Investment, Productivity and the Cost of Capital: Understanding New Zealand's "Capital Shallowness"

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Investment, Productivity and the Cost of Capital: Understanding New Zealand's "Capital Shallowness"

Summary and Introduction

New Zealand faces a big challenge to overcome its long-standing productivity shortfall

One of the biggest challenges facing New Zealand is its productivity shortfall relative to other OECD countries; New Zealand is currently ranked 22nd out of the 30 OECD countries in the productivity league table and an hour of work in New Zealand typically generates 30 per cent less output than an hour worked in Australia. Low productivity is not a new phenomenon; productivity has been an issue in New Zealand since at least the 1970s.

A focus on productivity is desirable not solely so that New Zealand becomes more internationally competitive, but also because in the long run, growth in incomes is fundamentally linked to output per worker. Growth in GDP per person rests on either encouraging a greater proportion of the population into work, or by improving the productivity with which each worker produces output. New Zealand has performed well in encouraging increased numbers of people into the labour market, but there is a limit to how much increased participation in the workforce can drive growth. Productivity growth must be at the heart of any future economic growth.

This is one of a series of Treasury papers on productivity performance

This paper is part of the *Productivity Performance and Policy* series of papers that discuss New Zealand's long-term productivity performance and the factors that may be inhibiting New Zealand from reaching its potential. *Putting Productivity First* is the overview paper which sets out the productivity challenge facing New Zealand and highlights key issues across five drivers of productivity: enterprise, skills, innovation, investment, and natural resources. The next two papers, *New Zealand's Productivity Performance* and *Does Quality Matter in Labour Input? The Changing Pattern of Labour Composition in New Zealand*, discuss past and more recent productivity performance and the impact that improving labour quality has had on labour productivity respectively. The final four papers address the enterprise, innovation, investment and skills drivers in turn, building on the analysis in the preceding papers by reviewing and interpreting available evidence to draw conclusions for the underlying factors affecting productivity.

This paper focuses on investment. The small size of New Zealand's capital stock has attracted much concern in the search for answers around New Zealand's productivity performance.

The main concern here is the *physical* capital stock – the total value of machinery, computing equipment, buildings, etc. – which is the result of annual investment. (Investment is the annual flow that adds to the stock and makes up for depreciation.)

The main points are:

- Compared to most OECD countries (including the US and Australia), New Zealand has low levels of labour productivity, capital intensity and multifactor productivity (MFP, a measure of how efficiently the economy makes use of capital and labour). Thinking in terms of a basic economic model allows for the insight that low capital intensity can be thought of as, at least partly, a *by-product* of low MFP.

- New Zealand firms face a somewhat elevated cost of capital compared to other OECD countries, resulting in lower capital intensity than would otherwise be justified by the economy's level of MFP.

- This paper discusses several factors – including low domestic saving, financial market development, exchange rate volatility, tax and high external indebtedness – that may be responsible for upward pressure on the cost of capital.

- More complicated models point to the importance of the terms of trade in understanding New Zealand's capital intensity and productivity experience. They also suggest that it may be useful to think of New Zealand as a *region* of a broader Australia-New Zealand economy.

- The quality of investment matters for productivity. Well-functioning markets are critical to guiding private investment to the highest returning investment opportunities. High quality public investment is more likely if based on sound principles of cost benefit analysis.

- Focusing on the factors that raise MFP will be an important part of the response to raising investment and labour productivity. Innovation, skills and building an environment that supports enterprise development are critical areas of focus. Addressing the potential factors that inflate New Zealand's cost of capital relative to other countries will also be important.

Investment and Productivity

As we will see in later sections, accumulation of physical capital through investment is a direct driver of productivity. The level of labour productivity (measured as the output per unit of labour employed) is affected by both the level of capital stock per worker and the level of multifactor productivity (MFP) — which measures the efficiency with which this labour and capital is combined to produce goods and services. Investment directly adds to the stock of capital that workers have available to them so they can produce more for a given level of labour input.

Investment also can have an indirect impact on labour productivity through spillover impacts on MFP. For example, through:

- new equipment making possible changes in work practices and also assisting labour to gain new skills, increasing their efficiency

- the creation of 'knowledge spillovers' as skilled personnel seek to understand and improve on technologies embodied in new capital equipment (PC 1999) and

- embodied technical change not captured in the market price of new equipment.

The relative strengths of these direct and indirect effects are discussed later in the paper.

As well as its immediate impact on labour productivity, growth in MFP can also support capital deepening by raising the profitability of capital and providing an incentive to increase investment. The rate of MFP growth will reflect underlying factors such as institutional quality, geography, technology and the environment for enterprise and innovation.

At an economy-wide level, the allocation of capital to different economic activity (sectors) can also influence economy-wide productivity performance.

New Zealand's Performance

Investment

New Zealand's rate of investment has been increasing but many OECD countries are investing at a faster rate

Investment in fixed assets in New Zealand represents around 23 percent of GDP. This rate of investment has varied quite substantially over the four decades varying from a high of over 31 percent in 1975 to a low of just over 17 percent in 1991/1992 (Figure 1). The period since 1992 has seen a steady, but moderate increase in investment as a share of GDP.

Government investment contributed significantly to the relatively high rates of the measured investment in the 1970s and early 1980s. Government investment accounted for around 21% of total fixed investment (just under 5 percent of GDP) in 2007.

Figure 1: Components of Gross Fixed Capital Formation
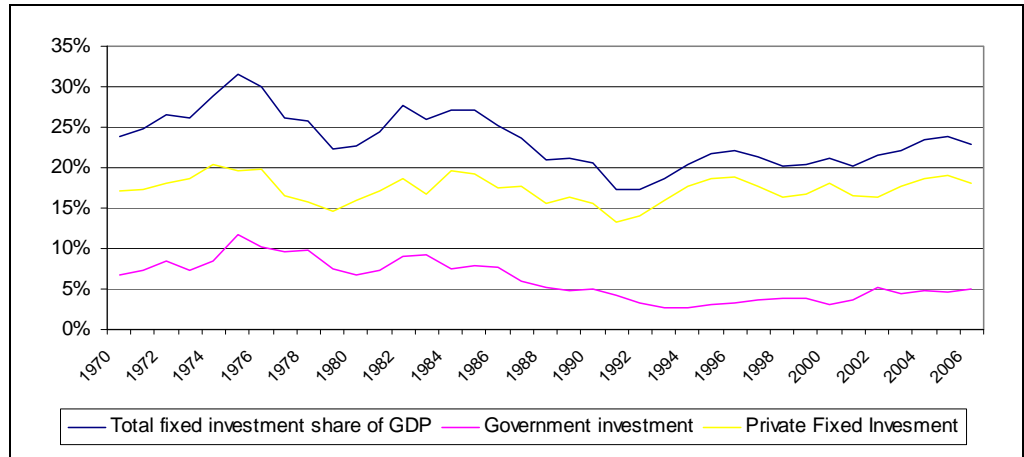
Source: OECD, Economic Outlook 82 Database.

Investment in residential building accounts has been accounting for an increasing share of fixed capital formation — rising from around 19 percent of fixed investment in 1988 to around 28 percent in 2007 (figure 2). Investment in plant and machinery also represents a significant share of fixed investment (26 percent). As a share of GDP, New Zealand's rate of investment in plant and machinery is higher than the OECD median (Treasury, Statistics NZ and MED 2007).

Figure 2: Gross Fixed Capital Formation by asset type year ended 2007
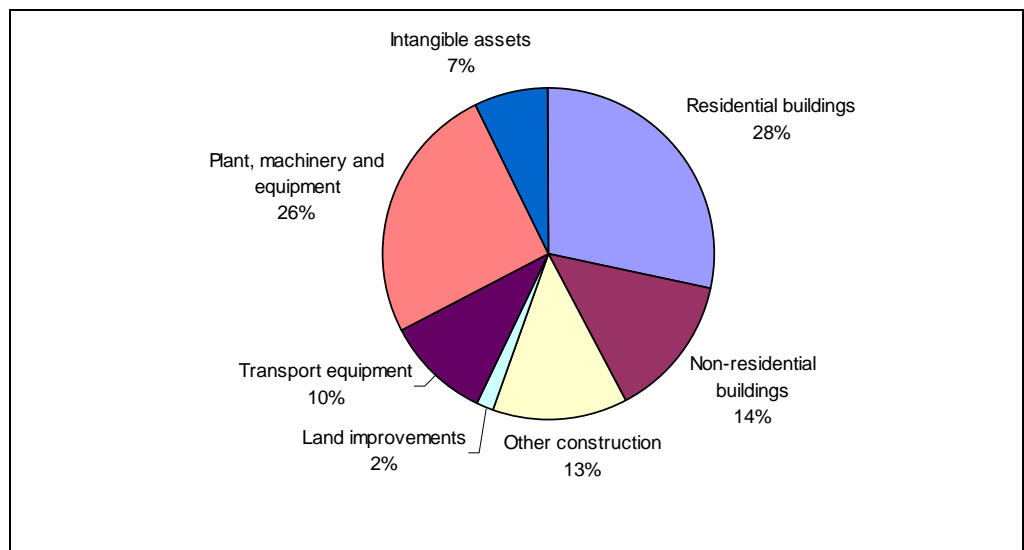
Source: Statistics New Zealand, National Accounts Data.

Overall business investment (taking account of investment in other types of assets such as non-residential buildings and other construction, transport equipment, land improvements and intangible assets) represents around

11.5 percent of GDP. It has largely fluctuated around this level since the 1990s and has been consistently below the OECD median (Figure 3). This relatively flat performance suggests that the increase in total investment (as a share of GDP) has been driven predominantly by increases in investment in residential dwellings and government investment.

Figure 3: Business investment as a share of GDP 1970 to 2006

Source: OECD, Economic Outlook 82 Database.
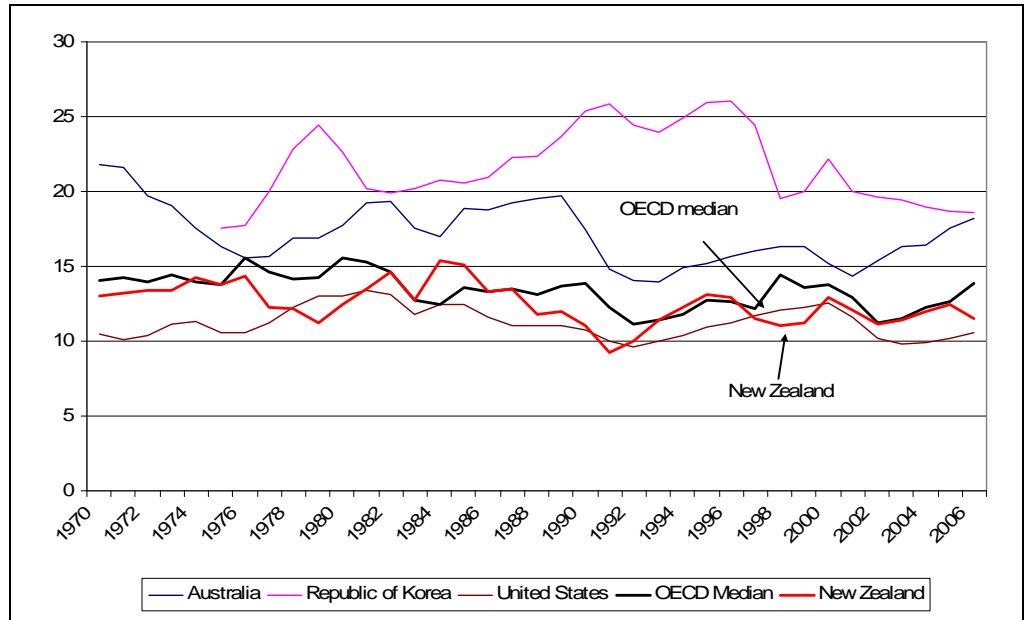
New Zealand's Capital Stock: OECD Comparisons

Two different estimates
show New Zealand with low
capital intensity relative to
other OECD countries

If annual investment outpaces the depreciation of old investment, then the capital stock grows. In most models of productivity, this capital stock is a crucial variable. Unfortunately, due to differences in coverage and the requirement for purchasing power parity conversions, it is difficult to accurately estimate capital stock levels (and MFP levels) so that they are easily comparable across countries. Figure 4 provides one comparison from MED and Treasury (2005), estimating that New Zealand's level of capital intensity (capital per unit of labour) is low compared to other OECD countries – about 71% percent of the US level and 74% of Australia's level. Schreyer (2005) uses more sophisticated methods and produces a significantly lower estimate of New Zealand's relative capital intensity in 2002: 49% of the US level and 63% compared to Australia.[1]

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[1]   Schreyer calculates his capital measure as "capital services" and uses an OECD 'harmonised' set of deflators for ICT products.

Figure 4: Capital Intensity — OECD Countries in 2002
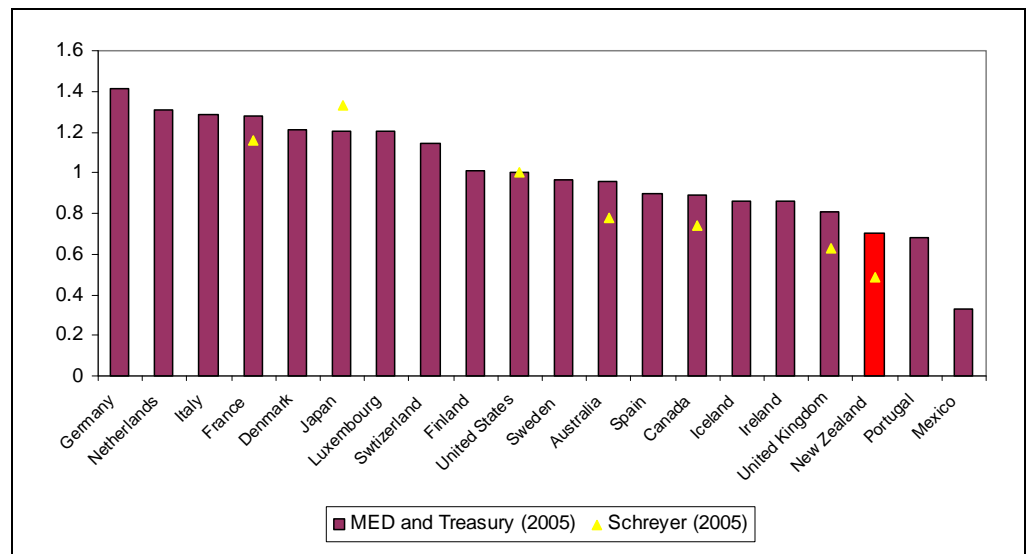
New Zealand also has a low level of MFP relative to the OECD

These same authors also demonstrate that New Zealand's level of MFP has been low compared to other OECD countries. Figure 5 shows the MED and Treasury estimate, which reports New Zealand's MFP at approximately 73% of the US level and 92% of the Australian level. Schreyer comes up with roughly similar values: 73% and 86%. This leaves us with the question of how to think about the interaction between the capital intensity and MFP gaps, and their relative importance for labour productivity. This is the subject of the next section.

Figure 5: MFP levels — OECD Countries in 2002
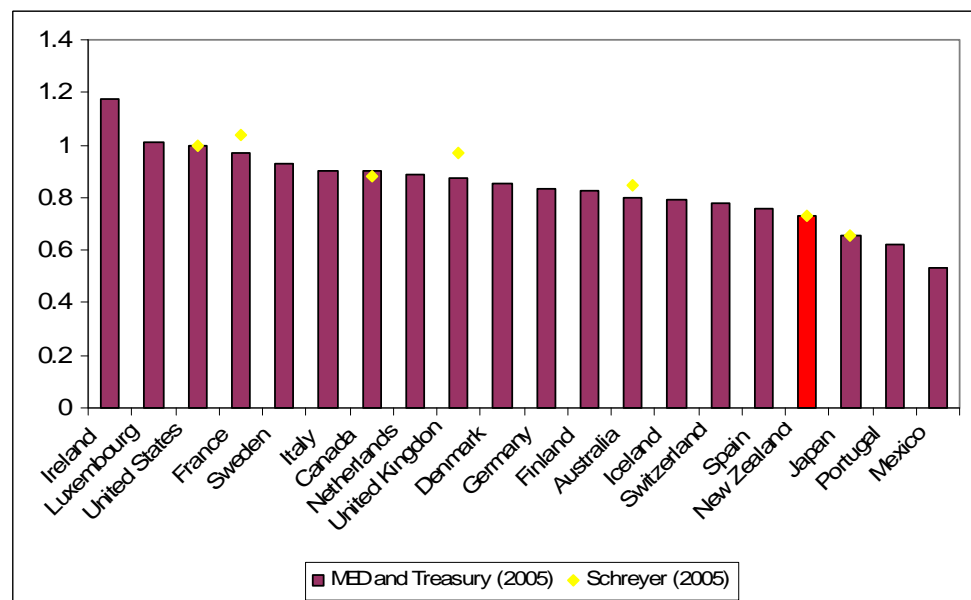
Low capital intensity is fairly widespread across sectors

Two pieces of evidence suggest that New Zealand's low capital intensity is fairly widespread across sectors of the economy. Mason and Osborne (2007) compare 22 New Zealand industries (corresponding to Statistics New Zealand measured sector plus business services) with counterparts in

the UK. Of these, only four have significantly higher capital intensity than the UK: wood and paper product manufacturing, metal product manufacturing, and construction and communication services.[2] IMF (2002) compares New Zealand industries with Australia (at a broader level of aggregation) and finds that New Zealand lags Australia's capital intensity across the board.

A Basic Model for Thinking about Investment and Productivity

The previous section established that New Zealand appears to have a low level of capital intensity (capital per unit of labour) *and* MFP compared to other OECD countries. We know from the analysis above that these two gaps must account for the gap in the level of labour productivity between New Zealand and these countries. However, without an economic model, we can't understand how these variables interact. This section lays out a basic model. The model has the following key building blocks:[3]

An economic model helps frame thoughts about capital accumulation and productivity

- As mentioned in the introduction, MFP is mainly driven by the environment for innovation and other underlying factors. (The most important drivers of MFP are the subjects of the other *Productivity Performance and Policy* papers mentioned in the introduction.) The model simply assumes a level of MFP for each country (that is, MFP is exogenous).

- An increase in MFP raises the productivity of capital and the return to investment in capital, spurring investors to increase the stock of capital. Capital may come from domestic or foreign savers.

- There may be "impediments" that get in the way of this process of capital accumulation, preventing investors from taking advantage of profitable opportunities presented by MFP growth. Another way of defining these impediments is to say that they elevate the <u>cost of capital</u> above the return received by capital.

- The model has a "long-run" focus, meaning that it abstracts from business cycle and currency fluctuation issues.[4]

Caselli and Feyrer (2006) call this the "standard neoclassical one-sector model". Although, as we will see in a later section, it leaves out potentially important complications, the model is very useful for organising thoughts about the relationship between capital intensity and productivity and is an essential reference point in the international literature that discusses relative capital-intensity across countries. A 1990 article by Lucas, titled

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[2] It is perhaps not surprising that these sectors have higher capital intensity given New Zealand's terrain and low population density.

[3] This model is also discussed in Treasury (2005).

[4] Purchasing power parity holds and there is no consideration of separate currencies.

"Why doesn't capital flow from rich to poor countries?" kicked off a large amount of research on this subject.[5]

Although it is enough to keep in mind the three points listed above, it is also useful to briefly discuss a graphical representation of the model. Figure 6 shows the relationship between GDP per unit of labour (labour productivity or "Y/L") and capital intensity ("K/L"), as determined by a country's curved "production function". The curved shape reflects the common assumption of diminishing returns to capital.[6] (That is, each additional unit of capital adds less and less extra output if labour is not also expanded.) The height of a country's production function reflects the country's level of MFP: a higher production function means the same level of capital intensity produces more output per unit labour. In line with the data presented in the previous section[7], New Zealand is drawn with a lower production function than the OECD comparator country[8]. Again, the model says nothing about what makes MFP high or low, but instead gets at the interaction between capital intensity and MFP in determining labour productivity.

Figure 6: Labour Productivity, Capital Intensity, and the Returns to/Cost of Capital
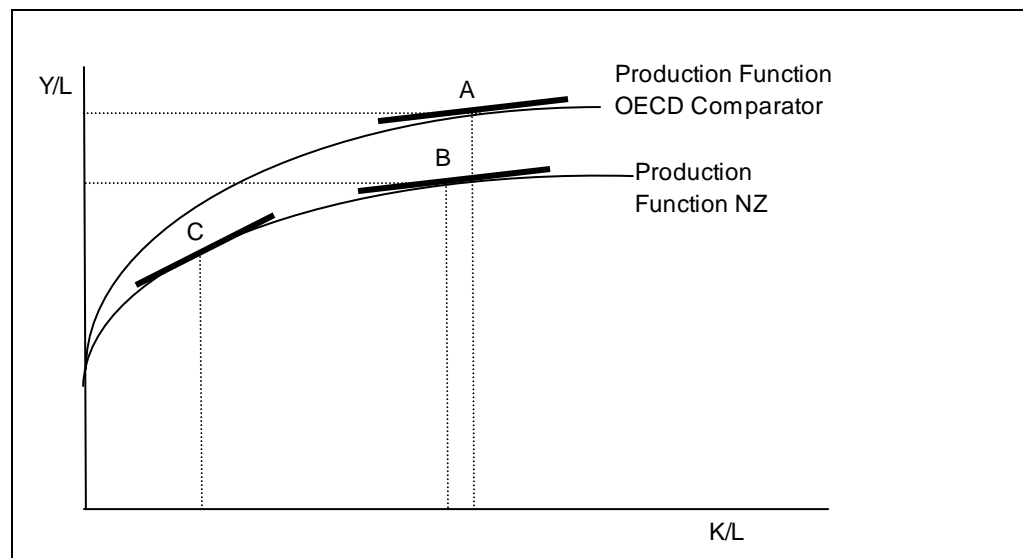
The marginal product of capital is the extra amount of output produced by one extra unit of capital, holding labour constant. This marginal product can be read in the graph as the slope of the production function at any given point. Moving along a production function, the marginal product of capital falls as capital intensity increases (again, this reflects diminishing returns to capital). Assuming capital markets are competitive, then the marginal product of capital defines the return to capital, which in turn equals

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[5]   Lucus (1990)

[6]   A later section briefly discusses increasing-returns production functions.

[7]   While the data in the previous section is for a single year and may not represent a 'long run' equilibrium position as the model assumes, it is a good reflection of New Zealand's position relative to most OECD countries in terms of capital intensity and MFP performance.

[8]   This can be thought of as a representative OECD country that has higher capital intensity and MFP than New Zealand.

the cost of capital. In other words, investors compete hard for investment opportunities, with the result that they are willing to bid and pay for investment projects until the extra amount of output that the unit of capital will produce just covers the financing cost.[9]

We can use Figure 6 to consider two scenarios. First, consider the case where <u>capital can flow freely across borders without encountering any frictions or impediments</u>. Under this assumption, capital markets will equalize the return to capital in both countries. (In other words, savers in New Zealand wouldn't finance any projects in New Zealand that offered lower returns than any available opportunity in the comparator country, and vice versa.) The graph shows that New Zealand's capital intensity and labour productivity will be lower than the comparator country's whenever the return to capital is equal in both countries (that is, whenever they are both at points where the slopes of their respective production functions are equal), as is the case where the comparator country is at point A and New Zealand is at point B. In this scenario, we can say that New Zealand's lower level of MFP drives New Zealand's lower level of capital intensity and thus is ultimately responsible for the entire labour productivity gap between the two countries. Note that the kind of accounting analysis discussed in the previous sections indicated that New Zealand's low capital intensity and low MFP are both components of the labour productivity gap. *The model allows us to see the deeper point that, in this scenario, low MFP is entirely responsible for New Zealand's low labour productivity (as well as for New Zealand's low capital intensity).*

Now consider the second scenario, where <u>investors encounter an impediment</u> that drives a wedge in New Zealand between the marginal product of capital and the return received by the investors. For example, imagine that New Zealand has an underdeveloped financial system that adds costs as it funnels capital to New Zealand investment projects. (Note that this impediment affects all investments in New Zealand equally – no matter whether the source of the funding is from savers in New Zealand or elsewhere.) In this case, marginal New Zealand investment opportunities that have a higher marginal product than alternatives in the comparator country will not receive funding because of the costs associated with the impediment. That is, New Zealand capital intensity and labour productivity will be lower than in the absence of the impediment, as at point C. *At point C, we can say that New Zealand's low labour intensity is partly due to low MFP and partly due to the impediment.* We can also say that, at point C, New Zealand faces a "high cost of capital", has a "high marginal product of capital" or pays a "high return to capital". These are all just different ways of stating the same thing.

To put the results from these two scenarios in yet another (more informal) way, New Zealand at point B simply lacks good opportunities for investment (that is, "lacks demand" for investment) that would allow its capital intensity to catch up with the comparator country's. In contrast, at point C, New

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9   This simple model abstracts from risk and sources of firm finance (debt and equity) that feature in the weighted average cost of capital (WACC) approach.

Zealand has relatively high value (high marginal product) unfilled investment opportunities requiring capital, but investors (both domestic and foreign) are unwilling to finance them due to the extra costs that would be caused by the impediment.

To sum up, the model has three important implications:

- New Zealand's low capital intensity can be thought of at least partly as a by-product of New Zealand's low MFP.

- There may also be impediments driving New Zealand's cost of capital upward and driving the capital stock downward below the level that would be justified by New Zealand's MFP.

- Policymakers should focus on boosting MFP. (In the model, this will always lead to increases in capital intensity and labour productivity, regardless of the existence of impediments.) However an important additional goal should be the removal of impediments, if they can be identified. This is discussed further in the section on policy conclusions.

In a later section, this paper will introduce complications to the model and discuss whether they change these implications. But first, the next section asks whether it is possible to tell whether New Zealand suffers from an impediment to capital accumulation – that is, whether we can think of New Zealand as being at point B (no impediment) or point C (impediment) in Figure 6.

Does New Zealand Suffer from an Impediment to Capital Accumulation?

There are two ways to look into the question of whether New Zealand suffers from an impediment to capital accumulation as described in the previous section. First, we can ask whether New Zealand appears to suffer from a high cost of capital relative to other countries. The second way is to explore what forms an impediment might take and ask whether any of these appear to exist in the New Zealand context.

Does New Zealand Have a High Cost of Capital?

Unfortunately, existing evidence about New Zealand's cost of capital from a macroeconomic or economy-wide point of view is scarce and much of what is available provides information that is now at least five years old. There are basically two types of available evidence: estimates of the return to the entire capital stock from national accounts data and estimates of real interest rates on comparable assets (similar maturity government bonds).

Information from National Accounts Data

Hall and Scobie (2005) take the national accounts approach. The idea is to estimate the average cost of capital for the entire capital stock by tallying up the total annual income that flows to capital and then divide it by the value of the stock of capital (which is estimated by aggregating historical investment flows). That is, in any given year:

cost of capital = total payments to capital / value of capital stock.

From the national accounts, it is straightforward to get a figure on how much of a country's annual income (that is, GDP) flows to labour inputs. It is very common in macroeconomic research to treat whatever GDP is left over after labour income is subtracted as capital's income; this is what Hall and Scobie do to calculate the numerator in the ratio above.[10] Figure 7 shows Hall and Scobie's estimates of the cost of capital for OECD countries. Their results show New Zealand's cost of capital as fairly high, with a rising trend. New Zealand equals or exceeds the "OECD Average" for 1976-2002 (the entire period for which they are able to make a New Zealand estimate).

Figure 7: Hall and Scobie's Estimates of the Cost of Capital, 1976-2002
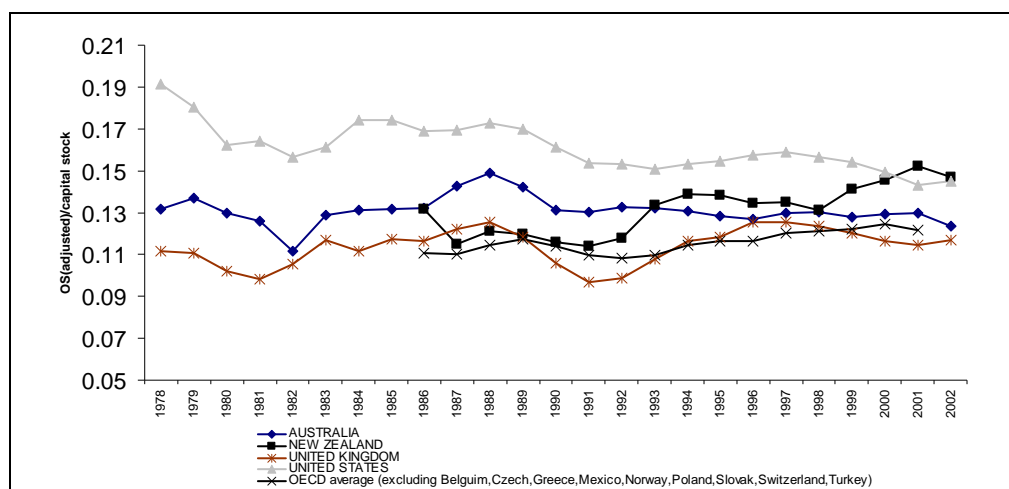
Source: Hall and Scobie's (2005) calculations, based on OECD national accounts data.
Note: The y-axis label "OS" refers to "operating surplus" which is the national accounts concept that corresponds to income after labour costs. The authors adjust this for the income of sole proprietors.

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[10] According to national accounting principles, national income (GDP) must equal the payments made to factors of production (labour, capital and any other factors).

Caselli and Feyrer (2006) make this same calculation for a sample of countries, including New Zealand, and then refine it further. They make an important criticism about calculating the cost of capital as described in the equation above: the measure of capital income used to calculate the return to capital includes not just payments to what they call "reproducible" physical capital (that is, the kind of capital we are interested in for the purposes of this paper: machinery, information and communications technology, buildings, etc.), but also payments to *natural* physical capital (land and natural resources) as well. Dividing the income that flows to *all* capital by the reproducible capital stock (as is the case in Hall and Scobie and many studies regarding other countries) will lead to an overestimate of the cost of capital – *particularly in countries where the value of land and natural resources are relatively substantial.*[11] Caselli and Feyrer use estimates on natural capital stocks from the World Bank (2006) to come up with a narrower estimate of income flows to reproducible physical capital. That is, they attempt to correct the problem by excluding income flows to land and natural resources.[12] Their results are shown in Figure 8. Unfortunately, their latest year of estimate is no more recent than 1996.

Figure 8: Caselli and Feyrer's Estimates of the Cost of Capital, 1996
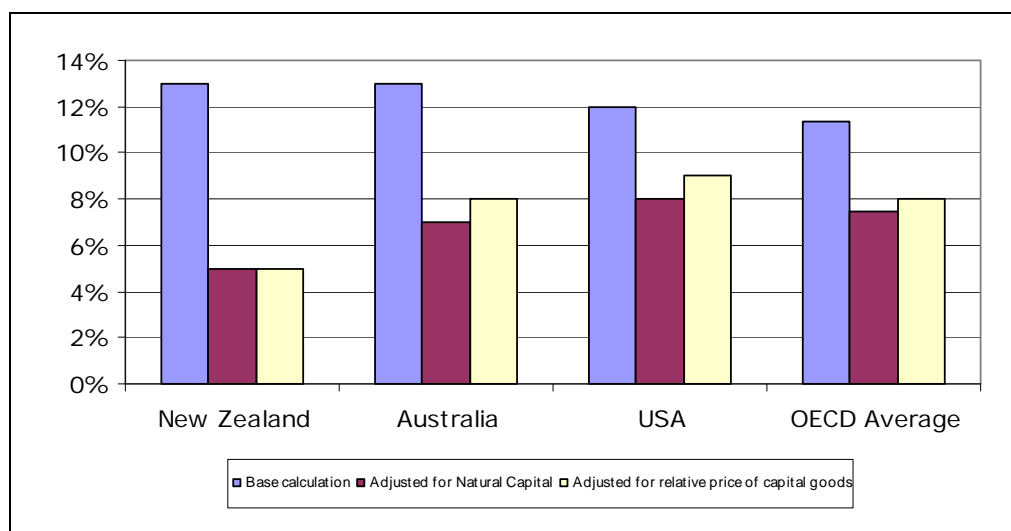
Caselli and Feyrer's base calculation of cost of capital for New Zealand and Australia is broadly in line with Hall and Scobie's for the same year: Caselli and Feyrer estimate 13% for both countries; Hall and Scobie put Australia at 13% but New Zealand closer to 14%. However, they disagree sharply regarding the US: Caselli and Feyrer make a base estimate of 12%, compared to Hall and Scobie's 16%. It is unclear what causes this discrepancy.

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[11]   Hall and Scobie compare (for Australia and New Zealand, p. 3-5) preliminary estimates of a combined stock of land *plus* reproducible capital. However, because they worry about data quality, they do not use this broader stock as the denominator when estimating the cost of capital.

[12]   Arguably Caselli and Feyrer's criticism could be taken further: their adjusted measure of reproducible physical capital income may still include income flows to other items that could be labelled as factors of production such as research and development.

Figure 8 also reports Caselli and Feyrer's revised cost of capital estimates, after adjustment for land and natural resources. New Zealand's adjusted cost of capital is significantly lower than Australia, the US and the OECD average. In fact, New Zealand ties with Sweden and Greece for the lowest adjusted cost of capital in Caselli and Feyrer's OECD sample. Caselli and Feyrer go on to make an additional adjustment for the relative price of capital equipment across countries.[13] This makes New Zealand's cost of capital appear yet lower than the comparator countries, but the effect is small, enlarging their estimate of the gap between New Zealand's cost of capital and that of the OECD average by an additional half a percentage point. (In other words, New Zealand faces only a slightly elevated cost of imported capital goods such as machinery and computer equipment.)

Caselli and Feyrer's natural resources adjustment should be taken cautiously – valuing a country's stock of natural capital is subject to even greater difficulties than valuing the stock of reproducible capital. The World Bank data is based on necessarily crude estimates of the value of subsoil resources and various types of land, including protected land. The World Bank estimates the per-capita U.S. dollar value (for year 2000) of New Zealand's natural capital (including urban land) at 42% higher than that of Australia (despite Australia's more valuable subsoil resources) and 66% percent higher than the US. An inspection of the World Bank's data suggests that a substantial part of the dramatic discrepancy between New Zealand's "base" and "adjusted" cost of capital in Figure 8 is due to the high value accorded by the World Bank to New Zealand's protected land.[14] However, even if protected land is excluded, New Zealand's natural capital stock is still 13% larger than Australia's and 35% larger than that of the US.

Information from Interest Rates

Comparisons of market interest rates are the second source of evidence regarding New Zealand's relative cost of capital and the possibility of an impediment to capital accumulation.

One approach calls for comparing interest rates on similar assets – typically government bonds. Long-term rates are the most relevant for the kind of "long-run" equilibrium considerations embodied in our discussion so far. Using the terminology developed in this paper, we can think of any gap between two country's nominal rates as comprising two components: 1) expected changes in the exchange rate and 2) a premium associated with any impediment. In a 'long-run' context we can make an approximate estimate of the second component by using the difference between real interest rates across countries.

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[13] This is the price of machinery, etc. (which is typically imported by small countries) as distinct from our use of the term "cost of capital" which refers to financial cost.

[14] There is some argument that perhaps Caselli and Feyrer should have excluded protected land from their measure of the natural capital stock.

In its 2007 Economic Survey, the OECD looked at real interest rate differentials between New Zealand and other OECD countries. Figure 9 compares New Zealand's real long term interest rates (10-year government bond rate) with Australia, the United States and the OECD average. While New Zealand's real interest rates have tended to converge with those of other economies, there has been a persistent premium for some time. New Zealand maintains an interest rate premium over the United States and OECD average.

Figure 9: Real long term interest rates
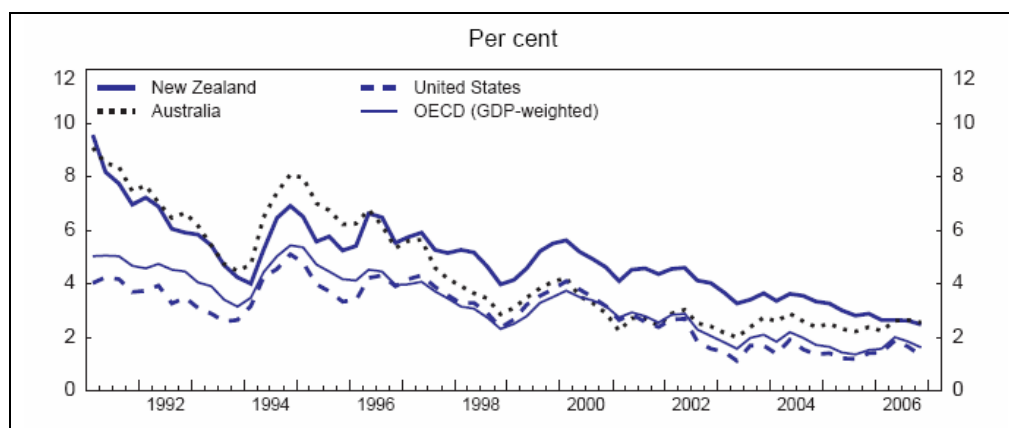
Source: OECD 2007

New Zealand's real short-term interest rates have averaged around 1 percent higher than those in Australia this decade. The Reserve Bank (2007) notes that, while different approaches to measuring the interest rate deliver slightly different results, there is a clear finding that real interest rates in New Zealand have remained persistently above those in Australia. They also note that Australian rates are higher than in many other developed countries.

Other authors have also examined New Zealand interest rate performance. Hawkesby et al (2000) compare nominal interest rates on ten-year New Zealand bonds with corresponding Australian and US rates and estimate the two gap components discussed above.[15] For the period of 1990Q1 through 2000Q2, they find a substantial impediment premium relative to the US (2.1 to 2.4 percentage points),[16] but no significant premium relative to Australia.

Björksten and Karagedikli (2003) offer another piece of evidence based on interest rate comparisons. Specifically, they explore various estimates for the "neutral real interest rate" (NRIR). Archibald and Hunter (2001) define

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[15]   Hawkesby et al use somewhat different terminology. Our "expected currency movement" component of course corresponds to their component of the same name; our "impediment" component corresponds to their "default and liquidity risk" component plus their residual (which they term "currency risk" but acknowledge that, as a residual, it includes the effect of all other factors). Note that, in their favoured estimate of gaps in long-term rates, "expected exchange rate changes" are driven entirely by relative purchasing power parity – ie, differences in inflation expectations.

[16]   See Hawkesby et al, Box 1.

the NRIR as "a broad indication of the level of real interest rates where monetary policy is neither contractionary nor expansionary." In other words, we can think of the NRIR as filtering out the "short-term" fluctuations in interest rates associated with the business cycle. In this way, NRIR comparisons are conceptually similar to the other cost of capital comparisons discussed in this section. Björksten and Karagedikli estimate that New Zealand's 2003 NRIR was significantly higher than that of Australia, the US and the other OECD countries in their sample: New Zealand's NIRR is more than 3.5%, compared to about 2.3% for Australia and about 1% for the US, Canada and Switzerland.

To sum up, a number of studies have examined whether New Zealand has a high cost of capital relative to other OECD countries. While some of the evidence is mixed, it is reasonably clear that New Zealand faces a higher cost of capital than most OECD countries, including the United States. Over the past decade the weight of evidence suggests that there has been some premium relative to Australia, although this looks to have narrowed over recent years. The Reserve Bank (2007) recently reached a similar conclusion: "a high domestic cost of capital is almost certain to be holding back the total level of real business investment in New Zealand" (p. 79).

What Might Cause a High Cost of Capital?

This section surveys *possible* sources of upward pressure on New Zealand's cost of capital (which would put New Zealand at point C instead of point B in Figure 6). The first three candidates are all linked to concerns about low domestic saving in New Zealand.

Several factors might act as an impediment to capital accumulation, putting upward pressure on the cost of capital

The interaction of global "home bias" and low domestic saving: Venables (2005) points to evidence that capital flows are highly correlated with distance. Put another way, some evidence suggests that investors demand a premium for financing projects at great distance. This idea that the savers of the world tend to prefer largely to invest at home is known as "home bias" and is often traced to the difficulties that investors face in getting reliable information about investment projects over long distances (and across cultural and linguistic divides). However, the existence of home bias alone does not qualify as an impediment for New Zealand. That is, even if world savers are biased toward home investment opportunities, New Zealand's cost of capital need not be comparatively high (and capital intensity need not be low) as long as domestic saving is sufficient. However, a recent Treasury paper by Cameron et al (2007) argues that the evidence in favour of global home bias is convincing and judges that New Zealand's recent savings performance is weak compared to other OECD countries.[17] They point to one theory (Razin et al 1996) that predicts any global home bias should dampen long-distance flows of portfolio equity more than flows of debt and direct investment, and note that New Zealand's capital inflows do seem to be slanted away from portfolio equity and toward debt and direct investment.

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[17] See also Treasury (2007).

The interaction of a high external debt burden and low domestic saving: Plantier (2003) points to growing external indebtedness (itself a reflection of many years of low domestic savings) as a source of upward pressure on New Zealand's cost of capital. In recent years, New Zealand's investment-income balance with the rest of the world has been running a deficit close to 8% of GDP (Treasury 2007). Like the "home bias" story above, this kind of story is only problematic in the presence of low domestic savings. That is, continuing low levels of domestic savings mean we face a continuing reliance on the savings of foreigners who may demand a premium given the existing high stock of external debt.

Financial system distortions: Cameron et al (2007) point out that New Zealand's banking system is much better developed than its financial markets and argue that this may be sub-optimal, effectively adding to the cost of capital in New Zealand. They trace this 'patchy' nature of the financial system to inadequate domestic savings – although they say that New Zealand's remoteness and taxation policies may also play a part. In particular, certain classes of firms are unlikely to have access to a comprehensive menu of financial services through all stages of their development effectively raising their cost of capital.

Taxation of capital: Taxes affect investment by raising the user cost of capital, driving a 'wedge' between the return offered from an investment and that received by the investor post-tax. Other things equal, in equilibrium, investors can be expected to look for investment in assets that equate their post-tax rates of return from different types of assets with the user costs of capital. Taxes can drive wedges between the return on capital and the user cost of capital and cause investors to change their behaviour in a number of ways:

- the *level of total investment*: choices between whether to invest or consume;

- *timing of investment*: for example, whether currently planned investment is delayed or brought forward in time;

- *the type of investment*: different tax treatment of different assets can affect the type of investment (residential property, industrial plant and machinery, portfolio investment);

- *the location of investment*: international differences in tax rates, exemptions, withholding taxes etc. can affect firms' decisions of whether to locate new investment at home or abroad (FDI).

Both average and marginal tax rates may be relevant. For example, the former is likely to affect multinationals' investment location decisions (once the decision to invest has been taken), while the latter affects incremental decisions.

The evidence is now broadly supportive of the view that tax systems can substantively distort or encourage investment choices, especially when major reforms take place. This latter aspect is increasingly supported by

studies utilising micro-level data, though in some cases investment responses may simply represent tax-induced changes in the *timing* of investment, or switching between types of tax-favoured/dis-favoured assets. More generally, at the firm level greater investment-tax responsiveness has been supported, leading one authoritative recent survey to conclude that "the elasticity of investment with respect to the tax-adjusted user cost of capital is between -0.5 and -1.0", and that "tax reforms appear to have generally had large effects on investment".[18]

The evidence on specific tax incentives for investment, however, generally questions their value in stimulating investment.

While at a general level, there is evidence that taxation affects investment behaviour; the impact of tax on investment in New Zealand's context is somewhat unknown. There is comparatively little information on how tax affects the user cost of capital and, in turn, how any change in user cost impacts investment decisions. Treasury sees this as an important area of focus for further research over the next two years.

Risk and uncertainty: Other things equal, investors demand a higher rate of return as risk increases. There are several possible sources of risk worth noting here:

- lack of knowledge of conditions in markets

- macroeconomic volatility

- uncertainty over the regulatory environment

An important point to note is that these uncertainties would have to be greater than in other countries in order to generate a high cost of capital in New Zealand relative to other countries.

New Zealand's macroeconomic framework is sound and has delivered improvements in macroeconomic stability over the past 15 years, particularly in terms of output and inflation. The exceptions have been relatively high real interest rates and exchange rate volatility.

The uncertainty created by exchange rate variability could spur investors to demand a currency risk premium. The OECD (2007) suggests that swings in the New Zealand dollar last longer than market instruments for managing risk can cover and could be a cause of the premium. On the other hand, Plantier's (2003) results cast some doubt on the importance of exchange rate and inflation variability in putting upward pressure on interest rates.

In relation to regulation, frequent or ad hoc changes in rules, unclear rules, or too much discretion or lack of consistency in application of regulation will add to investor uncertainty. This uncertainty may increase the hurdle rate

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[18]   Hasset, K.A. and Hubbard, R.G. (2002), (p.1324-5).

of return that investors require before committing funds to a project. [19] By way of example, some submitters highlighted concerns over uncertainty and its implications for investment in the recent review of the regulatory provisions of the Commerce Act. A higher hurdle rate due to uncertainty means there are likely to be unfunded, but profitable, investment opportunities that would have been exploited if the regulatory environment were more certain.

This highlights the importance of a high-quality regulatory management system that reviews both the stock and flow of new regulation in a systematic and transparent way to ensure that there are clear net benefits to be gained from introducing or maintaining regulation. This issue is discussed further in the productivity paper on enterprise.

If several of the issues above have even a small effect, the aggregate impact on the cost of capital could be significant. Further research should help to better identify any impediment issues.

Beyond the Basic Model

Other types of models offer insights into New Zealand's capital accumulation and productivity experience

So far this paper has relied on a basic model to frame discussion about capital accumulation and productivity. We need to consider what might be missing from the model and what more complicated models might be able to tell us.

The model developed by Grimes (2007) maintains much of the characteristics of the basic model: diminishing returns to capital, cross-country capital flows that act to equalize the marginal product of capital, and a focus on long-run considerations. However, the model allows for two domestic sectors (industries), each with its own production function. One produces internationally tradable goods and one produces goods solely for domestic consumption. This allows Grimes to directly consider the terms of trade as the ratio of the price of tradable goods to the (exogenous) price of imported capital goods.

The terms of trade appears to be particularly important for New Zealand

The results of the Grimes model are similar to the basic model, but offer additional insights, including the following three. First, as in the basic model, a currency premium (or any impediment) that raises the domestic economy's cost of capital above the international level will lower capital intensity and labour productivity. Second, a fall in the terms of trade lowers capital intensity and labour productivity (similar to a fall in MFP in the basic model). New Zealand's terms of trade experienced a large drop in the mid-seventies and is only recently re-approaching the average levels seen in the fifties and sixties (Borkin 2006). Grimes (2006) shows how the terms of trade explain a significant fraction of New Zealand's growth experience since 1960. Third, a rise in MFP of the traded sector boosts capital intensity and labour productivity; non-traded sector MFP does not matter for capital intensity and has a lesser effect on labour productivity. Grimes

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[19]   The hurdle rate of return is the expected rate of return an investor considers a project should deliver before it is prepared to invest.

notes this as a policy implication: in this model, achieving the same percentage increase in traded-sector MFP is better than the same percentage boost in non-traded MFP.

<div style="float:left; width:25%;">
Capital accumulation may spill over to MFP growth – particularly FDI and ICT
</div>

Moving beyond the neoclassical framework of the basic model and the Grimes model, some types of endogenous growth models allow for investment to have significant spillover effects that boosts MFP. So far we have only allowed for MFP to affect capital intensity; it is also possible to model causation that runs in the other direction. For example, a firm may invest in capital that is effectively a carrier of technology invented in other countries. Other domestic firms could observe this process and implement some of the technology without incurring the same costs. If this sort of process is widespread, then there will be underinvestment from a social point of view, because individual firms are not rewarded for the full social benefits of their investments. Görg and Greenaway (2004) explain that there are many theoretical reasons to suspect that direct investment by foreign firms (FDI) may be a source of such spillovers, although their review of the literature concludes that 1) it is difficult to find strong empirical evidence of spillovers from FDI[20] and 2) policies that improve the general "economic environment" such as macroeconomic stability are preferable to policies that offer incentives for specific investments. Some analysts argue that New Zealand receives substantial FDI inflows but has yet to benefit from spillovers.[21]

There is a significant literature that looks at the spillover effects of investments in information and communication technology (ICT) on MFP. ICT helps firms use other labour and non-ICT capital more efficiently and also can contribute to better innovation on an economy-wide scale. Jorgensen et al (2005) trace the upturn in United States MFP growth to ICT. Pilat (2004) finds evidence for the link between ICT growth and MFP in a wider sample of OECD countries. For New Zealand, Engelbrecht and Xayavong (2006) find it difficult to confirm the spillover effects of ICT, but find that MFP growth in New Zealand has been stronger in ICT intensive industries relative to other industries.

<div style="float:left; width:25%;">
New Zealand has some characteristics of a regional economy, competing for capital *and* labour with other parts of a broader Australia-New Zealand economy
</div>

The "new economic geography" features efforts to understand the costs of distance and the productivity effects of agglomeration (the concentration of economic activity in certain areas).[22] One class of models examines why a geographic *region* of an economy might develop and attract capital and labour at the expense of other regions. These models that try to understand regional differences within a country may be useful for understanding New Zealand's capital intensity and productivity experience. We can think of most OECD countries as sharing in a global capital market, but not being very open to labour flows (either due to legal or linguistic barriers). However, to a larger extent, New Zealand shares a labour market with its neighbour. So, there may be some insights to be drawn by

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[20]   A more recent paper by Blitzer et al (2007) finds some evidence of FDI spillovers in OECD countries.

[21]   See "Summary notes from Professor Peter Enderwick's Guest Lecture presented at the Treasury on 20 May 2003," http://www.treasury.govt.nz/publications/media-speeches/guestlectures/enderwick-may03

[22]   See Venables (2005) for an overview of the economic geography literature.

applying the economic geography literature and thinking about NZ as a "region" of a broader Australia-New Zealand economy. These kinds of models include increasing returns to scale: that is, there are agglomeration effects from locating in close proximity. As a result, firms have an incentive to put all their production in concentrated areas. Small historical differences between regions (or even random chance) may have decided the location where this high-productivity agglomeration gets started; but once it does, the productivity effects mean that there may be "lock-in". That is the economic activity may stay concentrated in the same area, even if it would no longer be the ideal place to start from scratch.[23]

What are the implications of thinking about New Zealand's regional characteristics within the Australia-New Zealand economy? Agglomeration patterns may be hard to change, but there may be scope to help spark the next wave of agglomeration and better compete with other regions for labour and capital. Krugman (2003) contemplates policy options for Scotland as a region of the UK, and suggests that education (human capital and higher education institutions), infrastructure and quality-of-life amenities (and to a lesser extent, tax policies) are important in attracting capital and labour, perhaps in addition to modest public efforts to back industrial "clusters".

There is also an aspect of the new economic geography literature that looks at distance and agglomeration nationally (instead of regionally). As Venables (2005) points out, distance from foreign export markets and sources of savings can be effectively reduced by improving infrastructure (particularly ICT) and perhaps also by building greater cultural and social links.

Public Capital and Infrastructure

So far, this discussion has treated investment as an entirely private matter, with individual investors competing for returns from investment opportunities. However, in reality the public sector is clearly responsible for many investment decisions – particularly in infrastructure. This section looks briefly at the large economic literature that considers public capital and productivity from a *macroeconomic* point of view. The main concern of this literature is the degree to which public capital *in aggregate* contributes to economic growth and productivity.[24] (There is, of course, also a huge literature on the microeconomics and regulation of investment in various sectors such as water, gas, electricity, transport, etc.)

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[23] Rice et al (2005) find empirical support for this kind of model in the UK context (that is, UK regions compete for capital and labour). They find that London pays higher wages because of agglomeration externalities, but offsetting congestion/housing costs prevent all labour from flooding to London.

[24] Like much of the literature, this section often talks about public capital and infrastructure in the same breath because governments traditionally play a large role in infrastructure investment. However, it is important to remember that private infrastructure investment has grown in importance in recent decades (for example, in electricity generation).

How big is the public capital stock?

One estimate suggests New Zealand's public capital stock may be larger than the OECD average

Kamps (2006) estimates public capital stocks for 22 OECD countries, reported in Figure 10, which shows New Zealand with a fairly high level of public capital per capita: 5% above the OECD average and 13% above the OECD median. This data does, however, have to be treated with caution as Kamps' estimates look to include investment of non-financial public enterprises in New Zealand but not in most other countries, including Australia. Kamps also reports that most of the 22 countries have experienced declining levels of public capital relative to GDP in recent decades. According to this data, New Zealand's decline began in the early 1990s. This partly reflects New Zealand's GDP, which accelerated about this time.

Public investment is often measured by cost, not by quality. This makes it hard to judge the true size of the public capital stock

Comparisons of public investment and capital stocks across countries should be taken even more cautiously than estimates of overall capital stocks. The value of public investment is typically calculated in national accounts data based on public expenditures; while there is a theoretical case for equating investment expenditure with productive value in the case of private markets – specifically, private investors under the pressure of competition should only be willing to invest the value of what they will get out of the project – this often breaks down in the case of public investment due to inefficiencies and political considerations (Pritchett 1996). To give a stark example, sometimes public investment goes to projects that boost productivity and output, and sometimes public investment goes to "white elephants"; the kind of comparison shown in Figure 10 is unable to account for this. If country A has a lower proportion of white elephants than country B, then the true value of country B's capital stock will be overstated. This type of overstatement may be partly the case in Japan (the country with the largest public capital stock according to Figure 10), which invested heavily in infrastructure in the 1990s, but often with the goal of choosing productive projects eclipsed by the goal of stimulating aggregate demand. It may also have been the case in New Zealand in the 1970s and early 1980s when (some) poor quality government investments boosted total investment as a share of GDP to over 30 percent (Figure 1).

Figure 10: Public Capital Stock Per Capita – OECD Countries, 2000
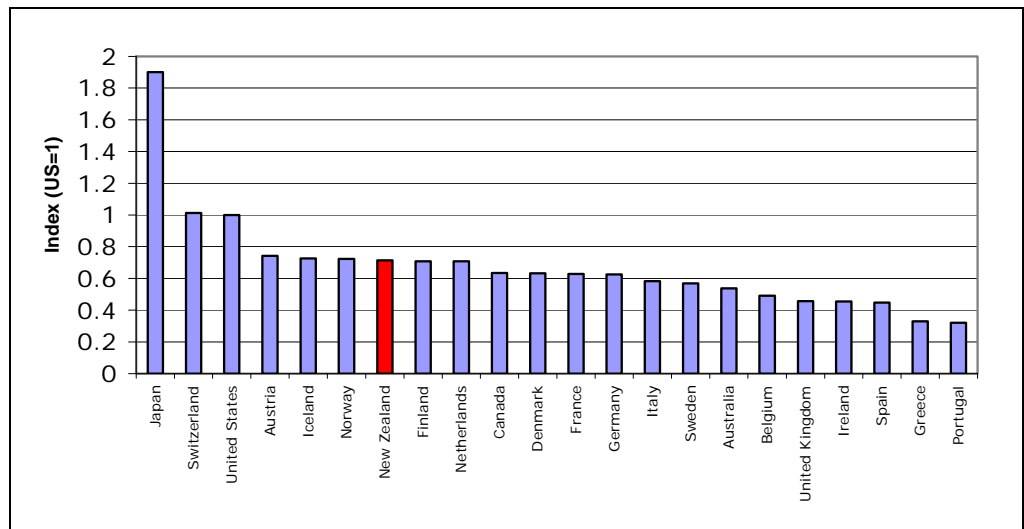
Source: Kamps (2006)

How much does the public capital stock contribute to productivity and growth?

Most international research finds a significant link between public capital and productivity

Ligthart and Suarez (2005) review 49 empirical studies on the link between public capital and economic growth. Not surprisingly, the strength of the link varies across countries and time periods. Overall, the many studies find a significant but not overwhelming effect of public capital on output: a one percentage point increase in investment adds 0.14% to GDP. This type of empirical analysis is complicated by the increasing-returns-to-scale nature of much infrastructure. That is, much infrastructure has network externalities: road systems, communications systems and electricity systems become more productive as they become larger. Much of the literature focuses on the concept of an "optimal" public capital stock. The idea is that any boost to aggregate productivity from new public investment should be weighed against any reductions in productivity associated with taxation (or borrowing) and the diversion of resources from other uses. However, the aggregate growth effect of taxation is a significant area of debate in its own right.

Kamps (2006) estimates the elasticity of aggregate output with respect to public capital for the entire period stretching from the early 1960s to the beginning of this decade. He finds that, for the OECD as a whole, a one percentage point increase in investment adds 0.2% to GDP. For New Zealand, however, he is unable to find evidence that increases add to GDP. This result should not be taken as an indication that the public capital stock is not productive in New Zealand; instead it hints that, given the existing level of public capital during this period, additional increments may not have had any effect.

Three recent reviews of the public capital literature conclude that the analysis at the aggregate level is probably too broad-brush to allow for concrete policy predictions (Prud'homme 2004, Romp and de Haan 2007, Straub 2008). In particular, the aggregate perspective is not well suited to addressing questions about the composition of public capital or the location of the border between private and public capital. These questions tend to differ in specific sub-sectoral details: for example, some countries have private ownership of electricity generation but not transmission (as is the case in New Zealand) while others (such as the UK) allow for private ownership of both. There is no substitute for close study of the microeconomics of public capital on a sector-by-sector basis.

Government policy has a role to play in ensuring efficient use of infrastructure. Subjecting public infrastructure spending proposals to the discipline of cost-benefit analysis is critical to ensure that funding is directed to the projects that are fit for purpose and offer the greatest benefits to the community. In addition, good regulation is vital while implementation of appropriate charging structures will both raise revenue from those who benefit from the investment and ration the infrastructure to those who generate the highest value added from using it.

Implications for Policy

New Zealand is capital shallow — that is, has less capital per worker — compared to most OECD countries. Our rates of investment have recovered from lows in the early 1990s but the rate of business investment lags the OECD median.

An important conclusion is that capital shallowness can be thought of, at least partly, as a by-product of New Zealand's low MFP. That is, New Zealand seems to use labour and capital less efficiently than other countries, and thus presents fewer comparable opportunities for investment.

There may also be some distortions or impediments – particularly linked to low domestic savings and high external indebtedness – that are putting (or threaten to put) upward pressure on the cost of capital, driving New Zealand's level of capital intensity below the level that would otherwise be justified by the economy's fundamental (MFP) conditions.

Extensions to our basic model provided additional insights into what factors might influence investment and capital intensity. MFP growth arising in the traded goods sector may have a greater impact on raising capital intensity than in the non-traded goods sector. This result, from Grimes (2006), is worth exploring further to test its robustness as a basis for developing policy.

Agglomeration effects are also important. These affect the relative returns from investment in more economically concentrated areas over less concentrated areas. Spillovers from investment to MFP, particularly from

FDI and ICT, may also increase the productivity benefits flowing from this type of investment.

What does this mean for policy?

One implication is that policies that support an increase in MFP (which directly increase labour productivity) are also likely to have an indirect effect of increasing incentives for investment. This would further boost labour productivity by adding to the stock of capital that workers have to work with. Innovation, skills and a business environment that is supportive of enterprise development will be the keys to producing more output from the given amounts of labour and capital inputs. These issues are discussed in more depth in the companion productivity driver papers.

A compelling explanation of why New Zealand faces a higher cost of capital is elusive but some policies that could help include:

A second implication, arising from New Zealand's elevated cost of capital, is to focus on impediments in the capital market that are giving rise to the interest rate premium New Zealand faces. While a compelling explanation for this interest rate premium is somewhat elusive, New Zealand's high external indebtedness and extended exchange rate cycles are possible candidates.

…measures to boost national saving

Increased domestic saving should reduce New Zealand's reliance on foreign savings. Treasury's position on savings policy was released in 2007 and concluded that 'in the light of the recent data, evidence and analysis mentioned above, on balance we think that further or stronger pro-saving action is now justified'.[25] This conclusion reflects a least-regrets approach in the light of data uncertainties, persistent macroeconomic imbalances and the possibility that individuals are basing saving decisions on long-run expectations that could turn out to be mistaken.

The Government has taken a number of measures such as KiwiSaver and tax changes for Portfolio Investment Entities that should support increased saving. Monitoring the effectiveness of these existing policies in terms of their impact on saving behaviour will help inform decisions around whether a further policy response is warranted.

…actions that reduce the volatility of the exchange rate cycle

Our exchange-rate cycle reflects a combination of local and international developments. Understanding what is driving exchange rate cycles and whether policy or other factors are exacerbating these movements are areas worth exploring further. These issues have been raised by submitters to the Finance and Expenditure Select Committee's inquiry into future monetary policy framework.

…promoting financial market development

Other factors that might be creating an impediment to accessing capital are a shallow financial sector and general business uncertainty (for example, from the regulatory environment).

Stable macroeconomic policies, good tax and regulatory policies and an environment conducive to the identification of sound investment

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25   See Treasury Report T2007/654: A Synopsis of Theory, Evidence and Recent Treasury Analysis on Saving available on Treasury's website at http://www.treasury.govt.nz/publications/informationreleases/saving/synopsis/t2007-654v2.pdf, p. 4.

opportunities are paramount for the development of the financial system. However, other measures might also support financial system development. These include measures that are currently being implemented including enhancing the regulatory framework including disclosure of information to savers, stronger supervision of non-bank deposit takers and collective investment schemes and licensing of financial advisors. Other possible areas of focus include:

- setting financial system development as an explicit goal and investigating whether there are further policy levers possible, beyond measures already taken in relation to export finance and venture capital;

- gaining a better understanding of the relationship between local capital markets and aspects of firm performance including potential barriers to access for firms with intellectual property or highly specific assets that are unable to be used for collateral; and

- removing barriers to the development of a strong domestic bond market.

Measures taken to boost national savings are also likely to contribute to enlarging and deepening financial markets, as has been experienced in other countries.

… and ensuring a stable and predictable regulatory and policy environment

Stability and predictability in the regulatory and general policy environment are also important to investors. Frequent and ad hoc changes in regulation should be avoided. A regulatory management system that ensures that both new and existing regulation are delivering net benefits to New Zealand is critical These issues are discussed more fully in the paper on enterprise.

The weight of evidence suggests that tax matters for investment but further work is required to identify the implications for New Zealand.

Agglomeration patterns are difficult to change but Auckland likely to play a key role

As this paper notes, agglomeration patterns may be difficult to alter. However, factors such as education, infrastructure and quality-of-life amenities are likely to be important. Auckland is likely to play a key role in generating agglomeration effects in New Zealand. Policies that facilitate its development into a world class city will assist. A focus on issues that affect productivity growth will be important.

Quality of investment matters — competition, efficient markets and in the case of public investment, cost benefit analysis, are the keys to quality

The final point worth making here is that the quality of investment matters. Simply ramping up investment expenditure will not mechanistically lead to higher productivity — investment projects must be productive. For private investment, competition and limiting distortions to markets will provide good signals to private investors about where their capital is most profitably invested. Well-functioning markets are critical. The situation is more difficult for public investment where other, non-economic, factors might affect investment decisions. Sound application of cost benefit analysis will ensure greater transparency of potential benefits and costs of public investment proposals and assist in raising the economic return from such investments.

References

Björksten, Nils and Özer Karagedikli (2003) "Neutral real interest rates revisited." The Reserve Bank of New Zealand Bulletin 66(3): 18-27.

Bitzer, Jürgen, Ingo Geishecker and Holger Görg (2007) "Productivity spillovers through vertical linkages: Evidence from 17 OECD countries." Mimeo (June).

Borkin, Philip (2006) "Past, present and future developments in New Zealand's terms of trade." New Zealand Treasury Working Paper 06/09.

Cameron, Linda, Bryan Chapple, Nick Davis, Artemisia Kousis and Geoff Lewis (2007) "New Zealand financial markets, saving and investment." New Zealand Treasury Policy Perspectives Paper 07/01.

Caselli, Francesco and James Feyrer (2006) "The marginal product of capital." Mimeo (July 28).

Engelbrecht, Hans-Jürgen and Vilaphonh Xayavong (2006) "The elusive contribution of ICT to productivity growth in New Zealand: Evidence from an extended industry-level growth accounting model." Mimeo (February).

Grimes, Arthur (2006) "A smooth ride: Terms of trade, volatility and GDP growth." New Zealand Ministry of Economic Development Occasional Paper 06/04.

Grimes, Arthur (2007) "Capital intensity and welfare: National and international determinants." Ministry of Economic Development Occasional Paper 07/03.

Görg, Holger and David Greenaway (2004) "Much ado about nothing? Do domestic firms really benefit from foreign direct investment?" World Bank Research Observer 19(2):171-197.

Hall, Julia and Grant Scobie (2005) "Capital shallowness: A problem for New Zealand?" New Zealand Treasury Working Paper 05/05.

Hasset, K.A. and Hubbard, R.G. (2002), 'Tax policy and business investment' Chapter 20 in A.J. Auerbach and M. Feldstein (eds.) Handbook of Public Economics, Volume 3. Amsterdam: Elsevier.

Hawkesby, Christian, Christie Smith and Christine Tether (2001) "New Zealand's currency risk premium." The Reserve Bank of New Zealand Bulletin 63(3): 30-44.

IMF (2002) "An exploration of income divergences between New Zealand and Australia." New Zealand: Selected Issues, Country Report 02/72.
<http://www.imf.org/external/pubs/cat/longres.cfm?sk=15751.0 >

Jorgenson, Dale, Mun Ho and Kevin Stiroh (2005) "Growth of US industries and investments in information technology and higher education." Final report to the Nomura Research Institute and the Economic and Social Research Institute International Collaboration Project (21 January).

Kamps, Christophe (2006) "New Estimates of Government Net Capital Stocks for 22 OECD Countries, 1960–2001" IMF Staff Papers 53(1): 120-50.

Krugman, Paul (2003) "Second winds for industrial regions?" The Allander Series: Growth on the periphery.

Ligthart, Jenny E. and Rosa M. Martin Suarez (2005) "The productivity of public capital: A meta analysis." Mimeo (October).

Lucas, Robert E. (1990) "Why doesn't capital flow from rich to poor countries?" The American Economic Review 80(2): 92-96.

Mason, Geoff and Matthew Osborne (2007) "Productivity, capital-intensity and labour quality at sector level in New Zealand and the UK." New Zealand Treasury Working Paper 07/01.

Ministry of Economic Development (MED) and The Treasury (2005) "Economic development indicators 2005."
<http://www.gif.med.govt.nz/aboutgif/indicators-2005/report/index.asp>

OECD (2007), 'OECD Economic Surveys: New Zealand', April, OECD, Paris.

Pilat, Dirk (2004) "The ICT productivity paradox: Insights from micro data." OECD Economic Studies No. 38, 2004/1.

Plantier, Chris (2003) "New Zealand's economic reforms after 1984 and the neutral real rate of interest." Mimeo (March).

Pritchett, Lant (1996) "Mind your P's and Q's: The cost of public investment is not the value of public capital" World Bank Policy Research Paper No. 1660.

Productivity Commission (1999) 'Microeconomic Reform and Australian Productivity: Exploring the Links', Research Paper, AusInfo, Canberra.

Prud'homme, Rémy (2004) "Infrastructure and development." Paper prepared for the ABCDE (Annual Bank Conference on Development Economics), Washington, May 3-5.

Razin A., E. Sadka, and C. Yuen (1996) "A pecking order theory of international capital flows." National Bureau of Economic Research Working Paper No. 5513.

Rice, Patricia, Anthony J. Venables and Eleonora Patacchini (2006) Spatial determinants of productivity: Analysis for the regions of Great Britain" Regional Science and Urban Economics 36(6): 727-752.

Romp, Ward and Jakob de Haan (2007) "Public capital and economic growth: A critical survey." Perspektiven der Wirtschaftspolitik 8(Special Issue): 6–52.

Schreyer, Paul (2005) "International comparisons of levels of capital input and productivity." Paper prepared for OECD/Ivie/BBVA workshop on productivity measurement, Madrid (17-19 October).

Straub, Stéphane (2008) "Infrastructure and growth in developing countries: Recent advances and research challenges" World Bank Policy Research Working Paper 4460.

Treasury (2004) "New Zealand economic growth: Analysis of performance and policy."

Treasury (2005) "Productivity: An update on progress." New Zealand Treasury Report T2005/1307.
<http://www.treasury.govt.nz/publications/informationreleases/health/sector/tr05-1307.pdf>

Treasury (2007) "A synopsis of theory, evidence and recent Treasury analysis on saving." New Zealand Treasury Report T2007/654.

Treasury, Statistics New Zealand and Ministry of Economic Development (2007) "Economic Development Indicators 2007" Wellington.

Venables, Anthony J. (2005) "Economic geography: spatial interactions in the world economy." Mimeo (5 January).

World Bank (2006) "Where is the wealth of nations? Measuring capital for the XXI century." Conference Edition (15 July 2005)