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# Why Haven't Economic Reforms Increased Productivity Growth in New Zealand?[1]


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*Productivity, measured by output per hour, grew by less than one percent per annum in post reform New Zealand. During the same period productivity grew at a rate two times faster in relatively protected Australia and one and half time faster in the "free market" economy of the US. This spectacular failure of economic reforms in boosting productivity growth to the international standard calls for an explanation. Unfortunately, nobody has yet offered a theoretical model of economic growth to respond to that call. This paper is an attempt to start that process within the academic discipline established by Solow, Lucas and Prescott, the only three growth economists who are Nobel Laureates. It offers an endogenous growth model with endogenous rent seeking, which adversely affects the economy's total factor productivity (TFP). The model determines TFP as a function of economic policy and not as unexplainable residuals, unlike most previous studies. In particular, it provides explicit formulas for measuring TFP and rent-seeking activity in an economy. The paper argues that well intended economic reforms could nonetheless lead to an endogenous skill shortage that may ironically turn innovators into rent-seekers and in turn, retard productivity growth.  Future research may apply this model or a modified version of it to determine if the above argument sheds some light in explaining the productivity puzzle of the post reform era in New Zealand.*


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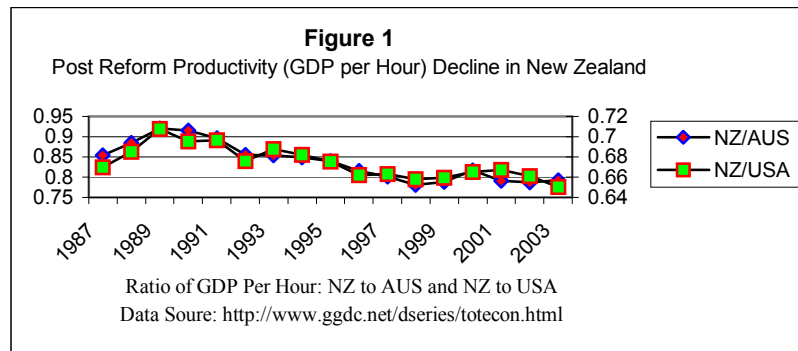
## I. Introduction

In his Richard Ely lecture at the 2002 annual meetings of the American Economic Association, Edward Prescott noted that New Zealand, unlike most developed countries, had remarkably low productivity growth. He asked why that might be the case. His model implied that various government protections were to blame. Yet, a comprehensive set of "textbook" reforms in New Zealand supposedly abolished most of those protective policies. Nevertheless, between 1990 and 2003 output per hour grew by only 0.90% per year in the post reform economy of New Zealand compared to 1.96% in the relatively protected Australian economy and 1.50% in the "free market" economy of the US (see, Table 1).

*Is this a puzzle?*

To identify a puzzle we do need to begin with a theoretical model. Which model? It is not a very silly question to ask. However, there are not many models around in the published literature. So, let us open any textbook and begin with chapter one, where we always find Solow (1956), since it is still the one we love. According to that model, output per hour grows faster in capital poor countries than in the capital rich countries because of the simple law of diminishing returns.[2] New Zealand is poorer than Australia and U.S.A. It follows, therefore, that the output per hour should grow faster here in New Zealand than in Australia or in the US. It does not. So it is a puzzle.



**Figure 1**
Post Reform Productivity (GDP per Hour) Decline in New Zealand

Ratio of GDP Per Hour: NZ to AUS and NZ to USA
Data Soure: http://www.ggdc.net/dseries/totecon.html

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[2] I hope nobody would seriously question the implicit assumption that the fundamental determinants (eg., saving rate and others) of short run growth rates in the Solow's model are similar among these three countries. Of course, the possibility of a permanent variation in the long run growth rate would indeed be a puzzle in his model, since he assumed it away.

Some argue that cyclical factors may be responsible for this downfall and hence it is temporary. The long-run permanent trend in the ratios of the real GDP per hour of New Zealand to Australia and to USA stand in sharp contrast with those conjectures. That ratio (see Figure 1) has been falling steadily since 1990 without any sign of stopping or reversing the trend. It follows, therefore, from the Solow model that the productivity growth in New Zealand must have been permanently lower than Australia and USA despite economic reforms. More importantly, it is a disconcerting puzzle why there is no sign of a catch up to regain any lost grounds.

A direct test of this conclusion of a permanent productivity slowdown in New Zealand relative to Australia and the US requires examining data on total factor productivity (TFP) constructed from Solow's model, which is not available. The TFP data compiled by Diewert and Lawrence (1999) use a special axiomatic definition. Unfortunately, they do not satisfy the dynamic restrictions of the Solow model and hence are neither an unbiased nor a consistent estimate of TFP. Nevertheless, it is interesting to note that the productivity measures constructed by Diewert and Lawrence do indicate a very low (about 1%) growth rate of TFP following economic reforms.

Fortunately, there is an alternative source of data on productivity that can be interpreted by Solow's model. It is the database of real earnings. According to Solow's model, in a perfectly competitive market economy, the growth rate of real wage should exceed the growth rate of technology.[3] Economic reforms presumably brought the NZ economy closer to a market economy, such as the US, with fewer barriers to technology diffusion. Consequently, the growth rate of real earnings should exceed the growth rate of productivity in New Zealand and that, in the absence of a productivity puzzle, should be equal to the growth rate of technology in the US, which is approximately equal to 1.50% per annum based on the US long-run growth rate of output per hour in the last 10 years.[4] It follows, therefore, that the annual growth rate of real earnings must at least exceed 1.50% after the economic reforms.

In fact, it was not even close (see Tables 2 and 3 in Appendix C). In the last ten years between 1993 and 2003, earnings per hour adjusted for the CPI inflation rate grew at an average annual growth rate of 0.98%. What about introducing geographical isolation in Solow's model as an explanation for the low productivity growth rate? Well, in that case, we should simply consider our isolated neighbour, Australia as a benchmark. Between 1993 and 2003, the real earnings per hour grew by about 1.71%

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[3] Note: $Y = AK^{1-a}L^a$ implies that $g_{w/P} = g_A + (1-a)g_{K/L}$. So, if the economy is approaching the growth path of the US economy from below then $g_{K/L} > 0$. Given $a < 1$, $g_{w/P}^{NZ} > g_A^{US}$.

[4] In the Solow's model the long run growth rate of output per hour equals the growth rate of labour augmenting technology.

per annum in Australia. It appears that a simple stretching of Solow's model would not provide a handy explanation for this puzzle.

*Is there an explanation beyond Solow?*

Solow's model applies to a free market economy. Prescott (2002) and Parente and Prescott (2000) modify that model to allow for institutional barriers that may interfere with the operation of a free market. They blame, for example, the government approved "monopoly rights" of the trade unions. Those rights to put up fences against new technology, according to them, are obstacles to productivity growth. By that logic, however, Australia would be a tortoise, thanks to the monopoly power of its national labour unions. On the other hand, the Employment Contract Act that destroyed the supreme power of labour unions would make New Zealand a reformed Kiwi that can fly! So, none of those arguments help us much here in New Zealand.

Atkenson and Kehoe (2001) extended Solow's model to highlight the notion of slow transition to an eventual growth miracle following economic reforms. They argue that people take time and divert productive resources to absorb new ideas that come with new machines as embedded designs. The growth of productivity due to a reform induced rapid injection of new machines may nonetheless get decelerated due to a costly learning process. According to that idea we should expect a miracle to come but continue to have patience while the New Zealanders learn from the embodied designs of new machines that should be entering rapidly to this country following economic reforms. Almost a decade following the reforms, however, patience may run out for some as they start looking for another explanation.

After all, data on productivity measured by real earnings, as presented in Appendix C, show that New Zealand did better than Australia during the initial phase of the reforms but did actually worse than Australia in the post reform era. Earnings per hour adjusted for CPI inflation shows (see Table 2 in Appendix C) that during the first seven years of reform (1987Q1-1994Q3) the real wage in New Zealand grew at a rate of about 0.66%, which was, interestingly, about 1.48 times the rate of 0.45% at which real wages grew in Australia. In the next seven years (1994Q1-2003Q3), following the reforms, the real wage in New Zealand grew at an annual rate of 0.98%, which was only about 57% of the real wage growth rate of 1.71% that we observed in Australia during the same period.

Grimes (1989) argues that changes in the terms of trade (TOT) over the period 1950-1985 could account for a reduction of annual growth rate by 0.13 percent. Loss of the favourable trading arrangement with the United Kingdom (see Lattimore and Wooding, 1996 for details.) or the so-called "decolonisation" may have caused a permanent decline in the productivity level. Kehoe and Ruhl (2003) consider the above argument but within a theoretical framework consistent with Solow's growth model. They rule out the TOT effect and the "decolonisation" effect as factors that could significantly account

for more than 5 to 10 percent of the substantial decline in productivity that they identify in their model for the New Zealand economy.[5]  They end their paper with a note that the inability of economic reforms to uplift the productivity level back to where its measured value was in the year 1972 is a puzzle yet to be explained.

*Need a new model for productivity*

The task of explaining productivity slowdown is challenging simply because there are not many models in the literature that determine productivity endogenously. This task cannot be fulfilled by throwing an open-ended list of variables on the right hand side of a regression equation and by using, on its left hand side, an unexplainable measure of "productivity."  So we need to work on building a new model. How? Aren't there millions of ways to do that? The answer is a clearly unambiguous "No," once we care to impose on our thought process the academic discipline of the general equilibrium theory that all of the three Nobel Laureates in the economic growth literature have followed.

There are not many models around us that determine productivity and link them back to Solow (1956). In this context, Prescott (1998) challenges researchers to build a new model for total factor productivity. Following that challenge Chatterjee (1999) summarises a couple of ground rules for the policymakers in the US who now wish to build such a model.  First, it must explicitly determine productivity as an outcome of actions taken by economic agents. And, second, it must specify how a government can influence productivity.

Bergoening, *et al.* (2002) build on Solow's model to provide one such theory and use it to contrast the post reform experience of Mexico and Chile. They describe how various economic reforms brought about significant changes in TFP.  Benabou (2002) abstracts from physical capital and highlights the importance of the distributional effect in determining optimal fiscal policy.[6]  Building on that framework I examine how economic reforms may have not only a direct effect on TFP but also an indirect effect that arises from the changes in the human capital distribution induced by those reforms.

Following Benabou (2002) I abstract from physical capital but incorporate a network effect that arises from complementarity between technology and cohort quality determined by the effectiveness in networking of people with different levels of human capital.[7]  That network effect, while important for productivity, also generates unproductive side effects by encouraging rent-seeking activities that merely

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[5] To avoid issues related to the lack of comparability across different methodology I omit other reports of TOT effects on productivity growth generated from regression based studies that do not use a general equilibrium model of economic growth such as Solow (1956).

[6] Bandyopadhyay and Basu (2001) also provide a framework for examining distributional effects on productivity.

[7] Bandyopadhyay (2001) reports preliminary evidence of a network effect on total factor productivity.

redistribute economic resources. The network effect can be compared to the idea of social capital discussed in Hazledine (2001).

The interaction between a policy regime and the distribution of human capital determines how economic agents allocate resources between innovative and rent-seeking activities and that, in turn, would determine TFP. Under certain economic conditions, agents with sufficiently high skill would find it optimal to engage in rent seeking rather than innovation. They do have a comparative advantage in extracting resources from others with relatively less knowledge. Agents with skills in the intermediate range would always find it optimal to innovate to compete. Those at the bottom, below the 'basic skill level', have a comparative advantage in supplying labour and hence they will always do so. The distribution of people around these three types of activities - innovation, rent seeking and work - influences the overall productivity level and its growth rate in the economy.

*A new hypothesis*

My hypothesis is that the economic reforms did improve efficiency in New Zealand initially by creating incentives for the skilled population to allocate a greater proportion of their resources to innovative activities. Those activities, however, required them to accumulate human capital faster than the economy wide average. Such accumulation of human capital raised demand for labour and hence labour costs. An increase in labour costs, in turn, raised the necessary skill for securing positive profit from innovation. Facing resource constraints against updating skill, the marginal innovators decided to switch from innovating to rent seeking, which did not require updating of skill, or to supplying labour. [8] The resulting shrinkage of innovative activities reduced competition for those who could update skill to continue innovation. However, with reduced competition their incentives also partially reverted from innovating to rent seeking, causing a low productivity growth rate.

One can draw an interesting parallel with the recent experience of Russia. Following the collapse of the Soviet Union, in the new Russia there were initially many entrepreneurs. However, pretty soon the system turned most of them into a chain of rent seekers. Is New Zealand having a mini Russia problem? Following liberalisations, here too, quite a large section of the elite may have been busy stripping public assets. At the same time, the middle part of the human capital distribution was becoming smaller for various reasons including sudden emigration of marginal innovators in late 1990s. A successful reform would, therefore, need to provide incentives and resources not only to prevent the middle group from shrinking but also to ensure an economic

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[8] This scenario of initial increase of wage relative to the profits of the innovators is consistent with the findings of Deardorff and Lattimore (1999, p. 82) that reforms initially improved income of "workers with lower qualifications" relative to those with higher qualifications. However, the long-term pictures of those changes have not been identified from the data yet.

environment in which entrepreneurs find it optimal to keep rent seeking to its minimum.

In the following two sections, I describe a general equilibrium model of economic growth and its steady state to examine the above hypothesis. As a part of that examination I report some possible explanations for the post-reform productivity decline in New Zealand. Section 3 contains a few concluding remarks followed by the list of references. A technical definition of equilibrium and the key equations that map the model economy to a national income account database are included in Appendix A and B respectively. Table 1 containing GDP per hour data and Table 2 containing earnings data are included in Appendix C.

## II. The Model

The model developed in this section is a modification of Solow (1956) but with optimising adults who live for infinitely many periods. The production function is Cobb-Douglas and depends on capital and labour, except that capital in this model is human capital, not physical capital as in Benabou (2002). The adults have different levels of education and hence possess different stocks of human capital. Everyone gets a basic education. Only a privileged few pursue higher education. Adults can choose two different types of jobs. The first type of job requires routine and supervised work. It can be carried out with the basic education. We call people in this type of occupation workers. The other type of jobs involves planning, organisation and supervision of workers. People in this job design the best possible plan for their production unit given the constraint of their human capital. We call these people managers. Assume for simplicity that a production unit consists of one manager and several workers. The manager hires the workers by promising them to pay a fixed wage or salary before production takes place. She receives the residual output after paying off the salary bill. The model's managers, therefore, represent anyone who does not receive only predetermined wages or salaries from other bosses and hence has some entrepreneurial motive for innovation. Their innovation could be technical or organisational.

The output $y$ of a production unit operated by a manager with $h$ units of human capital supervising $l$ units of workers is given by a production function similar to the one used by Solow as follows:

$$y = Ah^{1-a}l^{a} \;, \; 0 < a < 1. \tag{1}$$

The letter $A$ denotes the TFP of the production unit. The prevailing general knowledge within a country about the world technology is likely to provide an upper limit on the value of this TFP. Following the idea of Lucas (1988) I assume that the average human capital $H$ serves as a proxy for that general knowledge or social capital, such that $A = zH^{b}$, where $b>0$ denotes the externality parameter and $0<z<1$ denotes

the effectiveness of the social capital in decoding the world technology. Let us assume that the variable $z$ represents an i.i.d. shock with a distribution $N(1, \sigma^2)$.

Given this economy-wide TFP, and the market wage rate $w$ for unskilled labour, a manager chooses $l > 0$ units of workers so as to:

Maximize $zH^b h^{1-a} l^a - wl$. $\qquad\qquad$ (2)

The first order condition of (2) yields $w = azH^b h^{1-a} l^{a-1}$. Consequently, as a function of a manager's human capital $h$ the date $t$ optimal number $l(h)$ of workers is:

$$l(h) = l * h, \quad \text{where, } l* = \left( \frac{azH^b}{w} \right)^{\frac{1}{1-a}} \qquad\qquad (3)$$

By (3) and (4), the indirect profit, $\Pi(h, l(h))$ [9] of a manager is proportional to her human capital stock $h$ and is given by $rh$, where,

$$r = (1-a)zH^b (azH^a / w)^{a/(1-a)}, \qquad\qquad (4)$$

The above result will be useful in simplifying our analysis later. We summarise it in the following proposition.

*Proposition 1: A manager's income, $\Pi(h, l(h))$, from innovative activities is a constant proportion of her human capital stock h.*

The government redistributes income from the rich to poor. It taxes the rich at a constant proportional rate $0<\tau<1$ and transfers the proceeds to the poor as an equal amount of benefit payments $b>0$ per head. To avoid inessential details, in this paper, we focus only on the case where the rich agents are managers and the poor agents are workers.

In the above environment, a manager may not limit her focus to gathering information about the current technology frontier that raises her productivity and the national income. She may also spend some of her time in playing politics to

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[9]Note: $\Pi(h, l(h)) = zH^b h^{1-a}(l)^a h^a - wlh$ and $w(l)^{1-a} = azH^b$. It follows, therefore, that $\Pi_t(h, l(h)) = z_t H_t^b (l)^a h(1-a)$.

manufacture tax-loopholes, to gain special access to publicly funded benefit schemes, or to acquire public assets below their market value. Those activities cause a zero-sum transfer of income in her favour from the rest of the economy. I call the latter type of activities "rent-seeking."[10]  The value of the output per capita would be lower if managers devote more time in rent seeking. In other words, the average human capital of a country may only determine the potential output per capita and not the actual one.

Consequently, the macroeconomic productivity measures in this model would likely  vary according to how managers divide their time between rent seeking and profit seeking activities. By changing fiscal policy directly or through redistribution the government can influence macroeconomic productivity in this model. In that sense it is not only a model of endogenous growth along the line of Lucas (1988), but it is also a model of endogenous productivity that satisfies two necessary ground rules for modelling set by Chatterjee (1999).

I will now make a few assumptions for the sake of simplicity of analytical exposition as well as for numerical tractability. First, it is likely that a manager can use her "reputation" to gain influence or implicit rights over public institutions to be able to extract "rents" from the rest of the economy. I assume that a manager's "reputation" increases with her publicly verifiable income, or indirect profit. Implicitly, I also assume that unlike profits, rents are extracted in private and hence not taxable. Lastly, I assume that in a competition with others for a given sum of rents, those with human capital above the average will succeed and the amount of rent one can secure would be proportional to the ratio $p(h)$ of her human capital to the effective average human capital $zH$ in the country.

Suppose that the manager allocates a fraction $\rho \geq 0$ of her time to seeking rent and the remaining $(1-\rho) \geq 0$ fraction of her time to seeking profit. Consequently, she earns $(1-\tau)(1-\rho)rh$ units as a net of tax profit and extracts tax free rents in proportion to her reputation, measured by her profit and her ability, measured by the ratio $p(h)$. In particular, her rent equals to $\alpha \rho p(h)(1-\rho)rh$ units, where $\alpha > 0$ denotes a country specific parameter for rent-seeking activities. Consequently, her total disposable income would be a multiple $\bar{r}(\rho, h)$ of her human capital stock $h$ where,

$$\bar{r}(\rho,h) = (1 - \tau + \alpha\rho p(h))(1 - \rho)r, \text{ where } p(h) = h/zH . \tag{5}$$

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[10] I do so because it involves extracting 'other people's money' from manipulated rights over public institutions.  It neither benefits the production unit that the rent seeker manages nor raises the national income.  Murphy, et al. (1991) and Acemoglu (1995) incorporated similar ideas in their respective growth models.

In other words, a manager can reduce her effective tax rate by the rent-seeking activities but only after forgoing a part of her potential profit income. The trade-off described by (5) implies an optimal profile $\rho*(.)$ of rent-seeking among the managers as follows:

$$\rho*(h,z) = 0.5\left(1 - \frac{(1-\tau)zH}{\alpha h}\right), \ h \geq h_R = (1-\tau)zH/\alpha,$$
$$= 0, \text{otherwise.} \tag{6}$$

By (6), it follows, therefore, that a manager with a larger stock of human capital relative to others would allocate a greater proportion of her time in seeking rent.

At date $t$, $\Psi_t$ denotes the cumulative distribution function of human capital among the date $t$ adults. The history specifies the initial distribution $\Psi_0$. At each date $t$, let the proportion $m_t$ of the population be a manager and the remaining $(1-m_t)$ proportion of adults be a worker. The government transfers $b_t$ units of benefit to each workers and the government's budget constraint must satisfy

$$b_t(1-m_t) = \int_{\{h:n(h)=0\}} [(\tau - \alpha\rho_t^*(h)p_t(h))(1-\rho_t^*(h))r_t h]d\Psi_t(h), \tag{7}$$

where $n(.)$ indicates a discrete occupation: management ($n=0$) or work ($n=1$).

In the absence of any rent-seeking activity the higher the value of $\tau$ the greater is the degree of redistribution. Rent seeking activities change the effective degree of redistribution. By (7) we note that if the government targets a greater degree of redistribution of income from managers to workers then managers would react to mitigate it by diverting their skill from profit seeking to rent seeking. At each date $t \geq 0$, the occupational choice indicator $n_t(.)$ and the optimal earning profile determine the disposable income $d_t(.)$ of an adult as a function of her human capital $h \geq 0$:

$$d_t(h) = n_t(h) \cdot \overline{w}_t + (1 - n_t(h)) \cdot \overline{r}_t(\rho_t^*(h, z_t)) \text{ ,where } \overline{w}_t = w_t + b_t. \tag{8}$$

The occupational choice rules can be solved as static problem of income maximization. Those rules can be summarized by the following proposition:

*Proposition 2: At each date* $t \geq 0$ *there exist two real numbers* $x_t = \dfrac{\overline{w}_t}{\overline{r}_t} > 0$ *and*

$h_{Rt} = \dfrac{(1-\tau)z_t H_t}{\alpha}$ *that partition the domain of human capital to characterize the*

*adult's optimal allocation of time for various activities as a function of her human capital as follows:*

*(a) if $h<x_t$, she supplies all her time for work under the supervision of a manager;*

*(b) if $x_t<h<h_{Rt}$, she supplies all her time seeking profit as a manager;*

*(c) if $h>h_{Rt}>x_t$, she supplies part of her time seeking profit and the rest of her time seeking rent as a manager.*

Note that the basic skill, *x*, represents the minimum level of human capital necessary in order to earn an income (*rx*) from innovating activities that would exceed the market wage rate for supplying labour. People with human capital below this basic skill choose to supply labour. Consequently, in response to labour shortage the wage rate increases and by (4) the implicit rental price of human capital falls and that, in turn, raises the level of basic skill in the economy.

Let us assume that the average human capital *H* corresponds to an economy wide general knowledge about the world technology and/or a form of social capital as discussed in Hazledine (2001) while *zH* represents the effectiveness of that capital in facilitating networking among the educated adults. Clearly, a positive shock on this social infrastructure for networking indicated by a higher value of *z* would be beneficial to the innovators, since it would increase their profits by Proposition 1. However, by Proposition 2 , if the top end of the population accumulates high human capital faster than the growth rate of the effective social capital *zH*, possibly due to a misguided education policy of subsidized tertiary education, then those elites would engage themselves in rent seeking by ignoring the improved infrastructure for innovation.

If, instead, the education policy is designed to help the people who cannot afford tertiary education then it may improve the effectiveness of the social capital (*zH*) faster than the rate at which the elite would accumulate human capital under such policy. Consequently, the threshold for rent seeking will be increased and some of the elites would find the improved social capital lucrative for innovation rather than rent seeking.

I now describe the law of accumulation of human capital that incorporates effects of education, learning by doing and depreciation that varies across occupations. I assume that how people forget knowledge depends on how frequently they use it as well as how much new knowledge gets created by others. Different activities provide different frequency of usage of knowledge. Profit seekers are innovators of new design. So they forget the least. However, their activities make a part of the existing knowledge

obsolete. Consequently, a part of human capital of the non-innovators loses value or effectively depreciates. Innovators' human capital, however, gets updated automatically as a side effect of their dealings with the frontier technology. Workers do not innovate. So they lose their unused human capital and keep only the basic education necessary for following instructions from the managers. Through learning by doing they do acquire some command over the technology that their respective manager introduces. However, the effect of learning by doing on the growth of human capital of a worker is negligible compared to the effect of depreciation of their human capital implied by the obsolescence of past technology due to continual innovative activities of the managers.

In particular, the human capital of an agent who lies at or below the minimum basic skill ($x$) becomes obsolete after one period. The agent with human capital above the basic skill experiences an increasing depreciation rate as a function of the after tax rate of profit ($\bar{r}$) from innovative activities that presumably boosts the intensity of innovative activities. If the human capital stock exceeds the lucrative rent-seeking threshold level $h_R$ then the maintenance cost of human capital increases with its current level to reflect a negative external effect of rent seeking. Everyone, however, has the option to update their human capital by investing in schooling, and the investment $s_t$ in schooling increases human capital in one-to-one proportion. The law of accumulation of human capital is given by,

$$h_{t+1} = s_t + (1 - \delta_t^{\,N}(h))h_t, \qquad\qquad t=0,\ 1,\ 2,\ \dots\dots\text{where,}$$
$$\delta_t^{\,N}(h) = \delta + (1 + h_{Rt}/h)^{-1}\bar{r}_t,\ \text{if}\ h \ge h_{Rt},\ \delta < 1,$$
$$= \delta + 0.5\bar{r}_t,\ \text{if}\ x_t \le h \le h_{Rt},$$
$$= 1,\ \text{if}\ h < x_t, \tag{9}$$

and $h_{Rt} = (1 - \tau)z_t H_t / \alpha$ .

The rest of the model is standard and primarily follows Lucas (1988) to describe the individual optimisation problem and the equilibrium.

Each person divides her disposable income between current consumption and investment in human capital so as to maximize the present discounted value of her lifetime utility subject to the period-by-period budget constraints. The lifetime utility and the period-by-period budget constraints of a person are, respectively, given by,

$$v_0 = \sum_{t=0}^{\infty} \beta^t u(c_t), \text{ where, } u(c) = \ln c, \text{ }^{11} \tag{10}$$

$$c_t + s_t \le d_t(h, z_t) \qquad t=0, 1, 2,\ldots \tag{11}$$

The absence of a viable credit market is implicit in the budget constraint following Benabou (2002). At the beginning of each period $t$, agents observe the productivity shock $z_t$. At $t= 0$ the optimisation problem of an agent with $h \ge 0$ units of human capital is, therefore, to choose a sequence $\left\{c_t(h) \ge 0, s_t(h, z_t) \ge 0, n_t(h) \in \{0,1\}, \rho_t^*(h)\right\}_{t=0,1,2\ldots}$, so as to *Maximize* $\mathrm{E} \sum_{t=0}^{\infty} \beta^t u(c_t)$ subject to (1)-(11).

*Equilibrium*

At equilibrium, everyone behaves as if they are satisfying the above optimisation problem. Also, the optimising behaviour of each person generates decision rules for occupational choice, consumption and investment in schooling in a way such that they satisfy certain consistency conditions for the macro economy. I include the formal description of equilibrium in Appendix A.

## III. Balanced Growth State

A balanced growth state in the above environment is characterized by a common time invariant expected growth rate $\gamma^e \ge 0$ of per capita output, per capita consumption and the average human capital, a constant expected proportion $m$ of adults who are managers, a constant expected proportion $m_R$ of adults who seek rent, a constant expected relative share $\lambda_R$ of human capital of the rent seekers, a constant share of the threshold stock $h_0 > 0$ such that no adults with initial human capital below that level ever invest in human capital and a threshold level $h_R > h_0$ for rent seeking activity where $h_R = (1 - \tau) \int h d\Psi / \alpha$.

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[11] Jones, Manuelli and Stacchetti (2000) report that the use of a non-logarithmic utility function creates a built-in relationship between volatility and the expected long run growth rate. Moreover, the nature of that relationship changes qualitatively with a minimal change in the curvature of the utility function. I therefore choose logarithmic utility to highlight the argument that the relationship between volatility and growth arises directly from the optimal response of the agents to economic reforms rather than from a specific curvature of the utility function.

A competitive equilibrium with an initial distribution $\Psi_0$ with $\Psi_0(h) = 1-m$, for $0 \le h < h_0 < (1-\tau)\int h d\Psi_0 / \alpha$, describes a balanced growth state. In such a state, I calculate the stationary expected values of the variables for $\alpha = 0.5$ and report them below.[12]

Steady state proportions of various occupational groups in the labour force:

(a) Managers:
$$m_t = \int_{h \ge h_0} d\Psi_t(h) = m; \qquad (12)$$

(b) Rent-seekers:
$$m_{Rt} = \int_{h \ge h_R} d\Psi_t(h) = m_R. \qquad (13)$$

(c) Profit-seekers:
$$m_\Pi = (m - m_R). \qquad (14)$$

Human capital share of the rent-seekers:
$$\lambda_{Rt} = \frac{\int_{h \ge h_R} h d\Psi_t}{\int_{h > 0} h d\Psi_t} = \lambda_R. \qquad (15)$$

Expected value of TFP: $E(TFP_t) = (1 - 0.5\lambda_R + (1-\tau)m_\pi)^{1-a}(1-m)^a$. $\qquad$ (16)

Equation (16) provides an explicit formula for calculating the expected value of TFP according to the growth model I present here. Note that it depends on fiscal policy, on the share of human capital of the rent-seekers and on the distribution of population across different occupations.

An interesting property follows from the above formula for TFP. Contrary to conventional wisdom, there is no direct relationship between the number $m$ of managers or the number $m$ of entrepreneurs and the value of TFP in the model economy. If the number $m$ of entrepreneurs remains unchanged then an increase in total number of managers in the economy would reduce TFP. This feature shares the spirit of the findings of Hazledine (2001) that increased managerial activities adversely affect economic growth. However, contrary to Hazledine, an increase in the number of managers who are also entrepreneurs has an ambiguous effect on TFP. In particular, there is an optimum threshold $m$ * such that if the number of managers who are also

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[12] I have omitted the detailed algebra for deriving those formulas. They are available upon request.

entrepreneurs reaches that threshold then the TFP would reach its maximum value. On the other hand, if the total number $m$ of managers remains constant but the number $m$ of entrepreneurs increases as some rent seekers switch to entrepreneurship then the TFP increases unequivocally.

Consequently, the report of the Global Entrepreneurship Monitor (Reynolds *et al*, 2002) that New Zealand is one of the most entrepreneurial countries in the world may nonetheless be consistent with the possibility that New Zealand is stuck in a low TFP steady state. Such a state could arise possibly due to the fact that the number of entrepreneurs is too large (i.e., it exceeds the socially optimal threshold) or possibly because they spend a large fraction of their time seeking rent, or possibly due to a very skewed human capital distribution that results in a large share of human capital among the rent seekers (i.e., a large value of $\lambda_R$) which in turn implies a large but negative external effect on the TFP.

Given the formula for TFP we can compute the real wage rate, the real interest rate, which is related to the implicit price of human capital, and the growth rate of output per worker as follows:

Expected wage rate:

$$w_t^e = \frac{aE(TFP_t)H_t}{1 - m_t}. \tag{17}$$

Expected price of human capital:

$$r^e = (1-a)\left(\frac{E(TFP_t)}{1 - 0.5\lambda_R + (1-\tau)m_\pi}\right). \tag{18}$$

Expected growth rate of output per capita:

$$\gamma^e = \beta(0.5(1-\tau)r^e + 1 - \delta). \tag{19}$$

The formula for TFP and the growth rate of output per capita also indicate that implications of fiscal policy on those two variables are subtle. A higher redistributive tax rate $\tau$ on its own (i.e., assuming no associated change in the human capital distribution) would lower the expected value of total factor productivity and the growth rate. However, if that increase in tax rate $\tau$ alters the distribution of human capital sufficiently to reduce the share of human capital by the rent seekers and to increase the measure $m_\pi$ of profit seekers then the expected TFP would increase.

It is clear from the above analysis that economic reforms can have an ambiguous effect on the economy depending upon how they alter the distribution of human capital and distribution of population across different occupations. Based on the above equations, theoretically, a scenario could be constructed where a tax cut leads to the shrinkage of the measure of entrepreneurs, creating an endogenous skill shortage that will lower productivity permanently. This is, however, just a possibility that could arise in the model. The major contribution of this model lies in the exposition of an

analytically tractable formula for TFP and the intuition that fiscal policy can be designed to promote productivity growth by reducing harmful rent seeking activities. The model also provides an explicit formula to estimate the extent of potential rent seeking activities that go on in a economy.

Degree of rent seeking: $\theta_t = \dfrac{(1/8)(1 + CV_{Rt}^2 (\lambda_{Rt}/m_{\pi t})^2 - 0.5(1-\tau)^2 m_{\pi t}}{1 - 0.5\lambda_{Rt} + (1-\tau)m_{\pi t}}$ .    (20)

Note that a higher tax rate increases rent seeking through its direct effect. However, the general equilibrium effect of an increase in tax rate is ambiguous and depends on how it alters the underlying distribution of human capital and occupational composition of the labour force in the economy.

Also, note from equations (16) and (20) that there are multiple sources of endogenous volatility of TFP: $m$, $\lambda_R$, $m_\pi$, $cv_R^2$. Those secondary sources induce various after shocks in TFP following an exogenous productivity shock caused by a change in $z$, the effectiveness of average human capital or social capital for networking.

For example, an increase in networking effectiveness $z_t$ raises the threshold $h_{Rt} = 2(1-\tau)z_t H_t$ for the rent-seekers. Consequently, the measure $m_{Rt}$ of rent-seekers decreases while measure $m_.$ of entrepreneurs increases. In other words, a positive productivity shock decreases the measure of rent-seekers and increases the measure of the profit seekers. Consequently, a positive productivity shock precipitates innovative activities that further add to productivity growth. The opposite effect occurs in response to a negative productivity shock.

Let us now consider a well known negative productivity shock, namely, a deterioration of the Terms of Trade (TOT) such as caused by the "decolonisation" effect of the early 1970s in New Zealand. In the model, it would imply a lower value of the threshold for rent seeking. Also, it would decrease the after tax rate of profit from innovative activities. Consequently, such a negative productivity shock may persist by encouraging profit seekers to switch to rent seeking for a longer period. Also, by (6) a negative productivity shock encourages a manager to allocate a higher fraction of time to rent seeking. The resulting increase in rent seeking affects the level of TFP adversely. However, a later positive shock, such as economic reforms, is likely to improve the efficiency $z$ of human capital and that, in turn, should neutralise the effect of an adverse TOT shock or that of a "decolonisation" shock in the long run. Unless, of course, economic reforms for some unknown reasons adversely affect the effectiveness of social capital for facilitating networking activities in the economy. I leave that issue for future research.

Note that the variance of the threshold $\text{Var}(h_{Rt}) = 2(1-\tau)H_t\text{Var}(z_t)$ increases with a lower value of the tax rate for a given value of the variance of the productivity shock $z_t$. Consequently, a low tax regime may induce a high degree of volatility in the economy. By (20), this high volatility could encourage rent seeking by increasing the span of rent seekers and hence the coefficient of variation $CV_R^2$ in their human capital distribution.

Also, the variables $\lambda_{Rt}$, $m_{Rt}$ and $\theta$ that are negatively related to total factor productivity are non-decreasing functions of a mean preserving spread of the distribution of human capital among the managers. In other words, a larger dispersion of human capital in the skilled labour force would imply a greater degree of rent seeking and lower total factor productivity and a lower growth rate of output per worker. This result that a higher inequality of human capital leads to lower rate of growth of per capita income provides a theoretical justification of a negative empirical relationship between human capital inequality and growth rate reported by Castello and Domenech (2002).

Besides the increase in rent seeking activities there is also another dimension to the productivity problem. Economic growth has encouraged innovative activities among the managers under a low tax regime that immediately followed economic reforms. Those activities also encouraged the managers to accumulate human capital via schooling and networking and that, in turn, made a typical manager's technology more skill intensive. Recall from the specification of the manager's optimisation problem (2) that, given the human capital stock of a manager, she chooses the optimal number of workers to do the necessary functioning of the firm that requires no formal skill. The resulting skill bias in technology could induce a positive trend in the basic skill requirement for generating greater income from management than from work. The required level of human capital for benefiting from rent seeking could also decrease due to unconventional negative shocks from reforms, as discussed above. Consequently, the proportion of the managerial population that seeks profit could shrink despite well-intended economic reforms.

## IV. Concluding Remarks

In this paper I provide a model of TFP as a function of fiscal policy. The model allows for rent seeking activities to arise endogenously with harmful effects on TFP. It derives explicit formulas for TFP and the degree of rent seeking and uses them to elaborate channels through which well-intended economic reforms may ironically push the economy to a low TFP state.

A negative TOT shock or "decolonisation" could generate a persistent negative effect on TFP. However, positive effects of economic reforms would be likely to offset

them. So according to the model presented here the inability of economic reforms to raise TFP to the internationally set standard cannot be explained by those shocks.

The model I present highlights that the negative indicators of productivity are non-decreasing functions of a mean preserving spread of the distribution of human capital among the managers. In particular, rent-seeking activities increase in the model with the coefficient of variation of human capital among the high skill population. Consequently, a greater dispersion of human capital would imply a lower productivity in the economy.

In this paper I have only made a few conjectures based on various analytical properties of the above model. The model needs to be calibrated carefully to match the New Zealand data. I leave that exercise for future research. I have included in the Appendix B the key equations for partitioning the data to match the model's steady states to the national income statistics for future research involving a calibration exercise.

Without calibrating the model to the New Zealand economy, one cannot make a definite statement regarding what might be responsible for preventing well-intended reforms to produce its desired results. The paper does offer a hypothesis that possibly a reform-induced over-accumulation of human capital among the elite has precipitated an endogenous shortage of entrepreneurial initiatives for innovation, and that has prevented productivity acceleration. The model presented here rationalises that hypothesis within the framework of textbook models of growth that may be worth exploring in future for understanding the productivity puzzle of New Zealand.

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## Appendix A
*Equilibrium*

The set of sequences $\{c_t(h, z_t),\ s_t(h, z_t),\ n_t(h, z_t),\ \rho_t^*(h, z_t),\ l_t(h, z_t):\ h \geq 0 ; x_t,\ r_t^e,\ m_t^e,\ H_t^e,\ z_t,\ w_t^e, \tau\ \}_{t=0,1,2,..}$ and the initial distribution $\Psi_0$ describe the model's *equilibrium* such that, at each $t \geq 0$, the labour demand $l_t (.)$ satisfies (4), the implicit rental price $r_t$ of human capital satisfies (5), the expected breakeven skill $x_t$ satisfies (8), the optimisation problem (14) is satisfied for each agent and the sequence $\{H_t, m_t\}_{t \geq 0}$ coincides with the same generated by the optimal sequence of $\{\ s_t(h, z_t),\ n_t(h, z_t)\}_{t=0,1,2,..}$, such that

$$m_t = \int_{\{h:n_t(h,z_t,\tau)=0\}} d\Psi_t\ (h) , \tag{A1}$$

$$H_{t+1} = (1-\delta)\int h\, d\Psi_t(h) + \int (s_t(h,z_t) - \delta^N(h)d_t(h,z_t))d\Psi_t(h),\ \ H_0 = \int h\, d\Psi_0(h), \tag{A2}$$

and the labour market clears such that at each date $t=0,\ 1,\ 2,\ldots,$

$$\int_{\{h:n_t(h,\tau)=0\}} l_t(h,w_t;z_t H_t, m_t)d\Psi_t(h) = 1 - m_t \tag{A3}$$

The goods market clears such that at each date $t=0, 1, 2..,$

$$\int_{h\geq 0}(c_t(h,z_t)+s_t(h,z_t))d\Psi_t(h) = \int_{\{h:n_t(h,z_t,\tau)=0\}}q(h,l_t(h,z_t);z_tH_t,m_t)d\Psi_t(h) . \tag{A4}$$

The distribution of human capital evolves as

$$\Psi_{t+1}((1-\delta)h+(s_t(h,z_t)-\delta^N(h)y_t(h,z_t))) = \Psi_t(h) . \tag{A5}$$

This completes the definition of equilibrium.

## Appendix B
*Key Equations for Calibrating the Model Economy to the New Zealand Data:*
National income per capita: $Y_t = E(TFP_t)z_tH_t$. (B1)

Benefit per worker: $b_t = \dfrac{(\tau-\theta_t)(1-a)}{1-m_t}Y_t$. (B2)

Workers' income per capita: $Y_t^W = (a+(1-a)(\tau-\theta))Y_t$. (B3)

Clearly, workers lose as managers seek rent rather than profit.

Profit seekers' income per capita: $Y_t^{\Pi} = \left(\dfrac{(1-a)(1-\tau)(1-\lambda_{Rt})}{1-0.5\lambda_{Rt}+(1-\tau)m_{\pi t}}\right)Y_t$. (B4)

Rent seekers' income per capita: $Y_t^R = (1-a)\left(\dfrac{(1-\tau)(0.5\lambda_{Rt}-(1-\tau)m_{\pi t}}{1-0.5\lambda_{Rt}+(1-\tau)m_{\pi t}}+\theta_t\right)Y_t$. (B5)

Consumption of the workers per capita: $C_t^W = (a+(1-a)(\tau-\theta))Y_t$ (B6)

Saving (=investment) per capita: $S_t = S_t^{\Pi}+S_t^R$, where,
(a) Profit-seekers: $S_t^{\Pi} = (0.5(1+\beta)(1-\tau)r_t-(1-\beta)(1-\delta))(1-\lambda_{Rt})H_t$ ; (B7)
(b)Rent-seekers: $S_t^R = (0.5\beta(1-\tau)r_t-(1-\beta)(1-\delta))\lambda_{Rt}+(1/8)(\lambda_{Rt}/m_{\pi t})^2(1+cv_R^2)r_t)H_t$.
(B8)
Consumption per capita: $C_t = C_t^W + (Y_t^{\Pi}-S_t^{\Pi})+(Y_t^R-S_t^R)$. (B9)

National Income Identity: $Y_t = C_t + S_t^{\Pi}+S_t^R$. (B10)

## Table 1 (Productivity

| Productivity | | | | NZ Productivity Relative to Others | | | Growth Rate of Productivity | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| GDP per Hour, in 1999 EKS $ | | | | Ratio of GDP per Hour | | | Growth rate of GDP per Hour | | | |
| OECD | New Zealand | Australia | U.S.A | | NZ/AUS | NZ/USA | | NZ | AUS | USA |
| 1987 | 20.88 | 24.45 | 31.19 | 1987 | 85.41% | 66.96% | 1990 | -0.65% | -0.11% | 1.08% |
| 1988 | 21.54 | 24.35 | 31.44 | 1988 | 88.46% | 68.52% | 1991 | 1.06% | 3.16% | 0.93% |
| 1989 | 22.49 | 24.43 | 31.79 | 1989 | 92.06% | 70.75% | 1992 | -0.26% | 4.52% | 2.73% |
| 1990 | 22.35 | 24.41 | 32.14 | 1990 | 91.57% | 69.54% | 1993 | 1.90% | 2.02% | 0.17% |
| 1991 | 22.59 | 25.19 | 32.44 | 1991 | 89.67% | 69.63% | 1994 | 0.13% | 0.77% | 0.97% |
| 1992 | 22.53 | 26.35 | 33.34 | 1992 | 85.48% | 67.58% | 1995 | -0.67% | 0.41% | 0.27% |
| 1993 | 22.96 | 26.89 | 33.39 | 1993 | 85.38% | 68.76% | 1996 | 0.07% | 2.90% | 2.07% |
| 1994 | 22.99 | 27.10 | 33.72 | 1994 | 84.84% | 68.18% | 1997 | 1.65% | 3.46% | 1.52% |
| 1995 | 22.84 | 27.21 | 33.81 | 1995 | 83.92% | 67.54% | 1998 | 0.93% | 3.46% | 1.69% |
| 1996 | 22.85 | 28.01 | 34.52 | 1996 | 81.58% | 66.21% | 1999 | 2.48% | 1.54% | 2.27% |
| 1997 | 23.23 | 29.00 | 35.04 | 1997 | 80.12% | 66.29% | 2000 | 2.61% | -0.91% | 1.74% |
| 1998 | 23.45 | 30.02 | 35.64 | 1998 | 78.11% | 65.79% | 2001 | 0.70% | 3.87% | 0.36% |
| 1999 | 24.04 | 30.48 | 36.46 | 1999 | 78.85% | 65.93% | 2002 | 1.66% | 2.28% | 2.62% |
| 2000 | 24.67 | 30.21 | 37.10 | 2000 | 81.68% | 66.51% | 2003 | 0.92% | 0.15% | 2.56% |
| | | | | | | | Average: | | | |
| 2001 | 24.85 | 31.40 | 37.23 | 2001 | 79.14% | 66.74% | 1990-2003 | 0.90% | 1.96% | 1.50% |
| 2002 | 25.26 | 32.12 | 38.22 | 2002 | 78.66% | 66.10% | | | | |
| 2003 | 25.50 | 32.17 | 39.21 | 2003 | 79.26% | 65.02% | | | | |
| Source: | | | | | | | | | | |
| Groningen Growth and Development Centre and The Conference Board, Total Economy Database, February 2004, | | | | | | | | | | |

**Table 2 (Productivity Data, 1987Q1-1994Q3)**

Source: New Zealand Department of Labour; Australian Bureau of Statistics

| | CPI Inflation Rate | | Average hourly / weekly earnings | | Growth Rate of Earnings ($) | | Growth Rate of Earnings (Real) | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | *NZ* | *AUS* | *NZ (hourly)* | *AUS (weekly)* | *NZ* | *AUS* | *NZ* | *AUS* | |
| Q1 1987 | 2.35% | 2.01% | 10.81 | 429.60 | 3.15% | 0.56% | 0.80% | -1.44% | |
| Q2 1987 | 3.28% | 1.47% | 11.13 | 436.20 | 2.96% | 1.54% | -0.32% | 0.06% | |
| Q3 1987 | 1.59% | 1.69% | 11.41 | 444.20 | 2.52% | 1.83% | 0.93% | 0.14% | |
| Q4 1987 | 2.06% | 1.79% | 11.52 | 450.10 | 0.96% | 1.33% | -1.10% | -0.46% | |
| Q1 1988 | 1.77% | 1.75% | 11.94 | 458.80 | 3.65% | 1.93% | 1.87% | 0.18% | |
| Q2 1988 | 0.78% | 1.72% | 12.28 | 464.80 | 2.85% | 1.31% | 2.07% | -0.42% | |
| Q3 1988 | 0.89% | 1.92% | 12.51 | 470.90 | 1.87% | 1.31% | 0.98% | -0.61% | |
| Q4 1988 | 1.18% | 2.00% | 12.64 | 484.90 | 1.04% | 2.97% | -0.14% | 0.98% | |
| Q1 1989 | 1.10% | 0.98% | 12.91 | 492.30 | 2.14% | 1.53% | 1.04% | 0.55% | |
| Q2 1989 | 1.19% | 2.48% | 13.03 | 501.10 | 0.93% | 1.79% | -0.26% | -0.69% | |
| Q3 1989 | 3.52% | 2.31% | 13.15 | 508.40 | 0.92% | 1.46% | -2.60% | -0.85% | |
| Q4 1989 | 1.23% | 1.85% | 13.29 | 516.60 | 1.06% | 1.61% | -0.16% | -0.24% | |
| Q1 1990 | 0.93% | 1.71% | 13.7 | 524.70 | 3.09% | 1.57% | 2.15% | -0.15% | |
| Q2 1990 | 1.76% | 1.59% | 13.84 | 534.10 | 1.02% | 1.79% | -0.73% | 0.21% | |
| Q3 1990 | 1.00% | 0.78% | 13.98 | 541.00 | 1.01% | 1.29% | 0.01% | 0.51% | |
| Q4 1990 | 1.08% | 2.61% | 14.13 | 555.60 | 1.07% | 2.70% | -0.01% | 0.08% | |
| Q1 1991 | 0.62% | -0.19% | 14.3 | 564.20 | 1.20% | 1.55% | 0.58% | 1.74% | |
| Q2 1991 | 0.09% | 0.19% | 14.39 | 560.80 | 0.63% | -0.60% | 0.54% | -0.79% | |
| Q3 1991 | 0.35% | 0.57% | 14.5 | 567.70 | 0.76% | 1.23% | 0.41% | 0.66% | |
| Q4 1991 | -0.09% | 0.94% | 14.57 | 578.80 | 0.48% | 1.96% | 0.57% | 1.02% | |
| Q1 1992 | 0.44% | 0.00% | 14.69 | 589.20 | 0.82% | 1.80% | 0.38% | 1.80% | |
| Q2 1992 | 0.26% | -0.28% | 14.74 | 587.30 | 0.34% | -0.32% | 0.08% | -0.04% | |
| Q3 1992 | 0.35% | 0.09% | 14.71 | 585.80 | -0.20% | -0.26% | -0.55% | -0.35% | |
| Q4 1992 | 0.26% | 0.47% | 14.73 | 586.80 | 0.14% | 0.17% | -0.13% | -0.29% | |
| Q1 1993 | 0.09% | 0.93% | 14.72 | 593.70 | -0.07% | 1.18% | -0.15% | 0.25% | |
| Q2 1993 | 0.61% | 0.37% | 14.8 | 597.80 | 0.54% | 0.69% | -0.06% | 0.32% | |
| Q3 1993 | 0.52% | 0.46% | 14.74 | 602.40 | -0.41% | 0.77% | -0.92% | 0.31% | |
| Q4 1993 | 0.17% | 0.18% | 14.76 | 604.20 | 0.14% | 0.30% | -0.04% | 0.12% | |
| Q1 1994 | 0.00% | 0.36% | 14.86 | 612.30 | 0.68% | 1.34% | 0.68% | 0.98% | |
| Q2 1994 | 0.40% | 0.72% | 14.97 | 617.50 | 0.74% | 0.85% | 0.34% | 0.12% | Reform Era |
| Q3 1994 | 1.20% | 0.63% | 14.98 | 620.00 | 0.07% | 0.40% | -1.13% | -0.22% | g: |
| Annual Average: 87-95 | 4.00% | 4.40% | 54.55 | 2152.49 | 4.66% | 4.85% | 0.66% | 0.45% | **NZ/AUS= 1.48** |

### Table 3 (Productivity Data, 1994Q4-2002Q3)
Source: New Zealand Department of Labour; Australian Bureau of Statistics

| | CPI Inflation Rate | | Average hourly / weekly earnings | | Growth Rate of Earnings ($) | | Growth Rate of Earnings (Real) | | |
|---|---|---|---|---|---|---|---|---|---|
| | *NZ* | *AUS* | *NZ (hourly)* | *AUS (weekly)* | *NZ* | *AUS* | *NZ* | *AUS* | |
| Q4 1994 | 1.18% | 0.80% | 15.03 | 629.20 | 0.33% | 1.48% | -0.85% | 0.68% | |
| Q1 1995 | 1.17% | 1.68% | 15.14 | 639.10 | 0.73% | 1.57% | -0.44% | -0.11% | |
| Q2 1995 | 0.96% | 1.31% | 15.28 | 647.30 | 0.92% | 1.28% | -0.04% | -0.02% | |
| Q3 1995 | 0.19% | 1.20% | 15.38 | 651.90 | 0.65% | 0.71% | 0.46% | -0.49% | |
| Q4 1995 | 0.57% | 0.77% | 15.47 | 659.90 | 0.59% | 1.23% | 0.01% | 0.46% | |
| Q1 1996 | 0.47% | 0.42% | 15.61 | 665.70 | 0.90% | 0.88% | 0.43% | 0.46% | |
| Q2 1996 | 0.75% | 0.67% | 15.83 | 672.60 | 1.41% | 1.04% | 0.66% | 0.36% | |
| Q3 1996 | 0.56% | 0.25% | 15.93 | 676.60 | 0.63% | 0.59% | 0.07% | 0.34% | |
| Q4 1996 | 0.74% | 0.17% | 16.07 | 685.60 | 0.88% | 1.33% | 0.14% | 1.16% | |
| Q1 1997 | -0.28% | 0.17% | 16.28 | 694.10 | 1.31% | 1.24% | 1.58% | 1.07% | |
| Q2 1997 | 0.09% | -0.25% | 16.42 | 696.60 | 0.86% | 0.36% | 0.77% | 0.61% | |
| Q3 1997 | 0.46% | -0.42% | 16.54 | 706.60 | 0.73% | 1.44% | 0.27% | 1.85% | |
| Q4 1997 | 0.55% | 0.25% | 16.59 | 711.30 | 0.30% | 0.67% | -0.25% | 0.41% | |
| Q1 1998 | 0.18% | 0.25% | 16.7 | 722.30 | 0.66% | 1.55% | 0.48% | 1.30% | |
| Q2 1998 | 0.46% | 0.58% | 16.89 | 726.90 | 1.14% | 0.64% | 0.68% | 0.05% | |
| Q3 1998 | 0.55% | 0.25% | 16.97 | 736.10 | 0.47% | 1.27% | -0.07% | 1.02% | |
| Q4 1998 | -0.81% | 0.49% | 17.11 | 741.30 | 0.82% | 0.71% | 1.64% | 0.21% | |
| Q1 1999 | -0.27% | -0.08% | 17.2 | 744.80 | 0.53% | 0.47% | 0.80% | 0.55% | |
| Q2 1999 | 0.18% | 0.41% | 17.28 | 750.80 | 0.47% | 0.81% | 0.28% | 0.40% | |
| Q3 1999 | 0.40% | 0.90% | 17.5 | 751.80 | 1.27% | 0.13% | 0.87% | -0.77% | |
| Q4 1999 | 0.20% | 0.57% | 17.42 | 763.20 | -0.46% | 1.52% | -0.66% | 0.95% | |
| Q1 2000 | 0.70% | 0.89% | 17.5 | 775.00 | 0.46% | 1.55% | -0.24% | 0.66% | |
| Q2 2000 | 0.69% | 0.80% | 17.63 | 782.60 | 0.74% | 0.98% | 0.05% | 0.18% | |
| Q3 2000 | 1.37% | 3.72% | 17.81 | 798.10 | 1.02% | 1.98% | -0.35% | -1.74% | |
| Q4 2000 | 1.16% | 0.31% | 17.86 | 802.50 | 0.28% | 0.55% | -0.88% | 0.25% | |
| Q1 2001 | -0.19% | 1.07% | 18.05 | 810.60 | 1.06% | 1.01% | 1.26% | -0.06% | |
| Q2 2001 | 0.86% | 0.83% | 18.21 | 824.10 | 0.89% | 1.67% | 0.02% | 0.84% | |
| Q3 2001 | 0.57% | 0.30% | 18.42 | 838.50 | 1.15% | 1.75% | 0.58% | 1.45% | |
| Q4 2001 | 0.57% | 0.89% | 18.48 | 848.70 | 0.33% | 1.22% | -0.24% | 0.32% | |
| Q1 2002 | 0.56% | 0.89% | 18.71 | 860.50 | 1.24% | 1.39% | 0.68% | 0.50% | |
| Q2 2002 | 1.03% | 0.73% | 18.67 | 866.80 | -0.21% | 0.73% | -1.24% | 0.00% | Post-Reform |
| Q3 2002 | 0.46% | 0.65% | 19.00 | 879.40 | 1.77% | 1.45% | 1.31% | 0.80% | **g: NZ/AUS** |
| Annual Average: 87-95 | 2.01% | 2.68% | 67.87 | 2970.06 | 2.99% | 4.40% | 0.98% | 1.71% | **0.57** |