Global Connectedness and Bilateral Economic Linkages – Which Countries?

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Abstract

Access to off-shore markets, technology, and ideas are important to greater productivity and higher living standards in New Zealand. Global connectedness requires deep and rich links with other countries. However, as a small country, we only have the resources to focus on a handful of countries. Are there a key set of countries with which New Zealand should be seeking to form deeper bilateral economic relationships?

This paper reviews the benefits from deeper external bilateral economic engagements using the insights from the new literature on economic growth, which places great importance on trade, international integration, human capital, and local and cross-border knowledge spillovers from research and development (R&D) and foreign direct investment (FDI). This paper will then use insights from the new literature on economic growth to develop criteria for selecting countries as partners for deeper bilateral economic linkages across six global connectedness dimensions: FDI, R&D links, trade in goods, inbound tourism, education exports, and people linkages.

To account for the growing role of a number of economies in global trade, the partner selection criteria will identify two groupings of target countries. The first grouping is focus countries: those countries that are of immediate interest for deeper bilateral linkages. The second country grouping is horizon countries: countries that are likely to grow in their importance to New Zealand over the next 10 to 20 years.

The key message of this paper is a greater bilateral economic focus by New Zealand on the major economies along the Asia-Pacific Rim (and the UK). When external initiatives come before decision-makers, they should be seen through a lens that places greater confidence in proposals for deeper relationships with the Asia-Pacific Rim countries (or the UK), and greater scrutiny of proposals that emphasise other regions and countries.

JEL CLASSIFICATION

F15 - Economic Integration

F21 - International Investment; Long-Term Capital Movements

F22 - International Migration

F43 - Economic Growth of Open Economies

O33 - Technological Change: Choices and Consequences; Diffusion Processes

O4 - Economic Growth and Aggregate Productivity

KEYWORDS economic growth; trade; economic integration; migration; technology diffusion; New Zealand

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1 Introduction

This paper addresses the question of whether there are a key set of countries that New Zealand should be seeking to form deeper relationships with.

The country selection criteria will build on the distinction between global connectedness and openness. Openness is the absence of barriers, both here and abroad, to the international flow of factors of production. Global connectedness requires deeper and richer links with other countries than is implied by openness. Global connectedness can be defined as the actual flows of factors of production (such as goods, services, capital, people, knowledge, ideas and technology) between countries.

As a small country, New Zealand only has the resources to focus on a handful of countries. Additionally, it is important that external economic strategy consider the full range of levers that affect these relationships, such as immigration policy, export promotion, security links, regulatory policy, and foreign policy. Access to off-shore technology and ideas are likely to be a key element in improving New Zealand's productivity performance. Greater global connectedness allows us to take advantage of and participate in the larger international market and the latest technology and ideas.

Identifying the countries that New Zealand should focus on for deeper linkages will contribute to Treasury and Government thinking on priorities for budget and other initiatives. In each budget round, there are bids that are directed at increasing the levels of engagement with other countries. This paper will help develop thinking on which countries are the most important to New Zealand from an economic perspective and therefore help prioritise the different requests for funding. Also, this project will act as an input into discussions with other agencies on trade and other external linkages.

The plan of the paper is that section 2 will discuss the link between economic growth and global connectedness. Section 3 will discuss why country selection criteria are needed. Section 4 will develop the selection criteria and section 5 will apply them. Section 6 provides a summary of the paper and identifies next steps for the use of the criteria.

2 Economic growth and global connectedness

2.1 The old and new theories of economic growth

There is growing acceptance that openness to international exchanges contributes to a country's economic performance. Yet the mechanisms by which trade and other international exchanges promotes long-run growth have been less often articulated.

The traditional theory of growth dating from Solow (1956, 1957) emphasised labour and capital accumulation and technical progress as the drivers of long-run growth. The central importance of technological progress was accepted but not explained by Solow. The conclusion of Solow's theory was that long-run real economic growth did not depend strongly on economic policy. Most of long-run economic growth was determined by extra-economic factors: the general progress of science and technology.

The new theories of economic growth, usually associated with the writings of Romer (1986, 1990, 1994), Romer and Rivera-Batiz (1991a, 1991b), Lucas (1988, 1993, 2002), and Grossman and Helpman (1991, 1994), suggest that international economic integration, human capital, learning by doing, intentional industrial innovation, and local and cross-border spillovers from innovation are all important to the growth process. The new theories of growth provide many new ways to think about growth and a more diverse set of mechanisms for analysing the role of government policy in raising living standards.

Romer and others analysed technological change as part of an economy, not outside it as Solow had done. Both new and old theories of growth accept as fundamental that most increases in productivity and in living standards come from advances in knowledge, and in improvements in the application of knowledge. However, the new growth theories suggest that pro-growth policies can nurture and anti-growth policies can stifle long-run growth. The implication was that economic variables that could be accessible to policy manipulation, such as interest and tax rates, as well as subsidies for research and technical education, may influence the rate of innovation and the rate of economic growth.

The incentives for innovation are important in the new growth theories. Economic growth arrives in the form of a greater variety of products and as improvements in existing products. A major part of technological progress requires, at some stage, an intentional investment of resources by entrepreneurs (Grossman and Helpman 1991, 1994). The process of finding new technologies is a process in which no discovery is guaranteed, but the return to new technologies has to be such that firms have an incentive to invest in the process. R&D buys a chance of discovering the next generation of a targeted product.

A highly educated labour force is a key input into R&D. Human capital is vital to producing the new ideas that sustain growth. Worker productivity depends on the aggregate skill level of all workers. Societies with more skilled workers—a high stock of human capital—should generate more ideas and grow faster (Lucas 2002, Romer 1990).

A sufficient level of human capital is a prerequisite to imitation and adaptation by technological followers both at home and abroad (Caselli and Coleman 2001, Caselli and Wilson 2003 and Benhabib and Spiegel forthcoming) and to the innovation that creates the new technologies in the first place (Romer 1990, Lucas 2002).

2.2 Technology transfer and technology spillovers

The diffusion of new technologies is a lengthy process and many firms continue to invest in the older technologies. Each firm must weigh the benefits of adoption now versus adoption later. Adoption of a new technology can imply the scrapping of existing equipment and human capital and retraining. As the costs or benefits of adoption change, the number of adopters changes. Technology transfer is the cumulative result of a series of individual calculations that weigh the incremental benefits of adopting a new technology against the costs of change, often in an environment of uncertainty as to the future evolution of the technology and its benefits and by limited information about the benefits and costs and even about the very existence of the technology.

New products and processes must be adapted to fit each national market. There are costs involved in exchanging designs and providing training. There are three types of technology transfer. The first is material transfer, which is the simple import of materials (e.g., seeds, machines) and local adoption is not attempted. The second is design transfer, which is in the form of blueprints, handbooks, and formulas. The foreign equipment may be imported to be reverse engineered, so that local engineers can learn about the technology. The third is capacity transfer: the transfer of scientific knowledge and technical capability. This often requires strengthening of education and technical capacity. Firms are better able to adopt complex innovations if they can do R&D to adapt the technology to local conditions. The second and third forms of technology transfer are more likely to call for significant pre-existing human capital and then learning by doing.

Technology diffusion or transfer can come in the form of an arm's length transaction. When a technology is transferred in this way, the price is attempting to capture the full value of the innovation. However, if the cost of obtaining technological knowledge is less than the cost of its invention, including R&D costs, a spillover has occurred.

Spillovers can occur at the time of purchase despite price premiums due to intellectual property rights. Spillovers may result from importing intermediate and capital goods because the product improvements from the supplier's R&D efforts are often not fully absorbed in its price. This inability to embody fully the higher quality into prices arises from competitive pressures common in innovating industries. Competition from the ever expanding variety of inputs and displacement by a succession of product improvements by other firms means that the price premium on each innovation is often short and less than the full value of the technical breakthrough. Other firms take advantage of the new technical knowledge, eliminating the innovative firm's monopoly profits by producing goods that are similar or more advanced (Grossman and Helpman 1991).

Spillovers most commonly occur slowly across time because as firms develop new technologies, they can make discoveries that can be applied by others, at no extra cost. In addition, when innovators bring out new generations of similar products, they have begun where their predecessors finished, building on their insights and work. Romer (1990) contends that any technical knowledge discovered by a firm (and embodied in its products) will eventually benefit other firms, even those not engaged in R&D. Lucas (2002) observed that with growth driven by new ideas, much of the return from an idea, and virtually all of it for a really important idea, accrues to people other than the originator.

The new growth theories propose that innovation feeds on and adds to the cumulative stock of national and often global knowledge. R&D contributes to the stock of knowledge, which enhances the productivity of an economy, stimulating its growth and, importantly, it may generate spillovers that enhance the productivity of other nations.

2.3 Trade and technology transfer

Countries trade with one another, communicate with one another and learn from one another more than ever before. New Zealand can raise its productivity by learning from new products and ideas from abroad. A country that is integrated into world markets is likely to enjoy access to a larger knowledge base than those living in isolation.

There are a number of ways in which trade contributes to economic growth. Trade expands the stock of knowledge available to those engaging in R&D in New Zealand by exposing them to more goods produced using the latest designs which can be imitated and developed further. Trade spurs growth because a firm that invents a new product will have access to a larger market. Trade prevents duplication in research—the fixed costs of R&D needed to develop new designs need only be incurred once when results are fully disseminated. Economic integration means that the fixed costs of R&D can be recovered over larger markets. Trade provides channels of communication that stimulate cross-border learning, copying and adaptation of production methods and product designs.

The new growth theories suggest that external linkages that strengthen the cross-border flow of new technology and knowledge may increase New Zealand's growth rate. Our links with Australia are an example that could be used to deepen relationships with other countries. The policies that led to close economic relationships with Australia included free trade, free movement of people, and now regulatory harmonisation.

2.4 Knowledge capital and human capital

Understanding the policy challenge presented by technology diffusion from the global frontier to New Zealand requires an assessment of the extent that the diffusion is in the form of knowledge capital or human capital. The new growth theory divides into two strands of thought with different messages about technological progress and diffusion.

The first strand, which is associated with Romer (1986, 1990), has as its focus investment in R&D. Technological advances come in the form of new knowledge capital. There is a research sector in the economy which produces blueprints for new products and processes. The policy suggestion is that investing in more R&D may yield large social returns. A second strand of the new growth theories, most commonly associated with Lucas (1988, 1993, 2002) suspects that the relationship between technological improvement and economic growth is more indirect (see DeLong forthcoming).

For Lucas, the main advances in knowledge are not generated by processes that are rather unembedded in the rest of the economy. Human capital will increase as a by-product or bonus from learning how to utilise new types and new generations of capital equipment. Learning-by-doing is the knowledge that is the by-product of the experience gained in the production of goods. New human capital arises as a bonus from figuring out how to implement new capital goods, figuring out how the production process needs to be reorganised, and figuring out how the new capital goods need to be re-designed. The productivity of workers with a given amount of human capital depends upon the human capital of the workers that they interact with. It is reasonable to think workers' skills are augmented through learning, and that workers learn from those around them. Thus, moving a worker from a group where the average level of human capital is low to one where the average level is high will raise her productivity. More highly skilled workers are likely to learn new technologies faster than less skilled workers. Still further bonus increases in productivity have to come with the increases in human capital from on-the-job

training: the best way to become skilled and productive at handling modern technologies is to work at applying them and these improvements in workers' skills and capabilities are major social benefits. For Lucas (1993, 2002), the increased human capital resulting from learning by doing is a strong driver of economic growth.

The implication for New Zealand of the two strands of the new growth theory is about ease in availability of new knowledge. The differences between Lucas and Romer are about the existence of a single global pool of knowledge which New Zealand can draw on. New technology that is transmitted widely (such as through new blueprints) is a force towards convergence. The technological isolation implied by human capital being vested in specific individuals and groups favours divergence in national growth experiences.

If technological progress is in the form of new knowledge capital, the associate blueprints for new products or processes should be globally available on commercial terms and may diffuse quickly to New Zealand. If the growth of knowledge is through the research sectors of the global leaders producing more and more knowledge capital, openness allows the importing of those new blueprints to New Zealand at the world price.

If a significant part of technological progress is often indirect through learning by doing, technology diffusion may be indirect and may require the repeating of the learning by doing in New Zealand. This is why global connectedness differs in important respects from openness. If learning by doing is important, openness is not enough to maximise growth. New Zealand may need to connect directly to the individuals and firms that best allow the learning by doing and human capital accumulation to be quickly repeated.

Taking Lucas and Romer together, there may be two sources of new knowledge. There is a global pool of knowledge capital whose blueprints may diffuse quickly from the World's technological frontier to New Zealand. The human capital that is the by-product of learning by doing may not diffuse as rapidly because it is invested in specific individuals and groups. Access to this form of knowledge requires face-to-face contact and linkages.

2.5 Active and passive technology transfer

Two basic mechanisms for technology diffusion or transfer have been emphasised: active diffusion through direct learning about and applying of foreign knowledge; and passive diffusion by employing specialised and advanced intermediate products invented abroad (Keller 2001). If the cost of obtaining technological knowledge by active or passive means is less than the cost of its invention, including R&D costs, a spillover has occurred.

Employing specialised and advanced intermediate products and equipment that have been invented abroad is passive diffusion. For passive diffusion to happen, a purchase must occur, which is an arm's length transaction. New technology is embodied in the product that is being used. Its use should make domestic production more efficient. In principle, no new knowledge is passed on to domestic inventors, and the productivity of the domestic R&D sector does not increase. When the technology transfer is via an arm's length transaction, the price is attempting to capture the full value of the innovation. However, spillovers are still possible because competition from the ever expanding variety of inputs and displacement by the product improvements made by others means that the price premium is often short and less than the full value of the innovation. Other firms will take advantage of the new technical knowledge, eliminating the innovating firm's profits by producing goods that are similar or more advanced (Grossman and Helpman 1991).

Openness is important to passive technology transfer because barriers to trade in new intermediate products and capital equipment should restrict productivity in technology importing countries. Eaton and Kortum (2001) attribute 25% of cross-country productivity differences to variation in the relative price of capital equipment, about half of which could be ascribed to barriers to trade in equipment (see also Jones 1994).

The most common form of active diffusion is direct learning about foreign technological knowledge. This means learning about the blueprint of the new technology so that the recipient country can reproduce the technology. If the cost of obtaining this knowledge is less than the cost of invention, a spillover has occurred. Such spillovers should increase the productivity of domestic inventive activity. It becomes part of the domestic knowledge stock off which local inventors build. No purchase is necessary for active spillovers. They can be transferred via product blueprints. Such transfer can be low-cost. However, without licensing agreements, the inventor may choose to keep the blueprints secret.

Active technology diffusion or transfer does not always require access to the new product's blueprints. There are many other channels of active technology diffusion: demonstration effects (which can lead to reverse engineering); personal instruction; provision of expert services; hiring workers away from the innovating firm; conferences; face-to-face contact; scientific journals; libraries and the Internet; and patents.

The active forms of diffusion may be more spillover intensive because, apart from patent licensing, the diffusion is often through observation and imitation rather than after a payment for a good, service or intellectual property licence. The policy challenge for New Zealand may be that it needs to connect better to these more active (and perhaps more spillover intensive) channels of technology diffusion. There may be information and institutional gaps to be narrowed, and loose on-the-job human capital to be captured. The necessary off-shore contacts are required for direct learning and imitation and New Zealand–based human capital is required to absorb and adapt the new technology. Trade can provide the elements of a new technology, but other elements must be in place domestically for technology transfer to be successful: production capabilities; investment capabilities—the ability to expand production facilities and build new ones; and absorption capabilities—the ability in New Zealand to learn how to use the new technology and then adapt, improve, and develop it to suit local conditions and market needs.

3 Why are country selection criteria needed?

3.1 Developing focus without losing flexibility

Before looking at the different global connectedness dimensions and criteria for selecting countries for deeper linkages, it is important to consider the merits of compiling this list of countries, and to consider the implications of excluding a country from the list.

It needs to be remembered that New Zealand is a small nation and we are not at the top of every other country's list for closer links. In some situations it is also necessary to be open to opportunities arising in particular countries that are not on the list, and to keep an open mind towards improving linkages with these countries. These considerations mean that the list of focus countries should only be seen as a guide, and a means of prioritisation. We need to continue to be mindful of all opportunities that may arise. If a country does not appear on the list to be the focus of deepened linkages, this in itself is not a reason for not considering initiatives to improve linkages with such a country.

3.2 Designing a partner selection criteria for deeper bilateral economic relationships

The Government has a role in identifying a set of countries to deepen relationships for three reasons. The first reason is addressing market failure. Markets do not efficiently supply public goods such as basic R&D and generic off-shore investment and trade promotion. The second role of government is ensuring state sector efficiency. The core international business of government, such as trade and immigration policy, must be well planned and executed, and be cost effective and provide value for money to the taxpayer. The third reason is to ensure that external linkages are maximising opportunities for technology transfer and spillovers from the countries that are at the global frontier.

When a government responds to the challenges of supplying public goods, it must do so in an efficient and effective manner. The marginal benefits and costs of engaging with countries will differ between countries. The government is subject to a budget constraint so engagements with countries need to be ranked in terms of their respective payoffs. Unfortunately, the data that is available to assist in ranking countries is limited. This will make any ranking subjective, qualitative and prone to honest disagreements. Nevertheless, there is merit in determining how to evaluate the relative benefits from deeper engagements with various countries using the insights from modern growth literature about trade, knowledge creation and transfer, and R&D spillovers.

The country selection criteria can be used to help screen new policy proposals and existing initiatives to ensure they are cost-effective in achieving the objectives of the Government's Growth and Innovation Framework (GIF[1]). The GIF sets out what the Government believes it and the private sector must do to raise real economic growth. Innovation and knowledge are identified as drivers of growth, with the key areas being strengthening the innovation framework; growing and developing talent and skills; and improving global connectedness.

The selection criteria and the economic framework that underlies it aim to find policy synergies and to act as a robustness tool in the face of uncertainty and incomplete information when evaluating the costs and benefits of competing policy proposals. By declaring country priorities well in advance of individual project analysis, agencies can be better monitored because initiatives that fall outside the pre-announced regions require more justification. The selection criteria attempt to bring the lessons of experience and general trends to policy analysis. For example, a project with a favourable cost benefit analysis in an area where previous policy initiatives have met with repeated later failure will be scrutinised more closely than otherwise. Similarly, a policy proposal for deeper links with a country that is not on the list of focus countries warrants more attention. Whether an external policy initiative involves a focus country or not should be included in the list of significant evidence and arguments for and against the proposal.

[1] The web link is http://gif.med.govt.nz/

4 Developing country selection criteria

4.1 The six dimensions of global connectedness

The criteria for selecting countries for deeper relationships will have six dimensions: R&D, foreign direct investment (FDI), closer economic partnerships (CEPs) and other bilateral trade links, trade in services, education exports, and people-to-people linkages. Deeper bilateral relationships along these six dimensions should increase New Zealand's connectedness to the global technological frontier and to our more important export markets, and strengthen the innovation system in New Zealand.

The criteria for R&D, FDI and people-to-people linkages will focus on improving New Zealand's connections to the countries at the global technological frontier. Greater connectedness to the global technological frontier quickens technology diffusion which raises productivity performance directly and strengthens the domestic innovation system. Spillovers from deeper R&D, FDI and people linkages may be significant.

The criteria for trade will focus on opportunities to expand export market access through the bilateral liberalisation of trade barriers and promotion campaigns about New Zealand exports. Greater connectedness to the global technological frontier is not the main issue in the case of trade. New Zealand is, of course, embedded in a global system that generates mutual interdependence across countries. As is becoming more and more apparent, countries rely on each other for technology transfer, and they learn from each other's manufacturing methods, modes of organization, marketing, and product design. Industrial innovation is concentrated in a relatively few countries and these countries are major exporters of capital goods. This trade in capital goods spreads technological advances. Trade under conditions of low tariffs allows New Zealand firms to import newly invented capital and intermediate goods and equipment under liberal conditions. This is the passive transfer of technology as discussed in section 2.5. Spillovers may be few.

The criteria for selecting partners for CEPs and other agreements, and for trade promotion campaigns, will build on the distinction between global connectedness and openness. As noted above, openness is the absence of barriers, both here and abroad, to the international flow of factors of production. Deeper global connectedness requires greater actual flows of goods and services. This calls for more attention to markets that are most receptive to bilateral trade liberalisation proposals and/or are most suited to trade promotion campaigns, including the promotion of tourism and education exports.

4.2 The partner selection criteria must be dynamic

Any selection criteria for deepening linkages with other countries must take into account the changing circumstances of New Zealand and its external partners.

To account for the growing importance to international trade of a number of economies in the Asia-Pacific region, the selection criteria will identify two groupings of countries. The first grouping will be focus countries: countries that are currently major partners of New Zealand and are of immediate interest for deeper linkages. The second grouping is horizon countries: countries that are likely to grow in importance to New Zealand over the next 10 to 20 years as they grow in size in the global economy.

4.3 There are strong non-economic reasons for deeper bilateral relationships

The partner selection criteria below will help identify countries of economic importance to New Zealand. However, it should be remembered that we might well choose to focus on a country for a range of reasons, only one of which is economic.

Economic linkages do not define the character of our trade and foreign policy interests. There are many non-economic reasons why we might want to have strengthening links with a country (eg, Canada is a staunch multilateral partner on security and trade issues; Chile is a beach-head into Latin America and so is a strategic investment; and France is a key participant in the South Pacific). Broader and non-economic justifications for policy initiatives are fully acknowledged and should be kept in mind when using the selection criteria that are proposed below. Moreover, many of the countries listed below as of economic importance to New Zealand will on their own want to build economic linkages with New Zealand, often as part of a broader and multi-faceted bilateral relationship.

5 Applying the country selection criteria

5.1 Speeding up technology diffusion by deepening R&D links with the global leaders

Stronger R&D links are central to increasing global connectedness. Investment in R&D affects a country's productivity performance. The new theories of growth focus on this link and have identified channels through which a country's productivity performance is affected by the R&D efforts of its trading partners. However, only a few countries are the global technological leaders. Ninety-five per cent of business enterprise R&D in OECD statistics is conducted in the G7 countries (OECD 2003). They are the first to benefit from most innovations. Innovations spread only gradually to others inside a leading edge country and abroad. The USA is the only OECD country that does not import the majority of its new technology from abroad (Keller 2002a, 2002b, Eaton and Kortum 1999).

By deepening our links with leading edge countries with large stocks of knowledge from their cumulative R&D efforts, New Zealand may lift its productivity performance. New Zealand, of course, has areas of R&D excellence such as in the pastoral sector. In areas such as biotechnology, environmental science and certain kinds of information and computer technology, New Zealand has carved out a respected R&D niche for itself. However, in general, New Zealand is a technological follower. In industries marked by progressive innovation, where continually newer varieties and qualities are appearing, the advantage of large countries such as the USA and other G7 members with strong R&D infrastructures are often too strong for smaller economies to overcome. It is cheaper to copy, imitate or reverse engineer the successes of the global technological leaders.

At a high level of generality, the internationalisation of technology means that inventions, the people generating these inventions, and the ownership of these inventions cross national borders more frequently. Scientists and engineers born in one country graduate and get a job in another country, while possibly returning back to their home country after a while. Firms located in different countries set up alliances for R&D. Companies can buy patents, licences or know-how from foreign firms, they can observe competition (eg, reverse engineering), they can hire foreign scientists and engineers, they can interact with

foreign competitors who invested in their country, read the scientific and technological literature, or have direct contacts with foreign engineers and scientists at conferences.

Deciding which countries are to be selected for deeper R&D relationships will depend on the extent to which those countries are global R&D leaders. Less than 0.2% of the world's R&D expenditure occurs in New Zealand (MoRST 2002).

A common consideration when discussing international technology diffusion and direct learning about new technologies invented abroad is the impact of distance. The evidence on the extent to which technological progress is local and its rate of geographic diffusion is from a relatively young literature and contradictory results are often reported.

Keller (2002a, 2002b) initially suggested that the extent of technology diffusion fades rapidly with distance. Keller found that the geographic half life of spillovers, the distance at which half of the spillovers from foreign R&D have disappeared, is only 1,200 km. However, if true, it implies that New Zealand (and Australia), with their remote locations relative to the G7, benefit little from international technology diffusion. This is implausible. A considerable proportion of the cumulative stock of knowledge exists in the form of product blueprints and these blueprints should be readily available to New Zealanders.

Keller (2002a, 2002b) found after further analysis that trade patterns appear to account for the majority of all differences in bilateral technology spillovers, whereas foreign direct investment and communication flow differences (language differences) account for about 15% each. Keller found that these three channels account for almost the entire localisation effect that was otherwise attributed to geographic distance. Keller (2002a, 2002b) found that distance is a proxy for trade patterns, FDI and a shared language. When these variables are added, distance drops out from Keller's econometric analysis.

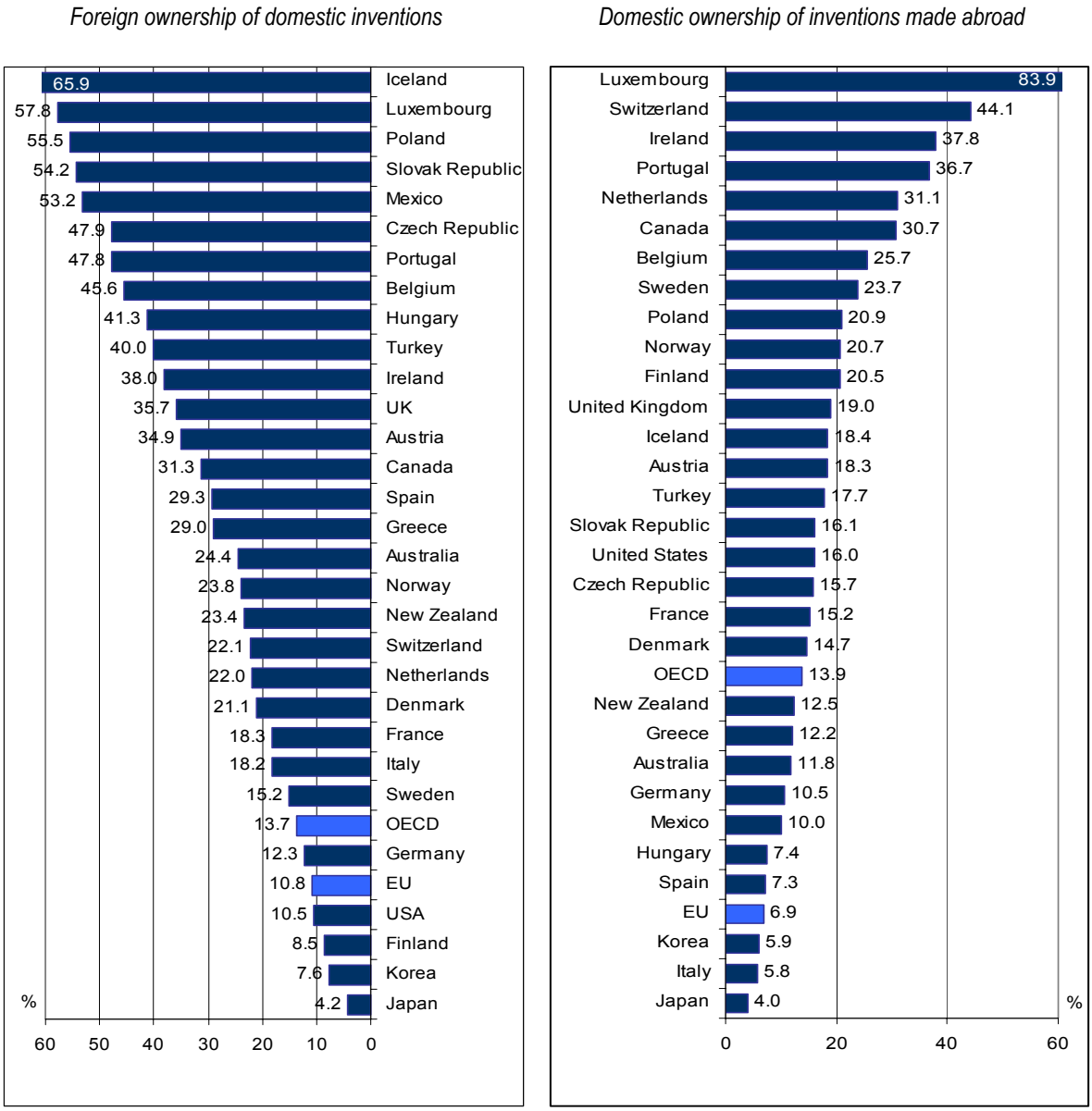
The data on technology connectedness suggests that New Zealand's R&D sector has well developed channels for active diffusion from the global technological frontier. OECD (2003) data for 1997-1999 from the European Patent Office (EPO) suggests that international co-inventions and cross-border ownership of New Zealand patent applications was in the middle of the OECD field and is similar to Australia, Canada and the Nordic countries (see table 1). Another indicator of international R&D collaboration is the share of patents with inventors with residences in two or more countries (as in table 2). New Zealand's rate of co-inventions is close to the middle of the OECD field. The number of New Zealand patent applications per million of the population with the EPO is about the same as for Australia (see table 2). The number of New Zealand applications at the EPO has tripled since 1991. Australia doubled. There was a 68% increase in patent applications from OECD countries at the EPO from 1991 to 1999 (OECD 2003).

Using 1993-95 patent applications data at the EPO and at the U.S. Patent Office, Guellec and van Pottelsberghe de la Potterie (2001) found that the degree of technological internationalisation is higher for the small OECD countries and that two countries are more likely to collaborate if they are close to each other, if they have similar technological specialisations, and if they shared a common language. Researchers in larger countries find it easier to enter partnerships with colleagues in their own country. However, researchers from smaller countries will have fewer local colleagues in their field and must look abroad for collaboration (Guellec and van Pottelsberghe de la Potterie 2001).

Data collected by the Ministry for Research, Science and Technology (MoRST 2002) indicate that the USA, Australia and the UK are New Zealand's principal scientific collaborators. At any one time, there are about one thousand New Zealand/U.S. collaborative research projects that are active, which is about double the number with any

other country. About one third of New Zealand scientists collaborate with UK counterparts. The MoRST (2002) data also shows significant New Zealand collaboration with German (14%) and to a lesser extent with French scientists (7%).

Table 1 – Percentage of patents applications with the European Patent Office with cross-border ownership, 1997-1999

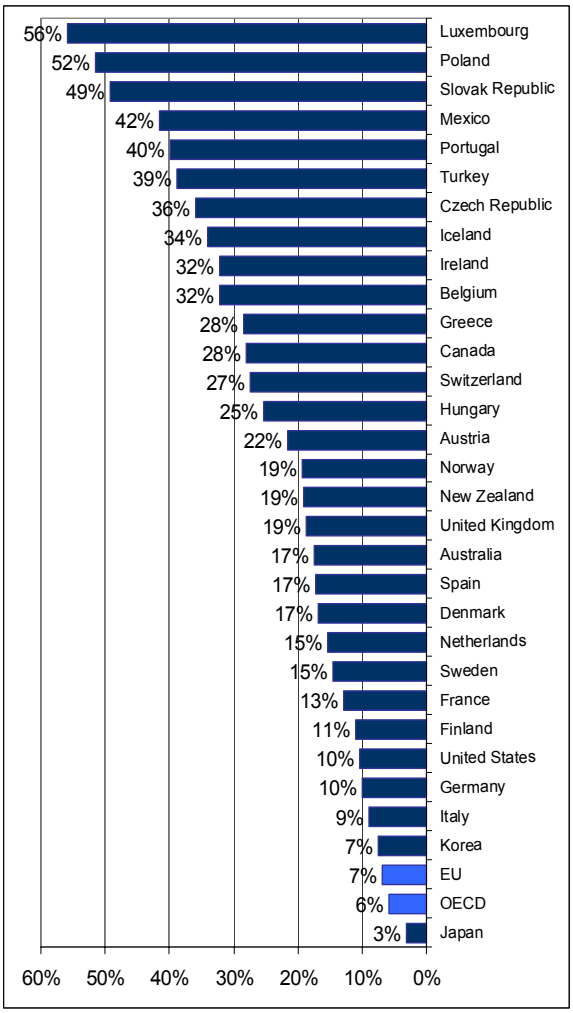


Source: OECD Science, Technology, and Industry Scoreboard 2003

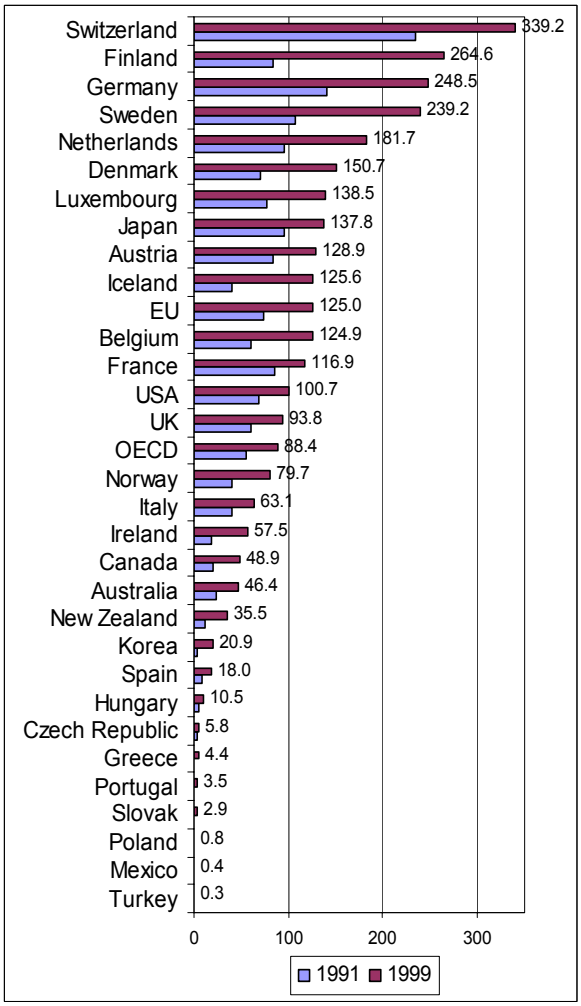
Strategies that seek to increase R&D collaboration with countries at the global technological frontier (the G7) are likely to have a positive impact on New Zealand's economic performance as most industrial innovations originate in those countries. New Zealand should deepen its R&D links with the global technological leaders that are geographically close, that already have extensive trade and FDI links with us, that have co-investment potential, that are receptive to collaborations, that share a common language, and that share technology specialisations. These criteria are consistent with the research of Keller (2002a, 2002b) on the geography of technology diffusion and of Guellec and van Pottelsberghe de la Potterie (2001) on cross-border R&D collaborations.

Table 2 – Percentage of patents applications with the European Patent Office with foreign co-inventors, 1997- 1999, and patents per million of population

Patent applications with a foreign co-inventor



Patent applications per million of population



Source: OECD Science, Technology and Industry Scoreboard 2003

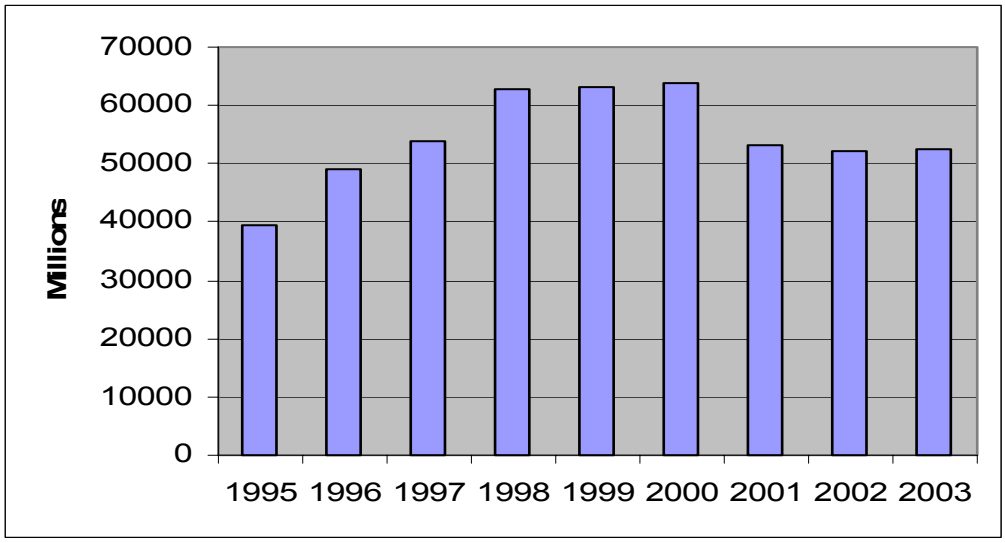
New Zealand's principal scientific collaborators are the USA, Australia and the UK. The USA is identified in MoRST's (2002) global linkages strategy as a priority bilateral partner. Significant R&D collaboration also occurs with Australia. We have extensive trade and FDI links with Australia. In addition, there is high level political support from leaders in both countries for improved Trans-Tasman R&D links. Australia should be a R&D focus country for these reasons even though it is not, in general, a global technology leader. Although distance is a challenge facing collaboration with the UK, New Zealand's crown research institutes (CRIs), universities and other researchers highly value existing extensive R&D links with their British counter-parts. Language works against R&D collaboration with Japan, nonetheless it should be a target for deeper R&D links because of its proximity and advanced capabilities. A country that warrants mention is Germany. 14% of New Zealand scientists already work in collaboration with German counterparts. Germany is the third largest global R&D spender (OECD 2003).

In sum, New Zealand should deepen its R&D connections with four countries at the global technological frontier (USA, Japan, UK and Germany) as well as with Australia. Countries that qualify as R&D horizon countries are Korea, Taiwan, and China. All have substantial R&D establishments, links to New Zealand, and are geographically close.

5.2 Deepening FDI links with the global technological leaders

As shown in figure 1, the stock of in-bound FDI into New Zealand grew steadily between 1995 and 1998, before levelling off at above NZ$ 60 billion and then reduced to around NZ$ 53 billion in 2001, 2002 and 2003. FDI can be motivated by the availability of location bound resources or assets; by access to a growing local economy; or by the cost advantages from setting up a subsidiary to produce either for local sales or for export.

Figure 1 – Stock of inbound FDI, New Zealand



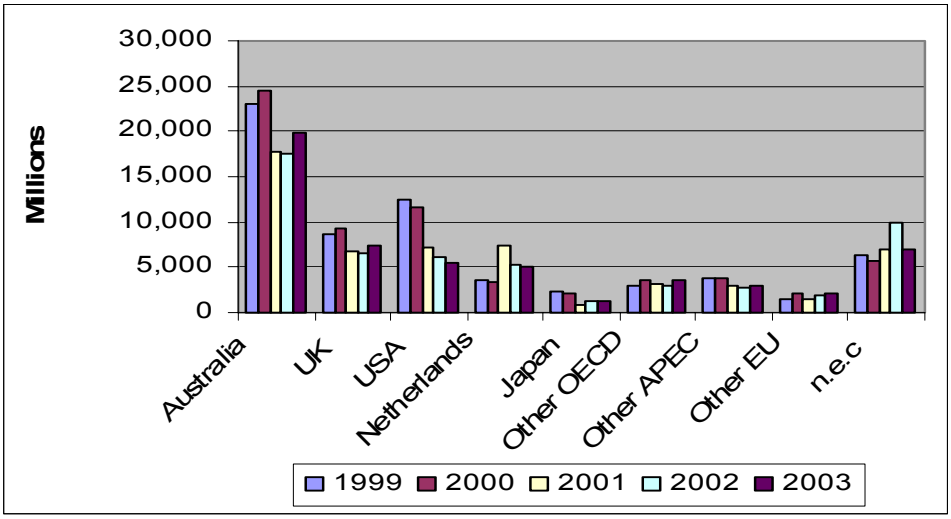
Source: Statistics New Zealand

Host countries associate FDI with many benefits: a larger capital stock, technology transfer, and more competitive markets. There may be knowledge spillovers if a local firm copies the technology used by the foreigner. Another spillover takes place if competition forces local firms to search for new, more efficient technologies. A transfer of technology is possible through the training of local employees, which may spillover as the employees move to other firms, or set up their own businesses. The empirical evidence suggests that there are spillovers from FDI. That is, FDI contributes to productivity and income growth in host countries beyond what would be triggered by additional domestic investment alone, but that these spillover effects appear to be small (Keller forthcoming). This result is not totally surprising. Multinational firms choose to operate through a fully-owned subsidiary rather than through joint ventures or technology licensing because FDI helps keep private the returns of technology internal to the multinational firm.

In deciding which countries should be the focus for deeper FDI relationships, the criteria are the closeness of the country to the global technological frontier, the size of the country, and the rate that technology diffuses from that country to New Zealand as proxied by distance and existing trade and FDI links. The size of the country is a factor because the largest OECD countries account for most of global R&D and they are the home of most multinational companies (MNCs). It is well known that the R&D of MNCs is concentrated in a few home countries, unlike their investment and production activities which are spread across the globe. Since domestic firms are likely to have better knowledge and access to domestic markets, a MNC that is entering a new market abroad must have some compensating advantages. It seems likely that the MNC will enjoy advantages derived from superior management skills and technology, economies of scale, and better access to international markets. Multinationals supply a package of needed

resources including management experience, entrepreneurial abilities, and technology skills which can then be transferred to their local counterparts by means of training programmes and the process of learning by doing. The larger the FDI source country, the greater the diversity and specialisation of companies in that country. This greater diversity and specialisation increases the chances that a foreign investor will have the expertise to identify unnoticed and under-valued projects in New Zealand. This abundance of intangible capital in specialised industries in FDI source countries, which generates superior expertise in screening investments, enhances FDI flows and makes for a more efficient and sophisticated utilisation of capital in New Zealand.

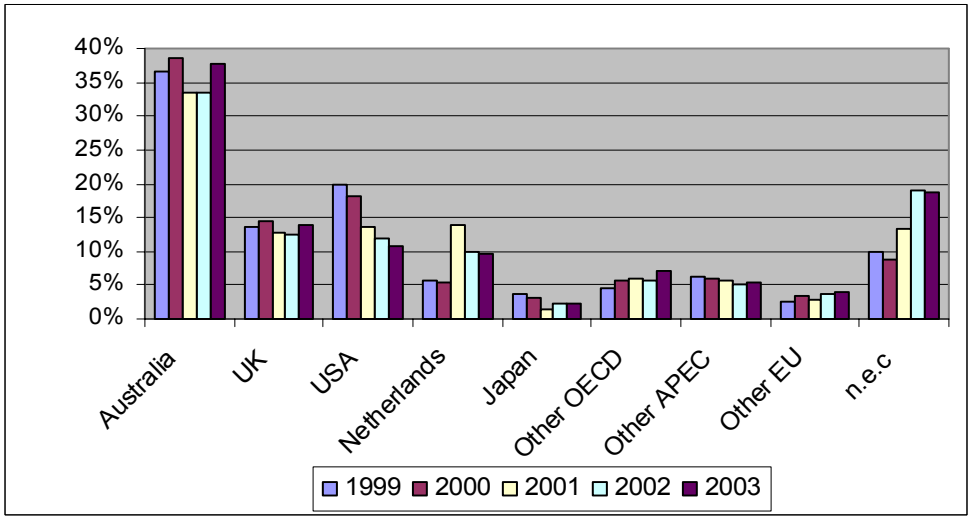
Figure 2 – Stock of inbound FDI, New Zealand, by source-country



Source: Statistics New Zealand

As can be seen from figures 2 and 3, most of the inbound-FDI stock in New Zealand divides by source between Australia (37%), the UK (14%), the US (11%) and the Netherlands (10%). Slightly over a sixth of the stock of inbound FDI is not identified by Statistics New Zealand by source-country. Japan, the rest of APEC, and the rest of the EU, are all small direct investors into New Zealand.

Figure 3 – Total stock of FDI, New Zealand, by source-country

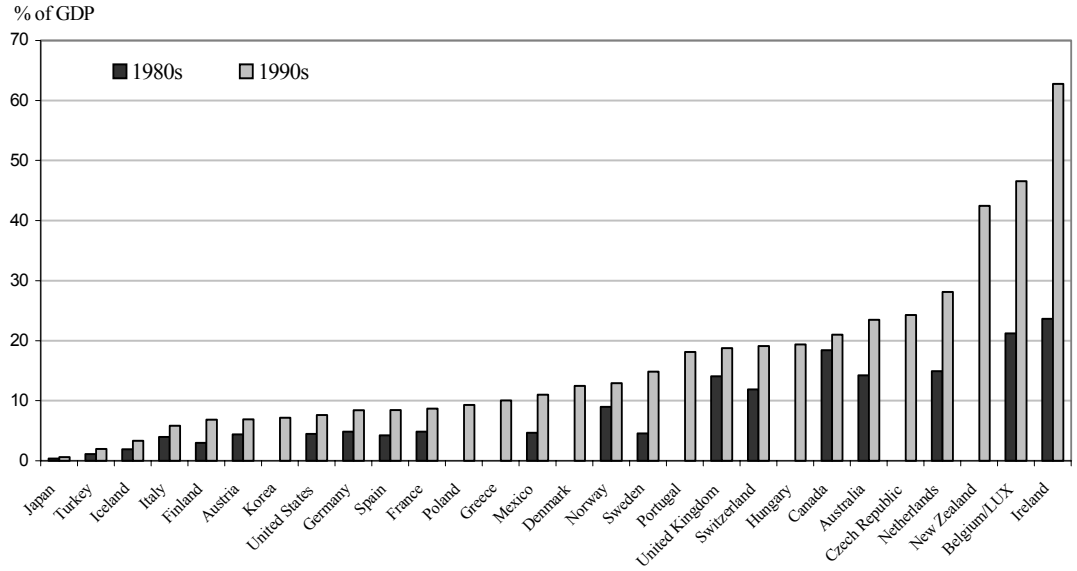


Source: Statistics New Zealand

Inbound FDI is highly internationalised by OECD standards (see figure 4). In the 1990s, compared to New Zealand, only Belgium and Ireland had a higher stock of inbound-FDI as a percentage of GDP. New Zealand's FDI stock as a percentage of GDP is nearly twice that of Australia and Canada and three times the Nordic countries (see figure 4).

Figure 4 – Inward FDI positions in OECD countries, 1980s and 1990s

Figure 4. **Inward FDI positions in OECD countries, 1980s and 1990s**[1]



1. Average values over the two periods. For countries where FDI position data are not available, values of bilateral stocks reported by their OECD partners were summed up to obtain an approximate measure of multilateral FDI stocks.

Source: OECD.

Figures 2 to 4 suggest that New Zealand is highly internationalised in terms of inbound FDI but much of that internationalisation does not involve connecting with the G7. New Zealand is highly connected with Australia in terms of FDI. Although there are many areas of R&D excellence in Australia, New Zealand should look to deepen its FDI relationships with source countries that are closer to the global technological frontier.

The obvious first choice for a deeper FDI relationship is the USA. The USA is at the leading edge of the global technological frontier and is a major trading partner and foreign investor. Another candidate for a deeper FDI relationship is the UK. The UK is a significant trade and FDI partner of New Zealand (see figures 2 and 3). Distance might count against FDI from the UK but the extensive and long-standing trade and FDI relationship offsets this disadvantage. Japan is another country that should be considered. Japan is a major trading partner but Japanese FDI into New Zealand is low (see figures 2 and 3). Language is a barrier to technological diffusion from Japan via FDI but on the other hand, Japan is much closer to New Zealand in terms of distance than are the members of the European Union. Japan accounts for a major share of global R&D and it is a large source country for outward-bound FDI and MNCs. The final country that should be a focus for a deeper FDI relationship is Australia. Australia does not rate as highly as the G7 countries as a source of technology. On the other hand, Australia is New Zealand's largest trading and FDI partner. Those links should be consolidated.

The countries that should be horizon countries for FDI linkages are Taiwan, Singapore, Hong Kong, Korea and China. Singapore and Hong Kong are major global financial centres. All five countries currently have moderately sized FDI in New Zealand. However, over the next 10 to 20 years, all five of these countries will grow in importance in the

global economy as major sources of outward FDI. New Zealand will need to deepen its FDI links and promotional efforts with these five horizon countries—these five major new global sources of FDI and MNC expertise—over the same time frame.

5.3 Developing criteria for selecting CEP partners—some are better than others

CEPs are an opportunity to remove tariff barriers on a bilateral basis and to deepen economic integration across the wider trade and investment relationship.

Selecting candidates for CEPs is complicated. A CEP raises welfare if it creates trade by allowing cheaper products from partners to substitute for more expensive domestic production. This is trade creation. CEPs can divert trade by allowing firms in partner countries to displace imported goods from outside the bloc that were cheaper when both faced equal tariffs. This is trade diversion. The tariff advantage over third countries allows high-cost firms in partner countries to win sales. While trade creation contributes positively to welfare in the home country, trade diversion results in a welfare loss.

The balance between trade creation and trade diversion is the key determinant of the benefits of a CEP and who is and is not a good potential partner. Trade diversion offsets trade creation because CEP members start to import goods from each other that they could have imported at lower cost from other countries in the absence of a preferential tariff. Little is gained if consumers pay much the same prices as before the CEP and tariff revenues are lost to make way for higher-cost imports from a partner country.

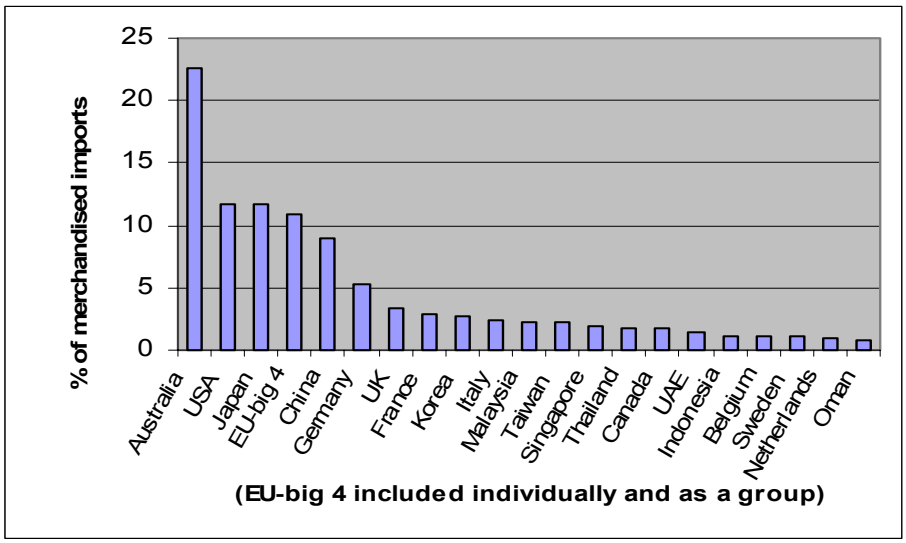
The welfare effects of CEPs vary from deal to deal: members split the gains from higher export prices but incur higher import prices. In those deals where there is trade diversion, a member pays more for imports, with the increase financed by what had previously accrued as tariff revenues. New Zealand collected $285 million in customs duty in the year to 30 June 2003, with $155 million in duty on textile, clothing and footwear imports. A poor choice of partner could lose millions in duty with few retail price benefits.

Studies of individual free trade agreements have produced a wide range of results. The previous empirical literature, as reviewed Schiff and Waters (2003) and Adams *et al* (2003) suggests that the nine CEPs studied (including CER) are modestly trade diverting, which is a relatively benign result. However, new empirical work undertaken by the Australian Productivity Commission (Adams *et al* 2003) suggests that of the 18 recent preferential trading agreements examined in detail, 12 have diverted more trade from non-members than they have created among members. What is more, some of the apparently quite liberal agreements—including EU, NAFTA, CER and MERCOSUR—have failed to create significant additional trade among members (relative to the average trade changes registered among countries in the sample). Overall, the empirical literature suggests that there is weak evidence that trade is smaller than it otherwise might have been in at least some of the blocs researched. However, the picture is sufficiently mixed that it is not possible to conclude that trade diversion has been a major problem.

In the early 1990s, analytical attention turned to the notion that free trade agreements (FTAs) should be formed between natural trading partners. Natural trading partners are countries which already trade a lot with each other. As most of the proposed partner's trade is already with each other, there is little additional trade to divert. A close variant of the 'natural trading partner' hypothesis is that FTAs are more likely to be beneficial when they are among geographic neighbours because transport costs will be lower.

The natural trading partners criterion for CEP partners has been criticised. The welfare effects of FTAs depend on the volumes of trade actually diverted, which need not be proportional to initial trade shares. That a trade flow is already large says nothing about the need to stimulate it. Some flows are large because of existing distortions and may need to be curtailed rather than boosted. Importantly, the larger the initial volume of trade, the larger the amount of tariff revenue that is to be foregone under a CEP.

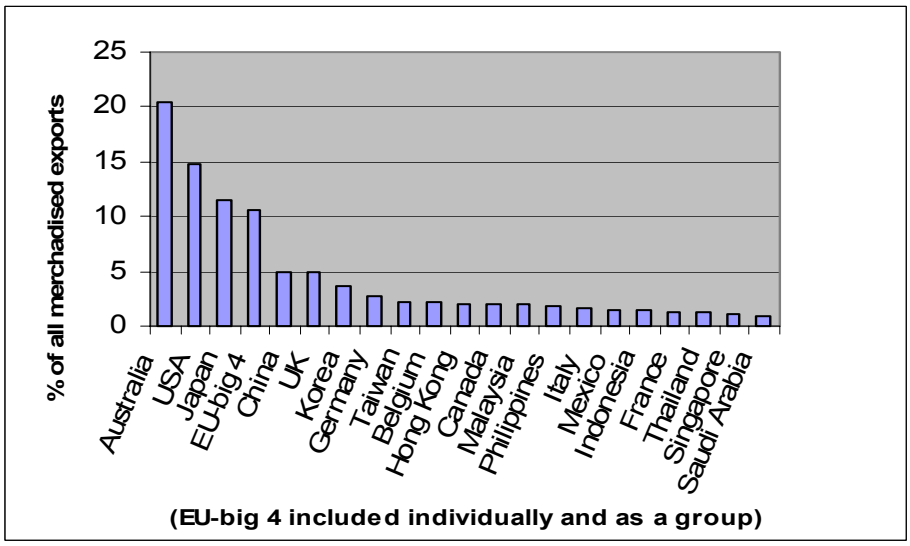
Figure 5 – Top 20 import sources, New Zealand, year to December 2003



Source: Statistics New Zealand

The practical value of proximity and volume of trade as CEP partner selection criteria may be restricted. Many countries have diversified trade and trade extensively with far away countries. Australia, our CER partner, only accounts for slightly more than one fifth of New Zealand's trade (see figures 5 and 6). After that, the EU big 4, the USA and Japan account for 10 to 15% each of imports and exports (see figures 5 and 6). After these few countries, (see figures 5 and 6), New Zealand's trading partners are a long tail.

Figure 6 – Top 20 export markets, New Zealand, year to December 2003



Source: Statistics New Zealand

Fortunately, trade diversion is a minor policy risk because 95% of imports by value land duty free. Customs collected $285 million in duty in the year to June 03, with $155 million of that duty collected from textile, clothing, and footwear (TCF) imports. That is not to say that there are no risks. A poor choice of partner, a partner with a high-cost TCF export expansion capability could forego significant amounts of customs duty.

With 95% of imports landing duty free into New Zealand, a CEP partner selection criterion based on proximity (with the TCF caveat) reasserts itself. Scollay (2003) has suggested that small and medium sized economies gain substantially from CEPs with large economies. This suggests that more CEPs along the Asia-Pacific Rim would take advantage of inherent cost advantages related to proximity. Other factors that should be taken into account are the export growth prospects of given markets, market size, the receptiveness of countries to trade liberalisation offers and comparative advantage.

An advantage of concentrating on the Pacific-Rim (USA, Japan, Australia and China) is that larger CEP partners are more likely to satisfy New Zealand's import demand without increasing their export prices. These countries have such large domestic markets that they are less likely to stop importing goods from the rest of the world that compete with New Zealand's exports and thus reduce their internal price of these goods below the world price plus their tariff on the third country imports. The price on New Zealand exports may continue to be the world price plus the tariff on third country imports.

As a small country exporting to large markets, preferential access would allow New Zealand exporters to win market share and raise export prices without depressing the consumer price in that export market, which is the world price plus the tariff. Modelling of the gains from a trade agreement with the USA assumes that U.S. prices will change little after a trade agreement so New Zealand exporters will gain market share and sell at a price that is higher than before the agreement. That price need only match the prices of competitors outside the trade agreement, who will be charging the world price plus the tariff. New Zealand exporters receive that price too, but have the advantage of not having to pay any tariff. The free trade agreement brings New Zealand exporters inside the tariff wall of the partner country and allows them to share in the price premiums of that tariff wall that are usually enjoyed by the import-competing industries in the partner country.

The horizon countries for deeper trade linkages would be South Korea and the ASEAN countries (particularly Thailand and Malaysia), and Mexico. New Zealand is currently undertaking joint studies of the possibility of a CEP with Thailand and with China. Closer economic partnerships with Mexico and with Chile have been discussed.

5.4 Deepening relationships short of CEPs

CEPs are not the only form of agreements through which New Zealand can seek to deepen trade links with focus countries. Trade and investment framework agreements and trade facilitation protocols can address non-tariff impediments.

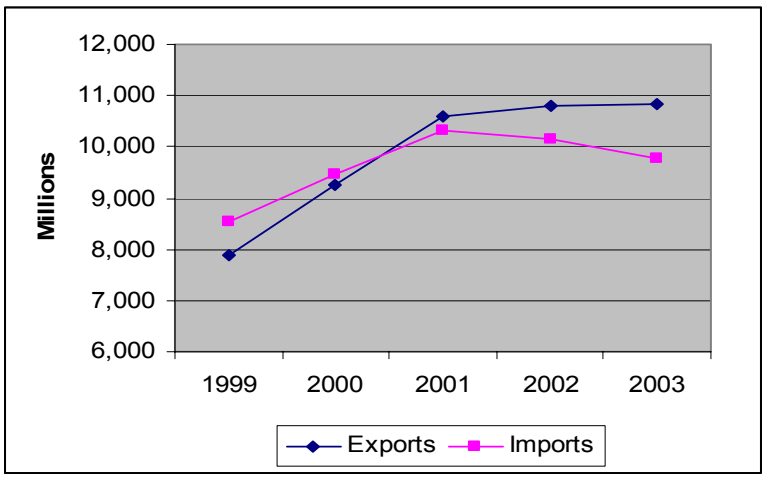
Deeper economic relationships can also cover unilateral initiatives such as increased promotion of exports (including tourism and educational services). The Brand New Zealand programme is an example of efforts to increase global connectedness that can be used to deepen relationships with the focus countries by unilateral means. A number of government programmes support businesses building international networks. World Class New Zealanders, run by New Zealand Trade and Enterprise (NZTE), provides opportunities for high potential New Zealand businesses to learn from top offshore businesses, improve their business capabilities and establish networks of overseas

experts and strategic partners. NZTE has sponsored the Kiwi Expatriates Abroad (KEA) network, under which talented New Zealanders living overseas help New Zealand businesses establish a presence in offshore markets and share their knowledge.

5.5 Promoting the services trade

Service exports and imports have evolved significantly over recent years. Between 1999 and 2003, New Zealand moved from being a net importer of services to being a net exporter, with a surplus of over $1 billion in the year to March 2003 (see figure 7).

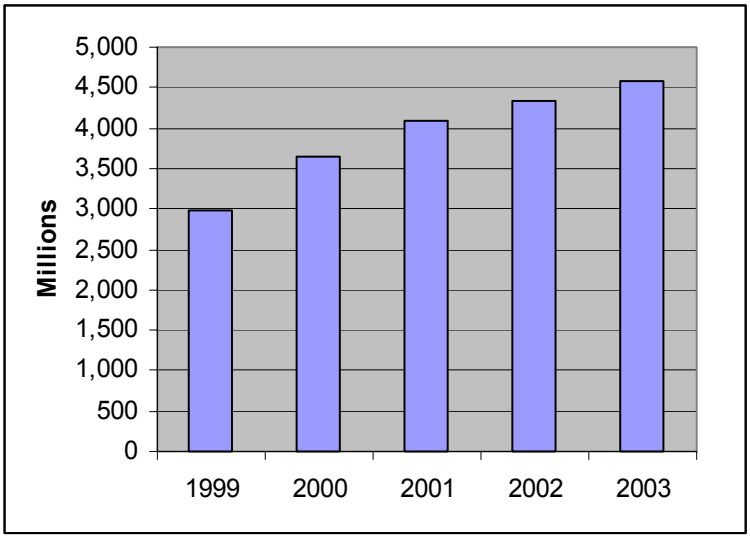
Figure 7 – Services trade, New Zealand, year to September



Source: Statistics New Zealand

The reasons for the switch from a deficit to a surplus are the sharp increases in tourism receipts and education exports. Tourism has gone up by 50% in value while education exports almost tripled in value (see figures 8 and 9).

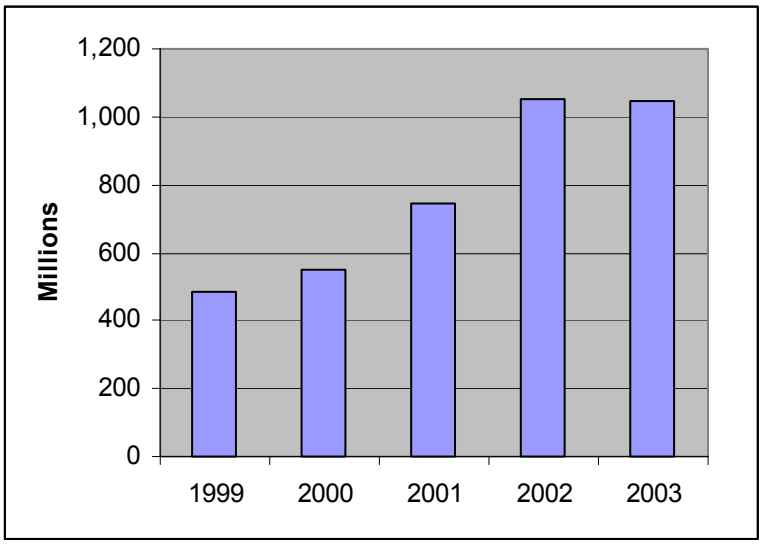
Figure 8 – Inbound tourism, New Zealand, year to September



Source: Statistics New Zealand

Education exports aside, the bulk of the service trade is transport, business travel, and tourism (see figure 10). Royalties and licence fees aside, transport and tourism and the rest of the services trade are not major gateways for technology. Chance encounters where tourists visit New Zealand and return as immigrants or as investors do happen but there is no data on whether these connections are major sources of new external links.

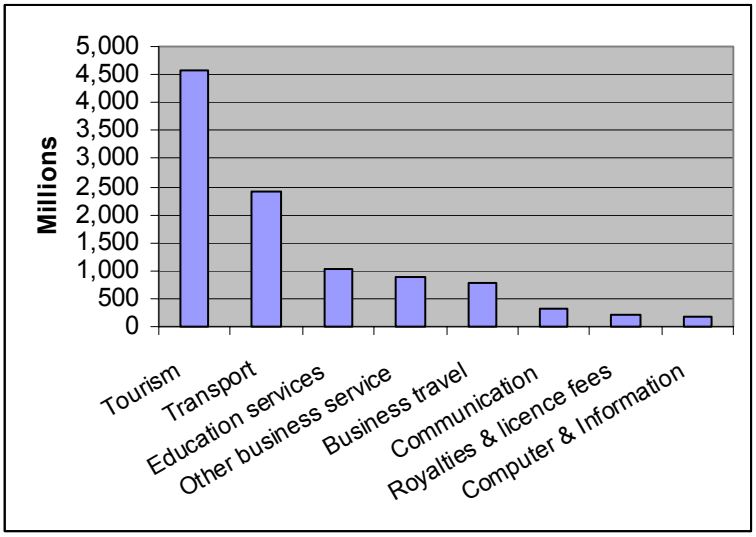
Figure 9 – Education exports, New Zealand, year to September



Source: Statistics New Zealand

The growth in the number of tourists (and of students) coming to New Zealand can be best explained by: the strength of the source-country economies; and the strength of the source-country currencies. The regions that continue to offer the strongest growth prospects are the Asia-Pacific and South Asia (World Bank 2003). The East Asia economies are expected by the World Bank (2003) to grow at twice the pace of the high-income countries in the next few years.

Figure 10 – Service exports, New Zealand, year to September

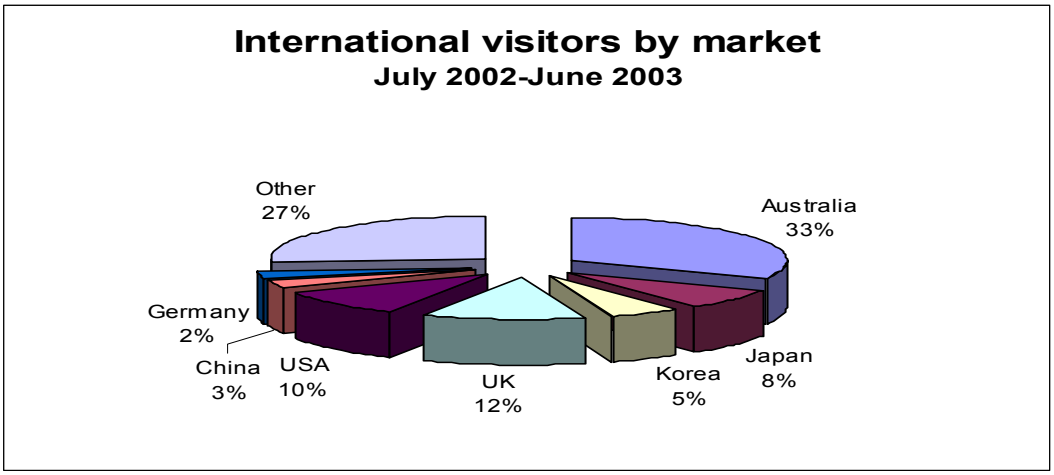


Source: Statistics New Zealand

The focus countries for tourism should be markets with major growth potential, those markets that are short- to medium hauls and/or are markets that are familiar with New Zealand as a holiday destination. These tourist markets are Australia, USA, UK, Japan, Korea, and China. The UK and the USA are long-haul markets but they are markets well familiar with New Zealand and send many tourists to New Zealand (see figure 11).

The horizon markets for tourism would be the ASEAN countries due to their growth potential, proximity, and rising incomes.

Figure 11 – International visitors by market, New Zealand, July 2002 – June 2003



Source: Statistics New Zealand

The focus on Asia for tourism is important because the World Tourism Organisation's (2003) projected growth in global tourist arrivals from East Asia is 8.2% for 2000-2010, which is notably higher than the global average growth forecast of 4.5%. The Tourism Research Council New Zealand (2003) also forecasts Asia to be New Zealand's strongest growth markets for tourism arrivals in the decade to 2010.

For New Zealand's education exports, the focus should be North and East Asia. The aim should be to deepen relationships with the major markets of China and Japan while diversifying into the smaller markets to mitigate single-market risk. For example, in 2000/01, no more than 11 to 18% of foreign fee-paying students in Australia, Canada and the USA came from any one country. Comparatively, in New Zealand, 30% of students came from Japan in 2000. By 2002, the largest single education export market had changed and nearly 40% of students came from China.

Market size and growth potential identify China, Japan, South Korea and the ASEAN countries as the focus countries for education exports. Given the high current exposure to China and Japan, there is a need to diversify by increasing efforts to attract students from Thailand, Malaysia, South Korea, Taiwan, Hong Kong and Indonesia.

India and Pakistan would be the horizon countries. India is a close call and it could be classified as a focus country. This is because India and China and are the two major emerging markets for education exports. As an additional complication, growth in education exports to India and Pakistan are full of twists and turns because of immigration over-stay risks and difficulties in verifying documentation.

5.6 Increased people-to-people linkages

People-to-people links bring access to knowledge of preferences in offshore export markets, to technological developments, to the latest ideas and thinking and to a larger pool of skilled labour. Deeper international people-to-people links can further lift the growth rate of the economy by increasing the average amount of human capital in the work-force and by increasing the stock of offshore knowledge that New Zealanders can access and exploit. Not all new technology diffuses in the form of written blueprints for new products. There is a role for direct learning and the human capital that is embodied in each worker and researcher. This raises the possibility that more interactions between New Zealand and overseas ideas workers could benefit domestic productivity rates.

Some new inventions spread quickly across borders. Others are more localised and are held closely by specific individuals and companies. For example, in biotechnology, an industry based almost exclusively on new knowledge and cutting edge scientific discoveries, firms tend to cluster together in just a handful of locations. Clustering is often due to the location of star scientists: those individuals with high amounts of human capital who are able to appropriate their knowledge thorough start-up firms (Audretsch and Feldman 1996). The importance of proximity is shaped by the role played by the scientist. The scientist is more likely to be located in the same region as the firm when the relationship involves the transfer of new economic knowledge or some other specialised input. When the scientist is providing a service that does not involve knowledge transfer or a specialised input associated with the human capital of specific individuals and groups, proximity and star scientists are less important (Audretsch and Feldman 1996).

A direct way of linking star foreign talent with New Zealand opportunities is short- and long-term immigration. Labour mobility is an important source of knowledge diffusion. One survey of the founders of companies on a 1989 list of the 100 fastest growing companies in the U.S. found that 71% of them replicated or modified an idea encountered through previous employment (see Bhide 1994). A study of patent data from the U.S. semiconductor industry by Almeida and Kogut (1999) found that ideas are spread through the mobility of key engineers. Song, Almeida and Wu (2001) used patent data to find that engineers who moved from the USA to South Korea or Taiwan built their subsequent innovations upon knowledge from their previous firms in the USA.

Direct learning across borders has a long history as the foundation for new industries and products. The U.S. textile industry in the 19th century and the Japanese automobile industry in the 20th century were both established after sending study missions abroad. The missions that Japan sent to the West after the Meiji restoration is a classic example of the potential of face-to-face learning. After World War II, the Marshall plan sponsored 20,000 people from Europe to visit the USA to learn the latest ideas.

New Zealand firms can hire foreign scientists and engineers. New Zealanders can interact with foreign competitors who invested here, read the scientific and technological literature, or have direct contacts with foreign engineers and other researchers in conferences or fairs and through joint ventures. Import-competing companies can acquire technology by R&D collaboration, reading patents and licenses; analysing competing products for reverse engineering and imitation; consultation with experts; communications with suppliers; mergers and joint ventures/alliances. Exporters can obtain new technology through R&D out-sourcing, analysing competing products, purchasing equipment, contacts with customers, joint ventures/alliances, and personnel exchanges.

The impact that new foreign knowledge has on New Zealand's productivity depends on having the capacity to digest such knowledge, and to make efficient use of it. This calls for sufficient technological capacity, human capital and R&D facilities to capitalise on the off-shore innovations. Countries may differ in their ability to absorb imported technologies even if the new knowledge is global and free. Barriers to diffusion and adaptation include regulation and taxes (Eaton and Kortum 1999, Jones 1994, Parente and Prescott 1994, 1999) and insufficient domestic human capital to absorb quickly the imported technology (Caselli and Coleman 2001, Caselli and Wilson 2003).

The rate at which the gap between the global technology frontier and the present level of productivity in New Zealand is closed depends heavily on the current level of human capital. More highly skilled workers are likely to learn new technologies faster than less skilled workers. Consequently, a New Zealand with a more skilled and globally connected labour force is likely to grow faster than an economy with a less skilled and less internationally connected labour force. Thus, the performance of the economy depends not only upon the size and growth of the labour pool in New Zealand, but also upon the level of skills possessed by and international connectedness of the members of that labour pool. The productivity of a worker with a given amount of human capital depends upon the human capital of other workers he or she interacts with (Lucas 2002).

As discussed in section 2.4, one strand of the new growth theories proposes that productivity gains come from investments in R&D with research labs producing blueprints of new products. Another strand of the new growth theories suspects that the relationship between new technology and economic growth is more indirect with human capital as the key. Economic growth and technological diffusion are much more than the turning discoveries into commercial blueprints. An important share of advances in knowledge may come from learning-by-doing (Lucas 1993). This may lead to delays between the appearance of a new technology and its peak usage (or full diffusion) in New Zealand. The leaning-by-doing and on-the-job accumulation of human capital must be repeated.

A different literature has emphasised the impact of networks and social capital found in a region or country (Agrawal, Cockburn and McHale 2002, Rauch 1999, 2003). Relational networks exist at multiple levels and they can link individuals, groups, firms, industries, regions, and countries. These relational networks create the face-to-face and work-place contact that facilitates the leaning-by-doing and on-the-job training prized by new growth theory. Human capital formation is a social activity, involving groups of people in a way that has no counterpart in the accumulation of physical capital. We learn from each other in acquiring a skill—each member of a group raises not just his own productivity but also the skill level and average productivity of the whole group. For example, research laboratories and facilities of New Zealand universities and their pool of foreign students and researchers and off-shore links and networks are sources of innovation-generating knowledge that are available to local private enterprise for commercial exploitation.

Research at universities provides a link that facilitates knowledge spillovers in the form of recruiting international talent to New Zealand, transferring technology through local and international linkages and interactions, placing students in industry, and providing a platform for firms and researchers to interact. Crown research institutes can also perform the hub and linking functions for research similar to those just described for universities. The mid-field ranking of New Zealand patent applications among OECD members at the European Patent Office that are international co-inventions or have cross-border ownership suggests New Zealand has good international R&D links (see tables 1 and 2).

5.7 Migration and trade

The ties that immigrants have to their home countries can play a role in fostering trade. Immigrant ties include knowledge of home-country markets, language, preferences, and business contacts that have the potential to decrease the transaction costs of trade. Migrants may also prefer products from their home countries, which implies more imports.

The empirical studies to date almost exclusively point to a positive impact of immigration on trade between the immigrants' host and home countries (see Law and Bryant forthcoming). A study of ethnic Chinese networks, as proxied by their population shares, found that these networks increased bilateral trade both within Southeast Asia and for other countries (see Rauch and Trindale 2002). Where ethnic Chinese communities are relatively large fractions of a country's population and have relatively numerous direct connections across international borders, Rauch and Trindale found that they facilitate trade by helping to match international buyers and sellers. Where ethnic Chinese communities are small fractions of their countries' populations, and they are close-knit, they facilitate trade by enforcing community sanctions that deter opportunistic behaviour.

Research being undertaken by Law and Bryant (forthcoming 2004) using New Zealand data indicates that there is a link between immigration and trade. The results of the data analysis concern the relationship between migrant stocks in New Zealand and New Zealand's trade. As table 3 shows, there has been very little change in migrant stocks from traditional sources, such as the UK, Australia, and Europe, but there have been large changes in migrant stocks from other sources such as Asia and the Pacific.

Table 3 – Census data on the place of birth of the New Zealand population

Place of birth	1981	1986	1991	1996	2001
New Zealand	2,679,054	2,759,178	2,812,035	2,848,206	2,890,869
East Asia & Pacific	75,819	97,617	147,663	197,775	252,759
United Kingdom	252,816	248,130	231,726	222,726	217,380
Unspecified / Undefined	13,491	21,849	35,067	165,474	148,137
Europe & Central Asia	47,772	55,527	55,806	63,207	67,983
Australia	43,809	47,208	48,636	54,570	56,142
Sub – Saharan Africa	7,527	7,734	9,195	17,409	36,234
South Asia	7,440	8,040	12,573	19,287	30,690
North America	11,769	13,935	15,297	19,218	21,279
Middle East & North Africa	1,515	1,851	3,348	7,191	11,805
Latin America & Caribbean	2,295	2,214	2,583	3,237	3,999
Total	3,143,307	3,263,283	3,373,929	3,618,300	3,737,277
Foreign-born as % of total*	14.4%	14.9%	15.8%	17.5%	19.5%

* These calculations deduct 'unspecified / undefined' from the total. This assumes that the proportion of 'unspecified / undefined' people who are foreign-born is the same as that of the rest of the population.

Source: Law and Bryant (forthcoming 2004).

Foreign born as a proportion of the New Zealand population have risen by a third in the 20 years to the 2001 (see table 3). In addition, the number of countries from which New Zealand has received significant migration has risen by several-fold (see table 4).

Table 4 – Increasing diversity of the migrant stock

Number of countries from which New Zealand has at least…	1981	1986	1991	1996	2001
10 migrants	150	136	142	163	177
100 migrants	86	85	90	109	121
1,000 migrants	28	33	36	46	48
10,000 migrants	5	5	7	15	16

Note – 'Migrant' here means foreign born.

Source: Law and Bryant (forthcoming 2004).

The percentage of the New Zealand population that is foreign-born (19.5%) is high by international standards (see table 5). Australia, Luxembourg and Switzerland are the only countries in table 5 with a higher percentage of foreign-born. Many OECD countries have foreign-born percentages well below 10%.

Tables 3-5 together suggest that, at least in terms of migration flows, New Zealand is already unusually well connected globally at the people-to-people level.

Table 5 – Foreign born as a percentage of population, selected countries

Country	Percent foreign born	Year	
Luxembourg	30.2	1991	
Australia	23.1	2001	
Switzerland	20.5	2000	
New Zealand	**19.5**	**2001**	
Canada	18.4	2001	
Singapore	18.3	2001	
Sweden	11.3	2000	
United States	11.1	2000	
Austria	10.4	2000	
Ireland	10.4	2002	
France	10.0	1990	
Netherlands	9.3	2001	
Germany	8.9	2000	*
Slovenia	8.5	2002	
Belgium	8.4	2000	*
United Kingdom	8.3	2001	
Norway	7.3	2001	
Denmark	5.8	2000	
Spain	5.4	2001	
Hungary	2.9	2000	
Finland	2.6	2000	
Italy	2.4	2000	*
South Africa	2.3	2001	
Portugal	2.2	2001	
Czech Rep.	2.0	2000	*
Japan	1.2	1997	*
Slovak Rep.	0.5	2000	*

* Foreign citizenship rather than foreign-born

Source: Law and Bryant (forthcoming 2004).

Analysis by Law and Bryant (forthcoming 2004) suggests that immigration increases New Zealand's trade. Specifically, a 1% increase in migrants from a given country leads to an approximately 0.2% increase in both imports and exports. These results for immigration and New Zealand trade are broadly in line with those of previous studies in other countries. The data is still being analysed, as is whether these linkages between immigration and export flows exist for all countries or for all export sectors.

Given the targeting of the Pacific-Rim countries for FDI, trade, services and R&D, those countries also should be targeted for greater people linkages. The UK also should be targeted so as to lever off existing strong relationships in all dimensions. The horizon countries for people linkages including immigration would be India and Pakistan. South Asia has a growing and well-educated middle class and fluency in English is common.

5.8 The Kiwi diaspora

Another people-to-people link is New Zealanders living aboard. These Diaspora ties may increase knowledge of markets, languages, preferences, and build business contacts that all have the potential to decrease trading costs. New Zealanders living abroad may prefer products from their home country, which implies that more trade. However, research being undertaken by Treasury is suggesting that Kiwi Diaspora links may be overstated.

Table 6 – Census data on New Zealander-born and Australian-born populations

Country	Date	NZ-born in country	As % of total identified NZ-born	Australian-born in country	As % of total identified Australian-born
New Zealand	2001	2,890,869	86.66%	56,142	0.40%
Australia	2000	355,765	10.66%	13,629,685	98.25%
England and Wales	2001	54,425	1.63%	98,772	0.71%
United States	2000	22,872	0.69%	60,965	0.44%
Canada	2001	9475	0.28%	18,910	0.14%
Republic of Ireland	2002	2,195	0.07%	5,947	0.04%
Northern Ireland	2001	448	0.01%	1,544	0.01%
Total identified New Zealanders or Australians		3,336,049	100.00%	13,871,965	100.00%

Source: Law and Bryant (forthcoming 2004).

Table 6 is based on census data from 7 countries. The data in table 6 concerns the birthplaces of usual residents of the 7 countries. The table shows, approximately, the global distribution of the New Zealand-born and Australian-born populations. It is only approximate because the table only covers some of the countries in which New Zealanders and Australians live (though they are probably the main countries.)

The main conclusion from table 6 seems to be that around 15% of the global New Zealand-born population lives outside New Zealand. Of these, over three-quarters live in Australia. The proportion of the Australian population that lives overseas is much smaller by comparison. The Diaspora is less geographically diversified than is sometimes assumed. Expectations about the opportunities the New Zealand Diaspora may offer as trade, investment and technology links may need to be tempered. The opportunities that the New Zealand Diaspora offer to their homeland as trade and technology links may be beneficial but should not be overstated.

6 Summary and next steps

This paper investigated whether there are a key set of countries with which New Zealand should be seeking to form deeper bilateral economic relationships. The paper used the insights of the new theories of economic growth to develop criteria for selecting countries as potential partners for deeper economic linkages across six global connectedness dimensions: FDI, R&D links, trade in goods, inbound tourism, education exports and people-to-people linkages. The new theories of economic growth provide many new ways to think about economic growth and international integration and a more diverse set of mechanisms for analysing the role of government policy and off-shore linkages.

We identified a core of countries along the Asia-Pacific Rim (as well as the UK) with which New Zealand should deepen its relations (see table 7) both as a focus over the next five years and further towards the horizon—in 10 to 20 years time.

Table 7 – Focus and horizon countries

Factor of production or output demand:	Connectedness dimension	Criteria – summary	Focus countries	Horizon Countries
Capital	FDI	Source of technology Size of capital markets Existing trade and FDI links Proximity	Australia, USA, Japan and UK	Taiwan, Singapore, Hong Kong, South Korea, and China
Knowledge, ideas and technology	R&D linkages, Highly skilled people	Global R&D leaders Existing linkages Proximity Future R&D expenditure Shared technological specialisations Co-investment potential Receptiveness to R&D collaboration	Australia, USA, Japan, UK and Germany	Taiwan, Korea, China
Trade in goods and services	Trade: CEPs and other trade agreements and export promotion	Future growth prospects Distance and market size Receptiveness to CEP negotiations and trade liberalisation Comparative advantage Trade creation Trade diversion risks	Australia, USA, Japan and China	Korea, ASEAN states (particularly Thailand and Malaysia), Mexico
	In-bound tourism	Market size, distance & familiarity	Australia, USA, Japan, Korea, China and UK	ASEAN countries
	Education exports	Current and projected demand	East and North Asia (China, Korea, Japan, ASEAN states)	India, Pakistan
Labour:	People linkages: Face-to-face contact, Migration flows, work and student visas	Language, skills. Means of complementing access in the other dimensions	UK and Pacific-Rim (major APEC economies)	India, Pakistan

The focus countries for FDI are the USA, Japan, the UK and Australia. The focus countries for R&D are the four countries just mentioned and Germany. The proposed

criteria for selecting partners for CEPs and for expanding the services trade focus on our nearer markets, which are along the Asia-Pacific Rim (as well as the UK for tourism). The horizon countries are located along the Asia-Pacific Rim and South Asia (see table 7).

An interesting and reassuring result from considering the countries that flow from the criteria is that many of the same countries keep appearing. Japan is a focus country for all six dimensions. The USA and Australia appear five times in the table. The UK and China appear four times in the table. A range of steps can be taken to deepen relationships with a focus and horizon countries. Some countries are candidates for CEPs. All could be the target of trade and investment promotion.

A key question is whether external policies will be mutually supportive so as to capture the synergies between flows of different factors. For New Zealand to become truly globally connected, policy initiatives need to be coordinated. The same core of countries appears in most criteria, which should facilitate synergies.

The practical policy implication is that when budget and other external initiatives come before Ministers, such initiatives should be seen through a lens that places a greater confidence in proposals for deeper relationships with the Asia-Pacific Rim countries or the UK and more scrutiny of proposals that emphasise other regions.

We are not saying that opportunities should be passed up because they are outside the Pacific-Rim. We are saying is that such proposals should be examined more closely. After this scrutiny, each proposal will have a clear intervention logic linking the individual global connectedness initiative and the package as a whole to improved productivity. It should be added that links do not solely define the character of our trade and foreign policy interests. These broader and non-economic justifications for external initiatives are fully acknowledged and should be kept in mind when using the proposed criteria.

New Zealand Trade and Enterprise and the Ministries of Foreign Affairs and Trade, Economic Development, Research, Science and Technology, Education and Agriculture and Forestry are among the agencies updating their international connectedness strategies. Their conclusions about countries to target for deeper relations are similar to those in this paper. The agencies just mentioned will have lead responsibility in ensuring that external linkages have the country and regional focus that is advocated in this paper.

The Treasury will have a role in implementing the country focus advocated in this paper. However, Treasury has responsibility for first opinion advice in a limited number of areas arising from its role as economic and fiscal advisor to the Government. The Treasury's opportunities to influence the external focus of other agencies will arise mainly through providing second opinion advice on the outputs of agencies, through the vote/monitoring/budget co-ordination role, and through participation in whole of government processes/reviews—such as the GIF steering group and the immigration review.

References

Adams, Richard, Philippa Dee, Jyothi Gali and Greg McGuire (2003) “The trade and investment effects of preferential trading arrangements—old and new evidence.” Canberra, Productivity Commission, Staff Working Paper, May. <www.pc.gov.au>.

Agrawal, Ajay, Iain Cockburn and John McHale (2003) “Gone but not forgotten: Labor flows, knowledge spillovers, and enduring social capital.” Cambridge MA, National Bureau of Economic Research, Working Paper No. W9950, September. <http://www.nber.org/papers/w9950>.

Almeida, Paul and Bruce Kogut (1999) “Localization of knowledge and the mobility of engineers in regional networks.” *Management Science* 45: 905-917.

Audretsch, David and Maryann Feldman (1996) “R&D spillovers and the geography of innovation and production.” *American Economic Review* 86(3): 630-640.

Benhabib, Jess and Mark Spiegel (forthcoming) “Human capital and technology diffusion.” in Philippe Aghion and Steven Durlauf *eds Handbook of Economic Growth.* <http://elsa.berkeley.edu/~chad/Handbook.html>.

Bhide, Amar (1994) “How entrepreneurs craft strategies that work.” *Harvard Business Review* 72(2): 150-161.

Bryant, John and David Law (fourthcoming 2004), "The diaspora, immigration, and New Zealand’s links to the world." Wellington, The Treasury, Draft Worknig Paper.

Caselli, Francesco and Wilbur Coleman (2001) “Cross-country technology diffusion: The case of computers.” *American Economic Review* 91(2): 328-335.

Caselli, Francesco and Daniel Wilson (2003) “Importing technology.” Cambridge MA, National Bureau of Economic Research, Working Paper No. W9928, August, <http://www.nber.org/papers/w9928>.

DeLong, J. Bradford (forthcoming), "What do we really know about economic growth?" in Michael Boskin *ed Economic Growth*. (Stanford: Hoover Institution). <http://econ161.berkeley.edu/Econ_Articles/hoover/growth_delong_hoover.html>.

Eaton, Jonathan and Samuel Kortum (1999) "International technology diffusion: theory and measurement." *International Economic Review* 40(3): 537-570.

Eaton, Jonathan and Samuel Kortum (2001) ”Trade in capital goods.” *European Economic Review* 45(7): 1195-1235.

Guellec, Dominique and Bruno van Pottelsberghe de la Potterie (2001) “The internationalisation of technology analysed with patent data.” *Research Policy* 30(8): 1253-1266.

Grossman, Gene and Elhanan Helpman (1991) *Innovation and growth in the global economy.* (Cambridge: MIT Press).

Grossman, Gene and Elhanan Helpman (1994) “Endogenous Innovation the Theory of Growth.” *Journal of Economic Perspectives* 8(1): 23-44.

Jones, Charles (1994) “Economic growth and the relative price of capital.” *Journal of Monetary Economics* 34(3): 359-382.

Keller, Wolfgang (2001) “International technology diffusion.” Cambridge MA, National Bureau of Economic Research, Working Paper No. W8573, October. <www.nber.org/papers/w8573>.

Keller, Wolfgang (2002a) "Geographic localization of international technology diffusion." *American Economic Review* 92(1): 120-142.

Keller, Wolfgang (2002b) “The geography and channels of knowledge spillovers at the world’s technology frontier.” Cambridge MA, National Bureau of Economic Research, Working Paper No. W8150, January. <www.nber.org/papers/w8150>.

Keller, Wolfgang (forthcoming) “International technology diffusion.” *Journal of Economic Literature*.

Lucas, Robert E. Jr. (1988) "On the mechanics of economic development." *Journal of Monetary Economics* 22(1): 3–42.

Lucas, Robert E. Jr. (1993) "Making a miracle." *Econometrica* 61(2): 251-272.

Lucas, Robert E. Jr. (2002) *Lectures on economic growth.* (Cambridge: Harvard University Press).

Ministry for Research, Science and Technology (MoRST 2002), *International linkages strategy*. (Wellington: Ministry for Research, Science and Technology). <www.morst.govt.nz>.

Moen, Jarle (2001) “Is mobility of technical personnel a source of R&D spillovers?” Cambridge MA, National Bureau of Economic Research, Working Paper No. <W7834. http://www.nber.org/papers/w7834>.

OECD (2003) *Science, Technology and Industry (STI) Scoreboard 2003*. (Paris: OECD). <www.oecd.org>.

Parente, Stephen and Edward Prescott (1994) “Barriers to technology adoption and development.” *Journal of Political Economy* 102(2): 298-321.

Parente, Stephen and Edward Prescott (1999) “Monopoly rights: A barrier to riches.” *American Economic Review* 89(5): 1216-1233.

Rauch, James (1999) “Networks versus markets in international trade.” *Journal of International Economics* 48(1): 7-35.

Rauch, James and Vitor Trindade (2002) "Ethnic Chinese networks in international trade." *Review of Economics and Statistics* 84(1): 116-130.

Rauch, James and Alessandra Casella (2003) “Overcoming informational barriers to international resource allocation: Prices and ties.” *Economic Journal* 113(1): 21-42.

Romer, Paul (1986) "Increasing returns and long run growth." *Journal of Political Economy* 94(5): 1002-1037.

Romer, Paul (1990) "Endogenous technological change." *Journal of Political Economy* 98(5): S71-S102.

Romer, Paul (1994) "The origins of endogenous growth." *Journal of Economic Perspective* 8(1): 3-22.

Romer, Paul and Luis Rivera-Batiz (1991a) "Economic integration and endogenous growth." *Quarterly Journal of Economics* 106(2): 531-555.

Romer, Paul and Luis Rivera-Batiz (1991b) "International trade with endogenous technological change." *European Economic Review* 35(4): 971-1004.

Schiff, Maurice and L. Alan Waters (2003) *Regional integration and development.* (Washington, D.C: World Bank). www.worldbank.org.

Scollay, Robert (2003) “Asia-Pacific RTAs as avenues for achieving the Bogor Goals: analysis and ways forward.” Singapore, PECC International Secretariat, May. <ww.pecc.org/trade/phuket-2003/scollay_analysis.pdf>.

Solow, Robert (1956) "A contribution to the theory of economic growth." *Quarterly Journal of Economics* 70(1): 56-70.

Solow, Robert (1957) "Technical change and the aggregate production function." *Review of Economics and Statistics* 39: 312-320.

Song, Jaeyong, Paul Almeida and Geraldine Wu (2001) ”Mobility of engineers and international technology transfer: Technological catch-up in the Korean and Taiwanese semi-conductor industries.” in Robert Burgelman and Henry Chesbrough *eds Comparative studies of technological evolution. Research on technological innovation, management and policy, vol. 7*. (Amsterdam; New York and Tokyo: Elsevier Science): 59-84.

Tourism Research Council New Zealand (2003) “New Zealand Tourism Forecasts 2003-2009.” Wellington, Tourism Research Council New Zealand. <http://www.trcnz.govt.nz/Topics/Forecasts+and+Trends/2003+-+2009+Forecasts+Summary/>.

World Bank Group 2003, *Global economic prospects 2004.* (Washington, D.C: World Bank). www.worldbank.org.

World Tourism Organization (2003) “Tourism 2020 vision vol. 7 global forecast and profiles of market segments.” Madrid, World Tourism Organization. <addeo.wtoelibrary.org/vl=699315/cl=24/nw=1/rpsv/journal/publication9284404665_home.htm>