy post-retirement have been increasing sharply over the past few decades. In some cases, decisions regarding labour market participation reflect the incentives of taxes and pensions, workforce practices, labour market restrictions or other policy barriers. At the same time the increase in labour-force participation that would offset the reduction from demographic change are for many countries very large and unprecedented in recent history. Policies that would support higher fertility have been advocated by some – although there would be a long lag before this would influence the labour force and significant uncertainty about the role of policy in raising fertility.
- **Policies that support the accumulation of capital and higher savings.** The range of policy choices includes the appropriate degree of government savings and pension reform (although the actual design of such reform is important to the overall effect on saving). For some countries greater participation in international capital flows can provide a means to smooth consumption and investment.
- **Policies that improve productivity with which labour and capital are applied.** More efficient use of inputs could be an important offset to an expected lower growth in labour supply in the next 50 years. In many countries structural reform has the potential to lift productivity growth. In itself this will not alleviate public financing pressures where benefits are linked to wages, although higher overall income may make the environment more conducive to reform.

Interactions with New Zealand policies and institutions

121. **External influences have had a powerful influence on New Zealand economic potential.** The New Zealand economy is still recovering from the largest external economic and financial shock since the Great Depression. Changing patterns of world growth have substantially raised the price of New Zealand exports and changed patterns of trade. Shifts in international saving, investment and risk appetites will influence the cost and availability of external finance.

122. **The way in which external influences will affect New Zealand's economic potential depends on the characteristics of the New Zealand economy, the quality of our institutions, and our policy settings.** Economic models relate the speed of conditional convergence to the degree of international integration, some measure of human capital, and a suite of indicators that attempt to capture the quality of policies and institutions in a country (Bouis and others 2011).[17]

123. **One drawback of these models is that while they explain the average historical OECD experience reasonably well, there is a large unexplained component for New Zealand.** In practical terms these simple models predict that New Zealand should currently have a smaller gap in GDP per capita than is it currently has.

124. **New Zealand is unique among developing countries.** It is distant from major centres of economic activity, small, has relatively low levels trade intensity, and a composition of trade that is heavily weighted towards primary.

125. **Evidence suggests that geography may limit the potential level of output in New Zealand compared with the technology leaders. E**stimates suggest that difficulties in market access due largely to distance from major markets penalises New Zealand by around 10 per cent of GDP (Boulhol and others, 2008).[18] While such estimates imply a material effect, there still remains a large residual that is not explained by size and distance.

126. **Future developments may also affect the relationship between size and distance and economic growth.**

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[17] More specifically, the OECD model of long-run scenarios models the steady state level of productivity of each country as a function of the OECD index of product market regulation (this is intended to account for international spillovers and competitive policies) while the speed of convergence towards the world frontier to depend on openness. Future openness is modelled as a function of domestic income, income of trading partners, population, competitiveness of countries (e.g. real exchange rate) and policy barriers to trade (e.g. PMR barriers to trade).

[18] The 10 percent estimate is with reference to a notional economy with no effects from size and distance. Translating this into cross-country comparisons elimination of the constraints of size and distance stance would close the gap in per capita GDP with the United States from 43 percent to 37 percent, the gap with the average of countries in the study from 27 percent to 16 percent and with Australia from 30 percent to 28 percent (Crawford, 2010)

- **Significant reductions in the cost of transportation and communication are likely to have favour greater economic integration and faster growth in New Zealand.** Analysis suggests that the reduction in transport costs has slowed materially over time (and has halted in the case of sea transport) and further improvements in communications technology may also slow.

- **Faster growth in the Asian region has reduced the effective economic distance for New Zealand and Australia** (Battersby and Ewing, 2004). To the extent that the shift in economic activity towards Asia continues, this trend is likely to continue and reduce the limiting effects on New Zealand's economic potential.

- **There are concerns that constraints on New Zealand growth are the result of higher economic returns to larger cities and countries attracting labour and capital away from New Zealand**.[19] If this process was cumulative (i.e. further agglomeration led to higher productivity which encourages further agglomeration) it would imply continually widening income disparities between New Zealand and the rest of the OECD.

127. **On balance, the evidence suggests that size and distance is best viewed as having an impact that constrains the level of GDP in New Zealand.** This constraint is material, but does not explain a significant part of the gap in GDP per capita with better performing countries. The evidence doesn't fit well with a cumulative process of agglomeration holding back New Zealand growth rates. Differences in measured sector productivity growth rates are not large over the last 30 years, and there is little evidence of more intensive foreign investment flows to Australia or emigration to Australia that is biased towards those with higher skills (Crawford 2010).

128. **New Zealand is one of the least integrated small open developed economies** (Skilling and Boven 2007; Box and Claridge, 2000). This is despite low formal barriers to trade and investment, and a high level of policy integration with Australia. The degree of trade integration is an important factor conditioning the pace of economic catch-up and convergence in productivity (Blakeley and others, 2009). Other dimensions of integration - such as capital and openness to people movement - are likely to be important, although their link to productivity is less clear cut.

129. **Concerns about the contribution and size of the tradable sector in New Zealand have a long history.** Examinations of constraints on New Zealand's tradable performance have emphasised the role played by high levels of domestic protection and microeconomic policies that discouraged trade prior to the 1980s; distance and economic structure(Battersby, 2005); low trade intensity that reflects in part the high level of value added in New Zealand exports (Black and others, 2003); the role of domestic demand, macroeconomic policy management and the exchange rate; natural constraints to supply responses to large terms of trade shifts; and that

[19] This explanation economic performance focused on the interaction between lower transaction costs (lower trade barriers, transport, travel, telecommunications) and agglomeration economies. Agglomeration economies arise because of a range of possible causes, including, most importantly for McCann's argument, knowledge spillovers, but also productivity benefits from "thick" labour and input markets, and increased competition. As spatial transaction costs fall, more productive economic activity is attracted to regions exhibiting agglomeration economies, leading to a divergence in incomes between regions.

New Zealand's comparative advantage lies in goods where demand has grown slowly compared with world trade in general (Briggs and others, 2001).

130. **Despite only moderate change in trade intensity over time, there is evidence that the nature of New Zealand exports have changed.** Over the past 30 years services exports – in particular travel and education – have become a larger share of our export base. Our trading partners have changed significantly over time – with a significant rise in the importance of Pacific and Asian trading partners – Australia and more recently China.

131. **New Zealand is among the most heavily indebted developed economies.** This creates vulnerabilities that need to be managed carefully (Savings Working Group, 2011). Access to international savings has been critical to funding a higher level of investment than possible from domestic savings. At the same time domestic savings and investment behaviour may expose New Zealand to risks from sudden reversals in international assessments (Andre, 2011) of New Zealand and may constrain growth by increasing the cost of capital.

132. **External economic developments are likely to shape prospects for deeper international integration:**

- Multilateral mechanisms that reduce barriers to trade have struggled to make progress in an environment of slow growth and a larger role for emerging markets. New Zealand has pursued a range of regional and bilateral arrangements in order to continue to lower trade barriers. However, a less supportive multilateral trading environment poses particular risks to small open economies (Skilling, 2012)

- Continued strong growth in emerging Asia, and the potential for gains from regional integration, are likely to provide opportunities to deepen and expand New Zealand trading prospects. As these economies continue to develop there are likely to be changes in the nature of demand. Some of these changes may support higher demand in sectors where New Zealand arguably has a comparative advantage – food production, education, tourism and environmental quality.

- The scope for greater international integration is likely to be shaped by domestic policies. These include the potential to better manage domestic demand pressures – and avoid large swings in exchange rate and interest rates.

133. **Renewable resources – land, water, marine resources and the environment – play an important role in economic activity in New Zealand.** Higher international prices for products derived from natural resources reflect increased demand for these resources. One consequence is additional environmental pressures from more intensive resource use. In some cases this requires addressing concerns about the effectiveness of the mechanisms for setting limits on resource use and ensuring these limits also lead to an efficient use of resources.

134. **The way in which resources pressures are managed has implications for growth.** Constraints on reallocation of resources will limit the ability for supply to respond to higher prices. Resource allocations that are based on historical use patterns may impede structural change. An absence of mechanisms to manage environmental externalities may result in blunt instruments that prevent economic

investment. More fundamentally, higher resources prices provide a key incentive for innovation to increases in the productivity of resource use and leads to substitution between different input mixes.

135. **The nature of participation by New Zealand in global climate change agreements may also affect investment and growth.** New Zealand's emission profile – agriculture makes an important contribution and energy production patterns already have low emissions. This implies significantly higher marginal abatement costs in New Zealand (Infometrics, 2007)). A broad framework exists in New Zealand for applying international commitments in a way that can help minimise economic cost. The extent to which New Zealand commits to ambitious targets for future emissions reduction targets will determine the scale of the economic costs incurred.

Institutions and policy settings

136. **The quality of underlying institutions – defined broadly as secure property rights and broad opportunities for economic participation – appear central to longer-term economic growth prospects.** Objective measures of the institutional quality tend to rate New Zealand as among better-performing developed economies. Preserving institutional quality will remain critical to overall performance.

137. **Cross-country growth regressions (used with a great deal of caution) provide broad guidance on the factors that are proximate determinants of growth.** A full discussion of these factors is beyond this report but the factors identified as important include; human capital, investment and capital market development, infrastructure, and the quality of product market and regulatory indicators.

138. **Simple models looking at proximate sources of growth and policy settings imply that New Zealand should have higher productivity and GDP per capita.** While there are some important dimensions that are missing from these models - including macroeconomic policies and geographical factors – they suggest substantial scope for New Zealand growth rates that exceed the technology leaders over the next 50 years.

139. **Improved policies and institutions and strong world growth increased New Zealand's average growth over the last 30 years.** These changes resulted in better productivity performance and increased labour participation (New Zealand Treasury, 2004). This improvement has broadly seen New Zealand per capita output keep pace with the OECD in recent decades. At the same time, there are few signs that the large gap that opened up with average advanced economy performance has closed.

140. **Productivity growth in New Zealand slowed over the 2000s.** GDP growth was supported by higher labour participation and faster capital accumulation. The ultimate source of slower productivity remains a matter of debate. Potential explanations of how policy might have contributed to the slowdown include: (i) the emergence of macroeconomic imbalances that hindered the growth of more productive tradable sector and slowed export growth, (ii) a slowing in the pace of microeconomic reform that prevented structural change necessary for faster productivity growth; and

(iii) an increase in the share of government spending as a proportion of GDP (2025 Taskforce, 2009).[20]

141. **It is difficult to quantify the contribution to the slowdown in productivity to particular factors.** Changes in structural policy settings over 2000s are quite moderate in the context of past episodes of structural reform. Unbalanced growth may have played some role in lower productivity (Procter, 2011). And although there were significant increases in government spending as proportion of the economy, the link between government size and productivity remains complex (Cook and others, 2011). Furthermore, the transition to lower productivity growth pre-dates the increase in government consumption.

142. **The financial crisis has affected New Zealand's economic performance severely over the past 5 years.** The recovery from the crisis has been slow and moderate compared with past economic cycles. Productivity growth has stalled, unemployment increased, and capital investment slowed markedly. Forecasts from international agencies show New Zealand will take 6-7 years to return to pre-crisis levels of output per capita. Current assessments (Yan, 2010) suggest that the crisis has reduced the *level* of potential output. This could be through an increase in the cost of capital of that leads to lower innovation and risk taking, and the potential loss in human capital from extended periods of higher unemployment.

143. **On balance it seems unlikely that the global financial crisis will have permanently reduced New Zealand's long-term potential productivity growth rate.**[21] International evidence generally points towards slower and longer recoveries in countries that suffer from financial crises or that experience a larger build-up in debt levels (IMF, 2012). At the same time, it appears that permanently lower growth rates as a result of such crisis are the exception.

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[20] Other potential explanations include changes in the quality of labour (as employment participation increased marginal workers with lower skills enter the workforce) (Treasury Productivity Perspective Overview 2006); cyclical factors – we have yet to go through full economic cycles from mid 2006;

[21] This judgement takes on a different complexion when thinking about the near-term evolution of the economy – where the stock of capital can change less rapidly and there is scope for miss-matches in labour markets to push unemployment above it natural rate (see the Reserve Bank of New Zealand Monetary Policy Statement, June 2012)

Box 9: Recent estimates of long-run growth

Scenario estimates of long-run growth assume that each country converges to its own steady-state trajectory of GDP per capita. Given the numerous difficulties of projecting long-run growth these exercises are inherently speculative and should better treated as thought experiments than forecasts.*

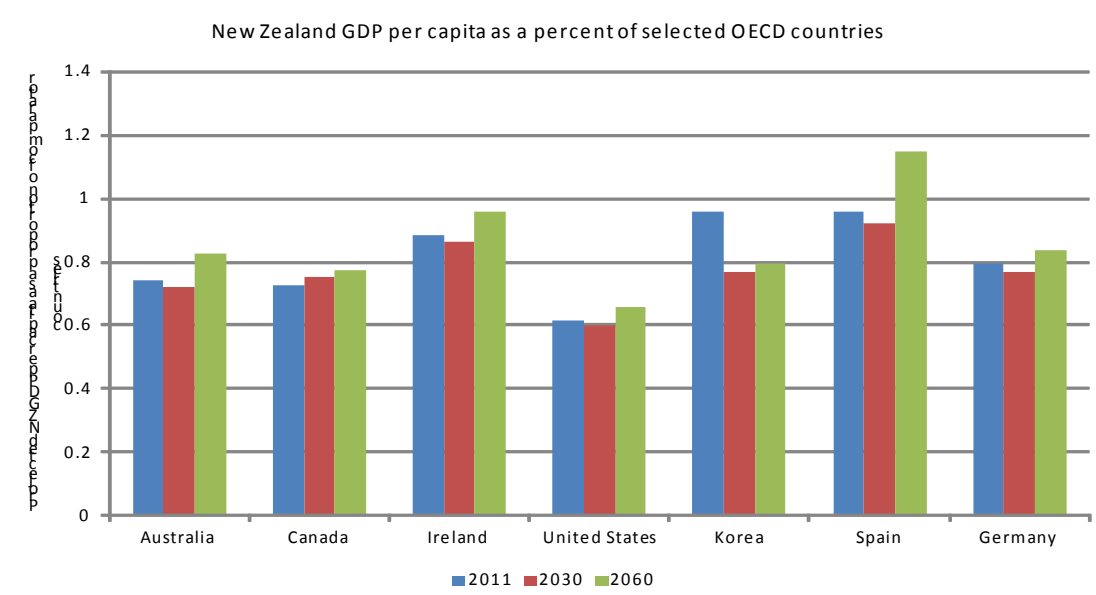
Convergence is determined by the interface between global technological development and country-specific structural conditions and policies. Economic forces act to reduce cross country GDP per capita gaps – countries catch-up as a result of the accumulation of human and physical capital and improvements in efficiency (driven by technology adoption and innovation). Cross-country differences are reduced over time as structural conditions change – driven by globalisation and adoption of better policies. Key features of the OECD approach to modelling long-run scenario include:

- Components of a production function are forecast for each country.
- Multi-factor productivity growth is driven by the
- global rate of technical progress assumed to be 1.3% per year – the average rate of MFP growth observed among advanced economies over the period 1996-2006) and by the speed at which lagging economies embody new technology and improve efficiency in order to catch-up to the level of technology.
- The speed of "catch-up" towards the country-specific steady-state level of MFP, which depends on trade openness and the strength of domestic competition. Product market regulation (PMR) affects the level of MFP, while openness (proxied as trade to GDP) affects the country-specific speed of convergence towards the technological frontier.
- Capital-to-potential-output is projected to be relatively stable.
- Human capital influences labour productivity through the accumulation of education over time (measures are not adjusted for quality)
- Labour supply is forecast based on population projection and participation is projected on the basis that all future cohorts will display the same exit and entry rates as the most recent cross-section of cohorts
- The level of potential output is lowered by the crisis in many advanced economies but potential growth rates remain unaffected.
- Policies are assumed to adjust to: (i) maintain the average share of lifetime spent in activity as population age; (ii) continued convergence in educational outcomes; (iii) adjust product market and regulatory practice to the OECD average; and (iv) public debt to GDP ratios are stabilised.

* First, there is model uncertainty, the most appropriate growth model is unknown and could feature a very wide range of determinants; second there is uncertainty about the magnitude – and in some even the nature – of the growth impact of any given determinant. Third, even if the first two issues were unimportant, all of the growth drivers themselves are hard to predict.

Box 9: Recent estimates of long-run growth (continued)

Figure 26: Measures of catch-up



Source: OECD (2012)

Other long-run projections take a similar modelling approach, with the key differences relating to the estimated speed of convergence, the assumed growth rate of world technology growth, and differences in the factors which condition convergence. Most estimates suggest per capita growth for New Zealand that is somewhat faster than the countries at the technology frontier. However, such growth rates imply a relatively slow pace of convergence and leave a significant gaps in GDP per capita in 2060 compared with the United States in 2060 (figure 25). Such an outcome would still be a significant improvement on past relative performance (see figure 26).

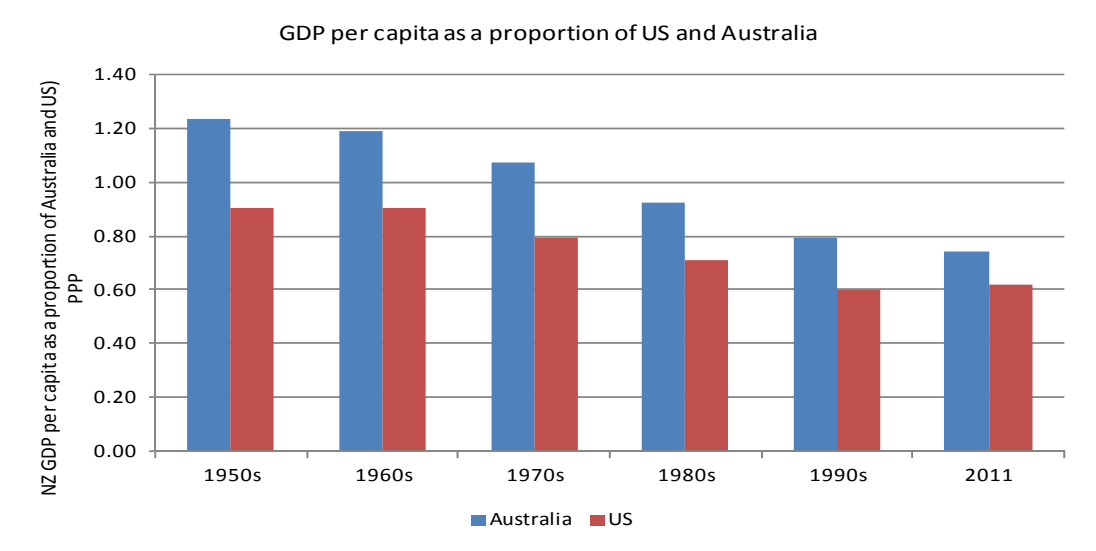
Box 9: Recent estimates of long-run growth (continued)

Table 3: Long-run growth estimates

	Average growth in GDP (US$ PPPs 2005)				Average growth in GDP per capita (US$ PPPs 2005)			
	1990-2011	2011-2030	2030-2060	2011-2060	1990-2011	2011-2030	2030-2060	2011-2060
OECD (2012 draft working paper)	2.7	2.2	2.2	2.2	1.5	1.4	1.9	1.7
	2005-2015	2015-2025	2025-2050	2005-2050	2005-2015	2015-2025	2025-2050	2005-2050
Duval and de la Maisonneuve (2010)	2.4	2.4	2.1	2.2	1.5	1.5	1.6	1.5
	2010-2020	2020-2030	2030-2040	2040-2050	2010-2020	2020-2030	2030-2040	2040-2050
Foure and others (2010)	2.786	1.906	1.600	1.226	1.91	1.38	1.30	1.60
	2010-2020	2020-2030	2030-2040	2040-2050				
Citibank (2011)**	3.2	2.6	2.5	2.5				
	Total GDP (average growth rates)				Income per capita (average growth rates)			
	2010-2020	2020-2030	2030-2040	2040-2050	2010-2020	2020-2030	2030-2040	2040-2050
HSBC (2012)	3.4	3	2.9	2.9	2.9	2.7	2.6	2.6

** Australia and New Zealand

Figure 25: Measures of catch-up



Source: OECD 2012

Risk and scenario

144. **The discussion of future influences above should not be seen as a central scenario.** Significant uncertainly exists. In addition, this uncertainty compounds as the economy is influences by a mix of different external developments. The path for the economy is also unlikely to be smooth and the economy will also be buffeted by a range of shocks. The past 3-4 years have series of large shocks hit the economy – drought, the global financial crisis, the Christchurch earthquake and the sharp increase in the terms of trade.

145. **It is common to set out a range of alternative scenarios that may alter some of the more central discussions above.** The attached table sets out some highly stylised alternative scenarios of eternal developments that would have fundamental implications of the future path of economic output.

	Scenarios	World impact	Impact on New Zealand economic prospects
Post-crisis recovery	Extended Japanese-style debt deflation in advanced countries	Stagnant incomes in advanced economies. Falling prices.	Significant. Would depend on whether New Zealand enters similar debt-deflation dynamics.
Economic Integration	Economic integration reverses	Global growth fall to a little over 1 percent – implying stagnant per capital incomes for advanced economies	May have a similar material impact on New Zealand. Stagnant per capita incomes
Economic Integration	Agglomeration forces are cumulative. The negative impact of size and distance lower labour productivity, further lowering size and creating a self-reinforcing dynamic.	Unclear.	Material impact on New Zealand. Gap in per capita income with OECD will resume widening.
Technology change	The pace of technology change slows markedly	World growth slows markedly and is driven mainly by catch-up in emerging markets. Fundamental changes to economies and society. Resource scarcity increases, population pressures bite and prospects for conflict increase materially.	Would slow growth in New Zealand materially. Fundamental effect on long-run welfare.
Natural resources	Extreme climate change - global mean temperature increase of 6 degrees	Could lower GDP per capita levels by 8-10 percent. Raises chance of permanently lower growth	Impact on New Zealand significant but not as large as average impact assessment (8-10 percent of GDP). Most losses fall in already warm regions. Subsequent political and societal impact unclear
Changes in world economic weight	Process of income convergence in India and China slows or halts	Materially lower world growth and commodity prices retuning to levels through the 1980s and 1990s	Significant impact on trading partner growth and large income shock from commodity prices
Demographic change slows growth	Failure to adapt behaviour or policies to older population.	Could lower world growth by as much as ½ percentage point.	The effect on New Zealand probably depends on our own approach to adapting to an older population.

References

2025 Taskforce (2009) 'Answering the $64,000 Question Closing the income gap with Australia by 2025: First Report and Recommendations 2025 Taskforce' Wellington

Abbas, S.M. Ali, Nazim Belhocine, Asmaa El-Ganainy and Mark Horton (2010) "A Historical Public Debt Database", IMF Working Paper WP/10/245, Washington, DC.

Abdelhak, S., (2004), "Sources of economic growth in New Zealand: A comparative analysis", section 1 in New Zealand: Selected Issues: IMF Country Report No. 04/127, May

Acemoglu, D., Johnson, S., and Robinson, J, (2005) 'Institutions as the Fundamental Cause of Long-Run Growth', Handbook of Economic Growth, Elsevier, North Holland, 2005.

Andre, J., (2011) 'Economic Imbalances: New Zealand's Structural Challenge' New Zealand Treasury WP 11/03, Wellington

Australian Commonwealth Government (2011) 'Opportunities and Challenges of an Economy in Transition' Budget Paper No. 1, Statement 4

Battersby, B., (2006) 'Does distance matter? The effect of geographic isolation on productivity levels' OECD Economic Studies No. 42 2006 Vol. 1

Battersby, B., and Ewing, R., (2005) 'International Trade Performance: The Gravity of Australia's Remoteness', Australian Treasury Working Papers

Bean, C., (2009) 'The Great Moderation, the Great Panic and the great Contraction: Schumpeter Lecture, Annual Congress of the European Economic Association

Bernanke, B., Bertaut, C., DeMarco, L., and Kamin, S., (2011) 'International Capital Flows and the Returns to Safe Assets in the United States, 2003-2007' Board of Governors of the Federal Reserve System International Finance Discussion Papers Number 1014, February 2011

Black, M., Vink, M., White, M (2003) "Aspects of the New Zealand Export Performance." Internal Treasury paper

Blakeley, N., Cruickshank, A., Kidd, N., and Thompson, C, (2009) 'International Connections and Productivity: Making Globalisation Work for New Zealand' New Zealand Treasury Productivity Paper 09/01 Published 2 Apr 2009

Blakeley, N., Lewis, G., and Mills, D., (2005) 'The Economics of Knowledge: What Makes Ideas Special for Economic Growth?' New Zealand Treasury Policy Perspectives Paper 05/05

Blanchard, O., and Milesi-Ferretti, G., (2009) ' Global Imbalances in Midstream', IMF Staff Position Note SPN/09/29, Washington DC

Blanchard, O., and Wolfers, J, (1999) 'The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence', NBER Working Papers 7282

Bloom, D., Canning, D., and Fink, G. (2011) 'Implications of Population Aging or Economic Growth, Working Paper Program of the Global Demography of Aging, Working paper No. 64. Harvard University

Bouis, R., Duval, R and F. Murtin (2011), "The Policy and Institutional Drivers of Economic Growth across OECD and Non-OECD Economies: New Evidence from Growth Regressions", OECD Economics Department Working Papers, No. 843, OECD Publishing. http://dx.doi.org/10.1787/5kghwnhxwkhj-en

Boulhol, H., de Serres, A., and Molnar, M (2008), "The contribution of economic geography to GDP per capita", OECD Economics Department Working Paper No.602, April

Briggs, P., Bishop, P., and Fan, E., (2001) 'New Zealand's economic growth: Why has it been so low? NZIER working paper 2001/2, New Zealand Institute of Economic Research, Wellington

Buiter, W., Rahbari, E., (2011)Global growth generators: Moving beyond emerging markets and BRICs', Centre for Economic Policy Research, Research Insight No. 55

Carraro , C., Gerlagh, R., van der Zwaan (2001), ' Endogenous technical change in environmental macroeconomics' Resource and Energy Economics 25 (2003) 1–10

Cecchetti, S., Mohanty, M., and Zampolli, F., (2011) 'The real effects of debt,' BIS Working Papers 352, Bank for International Settlements

Chen, V., Gupta, A., Therrien, A., Levanon, G., and van Ark, B., (2011) 'Recent Productivty Developments in the World Economy: An Overview from the Conferecne Board Total Economy Database', Research Report R-1475-11-RR, New York

Cook, D., Schousboe, C., and Law, D., (2011) ' Government and economic growth: Does size matter?' New Zealand Treasury Working Paper TP/11/01, Wellington

Cowen, T., (2011) The Great Stagnation: How America Ate All the Low-Hanging Fruit of Modern History, Got Sick, and Will (Eventually) Feel Better', Penguin Books Ltd, London, England

Crawford, R., (2010) 'Distance from markets and econometric estimates of effects on productivity in the OECD: A comment on two country level studies', Internal Treasury Memo

David, P. Bunn, J., (1988) 'The economics of gateway technologies and network evolution: Lessons from electricity supply history,' Information Economics and Policy, Elsevier, vol. 3(2), pages 165-202.

Dell, M., Jones, B., Olken, B., (2008) 'Climate Change and Economic Growth: Evidence from the Last Half Century' NBER Working Paper No. 14132, National Bureau of Economic Research

Easterly, W., and Levine, R., (2002) 'It´s Not Factor Accumulation: Stylized Facts and Growth Models,' Central Banking, Analysis, and Economic Policies Book Series, in: Norman Loayza & Raimundo Soto & Norman Loayza (Series Editor) & Klaus Schmidt-Hebbel (Series Editor) (ed.), Economic Growth: Sources, Trends, and Cycles, edition 1, volume 6, chapter 3, pages 061-114 Central Bank of Chile.

Economist Intelligence Unit, (2006) The World in 2020 Economic, industry and corporate trends, Economist Intelligence Unit

Eichengreen, B., and Gupta, P., (2009) 'The Two Waves of Service Sector Growth,' NBER Working Papers 14968, National Bureau of Economic Research

Eichengreen, B., Park, D., and Shin, K., (2011), "When Fast Growing Economies Slow Down: International Evidence and Implications for China," NBER Working Paper no.16919 (March)

Eurostat (2008) 'Study on International Trade in Services' http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-08-057/EN/KS-SF-08-057-EN.PDF

Fouré, J., Bénassy-Quéré, A., and Fontagné, L. (2010) 'The world economy in 2050: a tentative picture', Centre D'Estudes Prospectives et D'Informations Internationales EPII, WP No 2010-27

Gordon, R., (2000a) 'Interpreting the "One Big Wave" in U.S. Long-Term Productivity Growth,' NBER Working Papers 7752, National Bureau of Economic Research

Gordon, R., (2000b) 'Does the 'New Economy' Measure up to the Great Inventions of the Past?," CEPR Discussion Papers 2607, C.E.P.R. Discussion Papers.

Gordon, R., (2004) 'Two Centuries of Economic Growth: Europe Chasing the American Frontier' NBER Working Paper No. 10662

Gordon, R., (2010) 'Revisiting U. S. Productivity Growth over the Past Century with a View of the Future', NBER Working Paper No. 15834

Gordon, R., (2012) 'Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds' NBER Working Paper No. 18315, National Bureau of Economic Research

Griliches, Z., (1994) 'Productivity, R&D, and the Data Constraint,' American Economic Review, American Economic Association, vol. 84(1), pages 1-23, March.

Haugh, D., Ollivaud, P., and Turner, D., (2009) 'The Macroeconomic Consequences of Banking Crises in OECD Countries', Economics Department Working Paper No.683

Haugh, D., P. Ollivaud and D. Turner (2009), "The Macroeconomic Consequences of Banking Crises in OECD Countries", OECD Economics Department Working Papers, No. 683, OECD Publishing. http://dx.doi.org/10.1787/226123651438

Infometrics (2007) 'General Equilibrium Analysis of Options for Meeting New Zealand's International Emissions Obligations', report prepared for Emissions Trading Group

International Monetary Fund (2004), 'World Economic Outlook Chapter 3: How will Demographic change Affect the Global Economy', September 2004, Washington DC

International Monetary Fund (2009a), 'World Economic Outlook Chapter 3: From recession to recovery; How soon and how strong?', April 2009, Washington DC

International Monetary Fund (2009b), 'World Economic Outlook Chapter 3: What's the Damage? Medium-Term Output Dynamics after Financial Crises', October 2009, Washington DC

International Monetary Fund (2011), 'New Zealand Selected Issues: 'From East to West: Estimating External Spillovers to Australia and New Zealand' Country Report 11/103, Washington DC

International Monetary Fund (2011), 'The too Import-to-Fail Conundrum: Impossible to Ignore and Difficult to Resolve', Washington DC

International Monetary Fund (2011a), 'Strengthening the International Monetary System: Taking stock and Looking Ahead', Washington DC

International Monetary Fund (2011b), 'The too Import-to-Fail Conundrum: Impossible to Ignore and Difficult to Resolve', Washington DC

International Monetary Fund (2012), 'World Economic Outlook Chapter 3: Dealing with household debt', April 201, Washington DC

International Monetary Fund (2012), 'World Economic Outlook', April 2012, Washington DC

Jensen, B., and Kletzer, L., (2005) 'Tradable Services: Understanding the Scope and Impact of Services Outsourcing,' Working Paper Series WP05-9, Peterson Institute for International Economics

Jensen, J., and Kletzer, L., (2008) '"Fear" and Offshoring: The Scope and Potential Impact of Imports and Exports of Services,' Policy Briefs PB08-1, Peterson Institute for International Economics

Jones, C., (1995) 'R&D-Based Models of Economic Growth' Journal of Political Economy, August 1995, Vol. 103, pp. 759-784.

Jorgenson D., and Vu, K., (2009) Potential Growth of the World Economy, Harvard Economic Department working paper

Jorgenson D., and Yip, E., (2001) 'Whatever Happened to Productivity Growth?,' NBER Chapters, in: New Developments in Productivity Analysis, pages 509-540 National Bureau of Economic Research

Kjellstrom, T., Kovats, R. Lloyd, S., Holt. T., (2008) ' The direct impact of Climate Change on Regional Labour Productivity', Economic and Social Research Institute, Working Paper no. 260

Krautkraemer, J., (1998) 'Non-renewable Resource Scarcity' Journal of Economic Literature, Vol. 36, No. 4 (Dec., 1998), pp. 2065-2107

Krugman, P., and Venables, A., (1995) 'Globalization and the Inequality of Nations,' NBER Working Papers 5098, National Bureau of Economic Research

Kumar, M. and Woo, J. (2010) "Public Debt and Growth" IMF Working paper, WP/10/174

Laeven, L., and Valencia, F., (2012)' Systemic Banking Crises Database: An Update' IMF Working paper WP/12/163, Washington DC

Lindh, T., and Malmberg H., (1999) B 'Age structure effects and Growth in the OECD', Journal of Population Economics, 12: 431-449, Springer-Verlag

Lipsey, R., (2006) 'Measuring International Trade in Services,' NBER Working Papers 12271, National Bureau of Economic Research

Little, S., (2001) 'Lessons from the losers: what the also-rans can teach us about economic performance,' The Treasury Economic Transformation Papers (2001)

Maddison A., (2005) 'Evidence submitted to the Select Committee on Economic Affairs, House of Lords, London, for the inquiry into "Aspects of the Economics of Climate Change"

Maddison, A., (2008) 'The West and the Rest in the World Economy: 1000-2030,' World Economics, World Economics, Economic & Financial Publishing, Oxfordshire, United Kingdom, vol. 9(4), pages 75-100, October.

Magud, N., Sosa, S. (2010) "When and Why Worry About Real Exchange Rate Appreciation? The Missing Link between Dutch Disease and Growth", IMF Working Paper 10/271, Washington DC.

Mateos y Lago, I., Duttagupta, R., and Goyal, R., (2009) 'The Debate on the International Monetary System, Staff Position Note No. 2009/26

McCann, Philip (2009) 'Economic geography, globalisation and New Zealand's productivity paradox', New Zealand Economic Papers, 43: 3, 279 — 314

McKinsey Global Institute (2011), 'Resource Revolution: Meeting the World's Energy, Materials, Food and Water needs' November 2011

Milner, H., (1999)'The political economy of International trade' Annual Revue Political Science 1999, Vol 2:91–pp 114

Nelson, C., and Plosser, C., (1982), Trends and random walks in macroeconomic time series: Some evidence and implications, Journal of Monetary Economics, 10, issue 2, p. 139-162

Nordhaus, W., (1992) 'Lethal Model 2: The Limits to Growth Revisited,' Brookings Papers on Economic Activity, Economic Studies Program, The Brookings Institution, vol. 23(2), pages 1-60.

Nordhaus, W., (1992) 'The 'DICE' Model: Background and Structure of a Dynamic Integrated Climate-Economy Model of the Economics of Global Warming,'

Cowles Foundation Discussion Papers 1009, Cowles Foundation for Research in Economics, Yale University.

Nordhaus, W., (2002) 'The Health of Nations: The Contribution of Improved Health to Living Standards,' NBER Working Paper No. 8818, National Bureau of Economic Research

Nordhaus, W., (2004) 'Retrospective on the 1970s Productivity Slowdown,' NBER Working Papers 10950, National Bureau of Economic Research

Nordhaus, W., (2006) 'The "Stern Review" on the Economics of Climate Change,' NBER Working Papers 12741, National Bureau of Economic Research

Nordhaus, W., (2010) 'Economic aspects of global warming in a post-Copenhagen environment,' Proceedings of the National Academy of Sciences (US), June 2010

Nordhaus, W.D., Stavins, R., Weitzman, M., (1992), "Lethal Model 2: The Limits to Growth Revisited" Brookings Papers on Economic Activity, Vol. 1992, No. 2, pp. 1-59.

OECD (2011), Globalisation, Comparative Advantage and the Changing Dynamics of Trade, OECD Publishing. http://dx.doi.org/10.1787/9789264113084-en

OECD (2011), Globalisation, Comparative Advantage and the Changing Dynamics of Trade, OECD Publishing. http://dx.doi.org/10.1787/9789264113084-en

OECD (2012) 'Long-Term Growth Scenarios' Forthcoming Economics Department Working Paper, Paris

OECD (2012) 'The real economy and the crisis: revisiting productivity fundamentals' http://www.oecd.org/employment/labourstatistics/therealeconomyandthecrisisrevisitingproductivityfundamentals.htm

Ottaviano, G., Tabuchi, T., Thisse, J., (2002) 'Agglomeration and trade' International Economic Review, Vol. 43, No. 2, May 2002

Papell, D., and Prodan, R., (2011) The Statistical Behavior of GDP after Financial Crises and Severe Recessions', paper has been prepared for the Federal Reserve Bank of Boston conference on "Long-Term Effects of the Great Recession," October 18-19, 2011.

PriceWaterhouseCoopers, (2011) 'The World in 2050: The accelerating shift of global economic power: challenges and opportunities', www.pwc.co.uk/economics

Procter, R., (2011) 'Enhancing Productivity: Towards an Updated Action Agenda', Ministry of Economic Development, Occasional Paper 11/01

Rajan, R., (2010) 'Fault Lines, How Hidden Fractures Still Threaten the World Economy', Princeton University Press

Reinhart, C. Reinhart, V., and Rogoff, K., (2012) 'Debt Overhangs: Past and Present' NBER Working Paper No. 18015 April 2012

Rodrik, D., (2011)'The Future Of Economic Convergence', Paper prepared for the 2011 Jackson Hole Symposium of the Federal Reserve Bank of Kansas City, August

2011

Romer, Paul M. (1986) 'Increasing Returns and Long Run Growth, Journal of Political Economy, 94, pp 1002–37

Savings Working Group (2011) 'Saving New Zealand: Reducing Vulnerabilities and Barriers to Growth and Prosperity: Final Report to the Minister of Finance' http://www.treasury.govt.nz/publications/reviews-consultation/savingsworkinggroup/finalreport/

Skilling, D., (2012) 'In Uncertain Seas: Positioning small countries to succeed in a changing world', Landfall Strategy Group, Discussion paper

Skilling, D., Boven, D., (2007) 'Connecting New Zealand to the global economy: So far yet so close', New Zealand Institute Discussion paper 2007/1, Auckland

Speller, W., Thwaites, and Wright, M., (2011), "The future of international capital flows", Bank of England Financial Stability Paper No. 12.

Spence, M., (2011), 'The Next Convergence: The Future of Economic Growth in a Multispeed World', Farrar, Straus and Giroux, New York

Stavins R., "Comments on 'Lethal Model 2: The Limits to Growth Revisited' by William Nordhaus." Brookings Papers on Economic Activity, Vol. 1992, No. 2, pp. 44-50, 1992.

Stevens, W., (2007) 'The Risks and Opportunities from Globalisation,' New Zealand Treasury Working Paper 07/05

Stijepic, D., and Wagner. H., (2012) 'Population-ageing, structural change and productivity growth', Denis and, Helmut FernUniversitat in Hagen, MPRA Paper No. 37005

Stiroh, K., (2001) 'What drives Productivity Growth', Federal Reserve Bank of New York Economic Policy Review, March 2001

Sullivan, R., and Aldridge, T., (2011) 'The outlook for commodity prices and implications for New Zealand monetary policy', Reserve Bank of New Zealand

Sun, Y (2010) 'From West to East: Estimating External Spillovers to Australia and New Zealand' IMF Working Paper, WP/11/120

Temple, J., (2003) 'The Long-Run implications of Growth Theories,' Journal of Economic Surveys, 2003, vol. 17, issue 3, pages 497-510

The Conference Board, (2011) 'Performance 2011, Productivity, Employment, and Growth in the World's Economies', Research Report R-1475-11-RR, New York

The Treasury (2004) 'New Zealand economic growth: An analysis of performance and policy' Wellington

The Water Resource Group (2010) 'Charting Our Water Future: Economic frameworks to inform decision-making', 2030WaterResourcesGroup@mckinsey.com

United Nations (2011), 'World Population Prospects: The 2010 Revision', Department of Economic and Social Affairs, Population Division Working Paper No.

ESA/WP220

United Nations (2011), 'World Population Prospects: The 2010 Revision 1; Comprehensive Tables' Department of Economic and Social Affairs, Population Division United Nations, New York

van Groezen, B., Meijdamy, L and Verbony, A., (2005) Serving the old: Ageing and economic growth', Oxford Economic Papers, Oxford University Press 2005. doi:10.1093/oep/gpi035

Weitzman, M., (1997) ' Sustainability and Technical Progress,' Scandinavian Journal of Economics, Wiley Blackwell, vol. 99(1), pages 1-13, March.

Winter, S., and Nelson, R., 'An Evolutionary Theory of Economic Change' (1982).

World Bank (2012), 'China 2030: Building a Modern, Harmonious, and Creative High-Income Society' World Bank, Washington D.C.

World Trade Organisation (2011) 'Report On G20 Trade Measures', (Mid-October 2010 to April 2011)

Yan (2010) 'Potential Growth of Australia and New Zealand in the Aftermath of the Global Crisis' IMF Working Paper 10/127, Washington DC.