Targeting Growth in Papua New Guinea

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Abstract
This paper uses the standard neoclassical framework to compute the rate of
investment that is necessary to achieve a sustained growth rate in per capita income of
6 percent annually. Our calculations suggest that PNG would need an investment rate
of 30 percent of GDP, equal to K4.1 billion in 2004, to achieve the espoused target.
This is a 76 percent jump over the figure of K2.3 billion for 2004; an amount equal to
an additional 1.8 billion Kina over the level for 2004. Some K670 million of this
additional investment would, over the next several years, be destined for the primary
non-mineral sector. The pattern of investment over the longer term is likely to change
as the secondary and tertiary sectors expand.

This analysis presents three clear messages: first, that the rate of productivity growth
must rise if the target rate of growth is to be realised; second a significant rise in
investment, absent any major structural changes within the economy, will entail large
investments within the primary and rural non-mining sector of the economy; and,
third that a higher productivity growth will ease the need for very large increases in
investment. The last may entail structural transformation, but one likely to take place
over a prolonged period of time.

1. Introduction

Aggregate gross domestic product (GDP), that is, the money value of all goods and services produced in Papua New Guinea, grew by 2.7 and 2.8 percent in 2003 and 2004, respectively. This is indeed welcome news given the contraction in GDP in the three years from 2000 to 2002. The positive rates of growth for 2003 and 2004, however, are only marginally greater than the 2.5 percent rate of annual increase in the PNG population and thus insufficient to provide significant increases in the level of per capita income for several generations of Papua New Guineans. Per capita income in PNG increased by 0.3 percent in 2004; at this rate, purchasing power parity adjusted per capita income of US$2,300 will double every 233 years! Put differently, at the prevailing rate of growth of per capita GNI, it will take some 306 years for the per capita incomes in PNG to catch up with the 2004 level of per capita income of Fiji of US$5700. Even this would not be a significant achievement given that Fijian incomes are far from being high in comparison to other developing countries.

The above clearly demonstrates the need to break away from the low rate of growth of income of the past. This challenge is likely to remain for the foreseeable future since PNG has a long way to go in terms of raising the living standards of its population. The analysis here is narrowed down to considering strategies for raising the rate of growth of income. We have assumed a target growth rate of per capita income of 6 percent per annum; this with an annual population growth rate of 2.5 percent implies that aggregate GDP would need to grow by 8.5 percent on an annual basis. The target rate of growth of income is well above the historical rates, but the wider population is likely to remain poor unless a break is made from the past. Even with a per-capita growth in income of 6 percent annually, the levels of income would double every 12 years. Thus, if the above target is achieved then the current level of per capita income of US$2300 will double to US$4,600 by 2016. This will still leave PNG behind the current, that is 2004, levels of per capita income in Fiji and Samoa.

A significantly higher rate of growth than that of the past is critical to raising welfare of the general population, but this on its own is not sufficient for improvements in the wellbeing of the general population. This paper considers strategies to raise income as a <u>first</u> step towards seeing an improvement in the wellbeing of the general population. The fruits of growth would need to be equitably distributed to realise the full potential of improved wellbeing of the wider population, an issue that will deserve attention but only after having achieved a higher rate of growth of income. Raising the rate of growth, therefore, has priority over redistribution.

The analysis that follows employs the neoclassical growth framework to model the growth process and to draw implications form the model. The two major findings from this analysis include: the rate of growth of total factor productivity in PNG would have to be increased several fold; and, the rate of investment would need to be doubled if output growth was to be raised. The latter is somewhat easier to address via policies and this is considered first. Raising productivity growth would entail significant restructuring of the economy and this issue is taken up as the next challenge.

The rest of the paper is organised as follows. The next section presents the conceptual framework to analyse the growth experience of PNG both over the recent past and

that for the future. Simulation results from the model are presented in section 3 while policies for raising growth is considered in section 4. Conclusions and issues for further investigation bring the paper to a close.

2. The Analytical Framework.

The neoclassical growth framework, much akin to that used by Rao (2004), is used to model the growth process in Papua New Guinea.

We take the Hicks-neutral form of the neoclassical production function; that is,
$$Y = AF(K,L) \qquad (1),$$

where the function F is assumed to be positive, and concave. The Cobb-Douglas representation of (1), that satisfies all of these assumptions, is given by:

$$Y = e^{gt} K^{\alpha} L^{\beta} \qquad (2);$$

whereY denotes GDP, K denotes capital stock, L denotes labour input, while the parameters g, α, and β represent the rate of growth of productivity, and the elasticity of capital and labour, respectively.

We can differentiate (2) to obtain the growth accounting identity; that is,

$$\hat{Y} = g + \alpha\hat{K} + \beta\hat{L} \qquad (3),$$

where a '∧' over a variable represents its rate of growth. Equation (3) simply shows that the rate of growth of output is equal to the sum of three components; namely, the rate of growth of productivity and that of factor inputs weighted by their shares in total output. Since (3) is an identity, the rate of growth of capital is deduced rearranging terms in equation (3) as follows:

$$\hat{K} = \frac{\hat{Y} - g - \beta n}{\alpha} \qquad (4);$$

where n denotes the rate of growth of labour input. Imposing the assumption of constant returns to scale and letting $\Delta K \cong dK$ allows us to express (4), the gross investment ratio, as

$$\frac{I}{Y} = \frac{\Delta K - \delta K}{Y} = \frac{\hat{Y} - g - \beta n - \delta}{1 - \beta} \frac{K}{Y} \qquad (5),$$

where δ denotes the depreciation rate. Imposing the assumption of constant returns to scale implies that $\alpha + \beta = 1$. Competitive factor markets imply that α and β represent the shares of labour and capital in total output. Equation (5) is a steady state relationship between the investment rate and that of growth rates of output, the given parameters, and the capital-output ratio. It allows us to calculate the desired rate of investment given a target rate of growth of aggregate output

3.   Simulation results on required rate of TFP growth and investment.

The empirical implementation of equation (5) requires knowledge of the values of the parameters α, δ, n, and K/Y. These values are assumed to be as follows.

The target rate of growth of per capita is set at 6 percent per annum; population growth rate is set at 2.5 percent which then implies that the target for the rate of aggregate GDP is 8.5; the rate of depreciation is set at10 percent; the labour force growth rate is set at 2.5 percent; and, the capital-output ratio is assumed to be 2. The last assumption implies that two Kina of capital is required to produce every Kina of output.

The rate of productivity growth differs considerably between economies, thus we take three values of g; that of 1.5, 2, and 2.5. Labour's share in output, this being the value of β, is assumed to be 65 percent with the residual 35 percent of output, this being the value for α, assumed to accrue to owners of capital. The sensitivity of the required rate of investment is tested in the simulations by varying the values of the above-mentioned critical parameters.

Table 1 provides the results of six simulations based on separate assumptions based on values of some of the critical parameters reflected in equation (5) above. The first row backs-out the value of g, the rate of productivity growth, given the rate of growth of income in 2004. The values shown in bold italics are the calculated figures given the values of the other remaining parameters.

Table 1: Implied investment rates given a range of parameter values

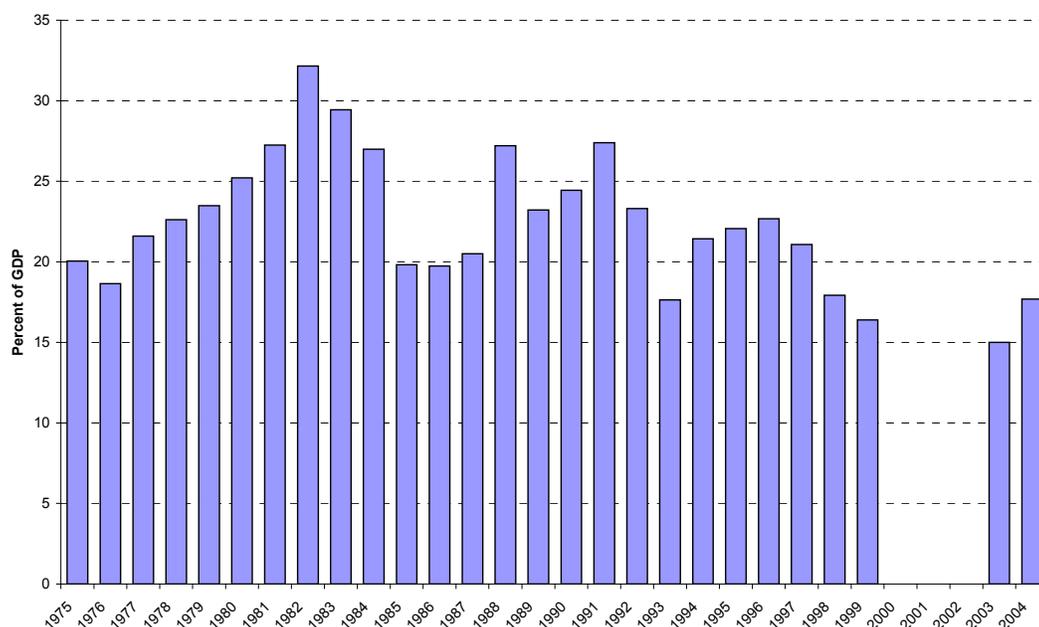| Row	Y-hat	g	n	α	β	δ	K/Y	I/Y
1	2.8	*0.2*	2.5	0.35	0.65	0.1	2.0	17.7
2	8.5	1.5	2.5	0.35	0.65	0.1	2.0	*30.4*
3	8.5	2.0	2.5	0.35	0.65	0.1	2.0	*27.6*
4	8.5	2.5	2.5	0.35	0.65	0.1	2.0	*24.7*

Source: Author's calculations.

Row 1 shows that if capital growth equals the rate of growth of income,[1] then productivity growth for 2004 equalled merely 0.2 percent. This rate of productivity growth is particularly low in comparison to growth rates in other developing countries. ***The <u>first</u> clear message from this analysis is that the rate of productivity growth would need to rise some ten-fold if the target rate of growth is to be realised. How this may be done is discussed later in the text.***

Rows 2 to 4 impose annual productivity growth rates of 1.5, 2.0, and 2.5 percent, respectively. Even if PNG, by some miracle, achieves the rate of productivity growth similar to that of other well performing developing countries then the prevailing rate of investment is well below the required rates to achieve the set growth target of 6 percent. The last column in table 1 shows that the prevailing investment rates would have to nearly double if PNG were to achieve the set growth target.

Figure 1: Gross Fixed Capital Formation in PNG, 1975 to 2004

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[1] This is a steady-state assumption where output and aggregate capita stock grow at the same rate such that the capital-output ratio remains constant.

Percent of GDP

35
30
25
20
15
10
5
0

1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004

Notes: Data sourced from World Bank's Development Indicators database, accessed online on 8 December 2005.

Gross capital formation peaked in 1982 at 32 percent but has since fallen with the 2004 figure of 17.7 percent just 55 percent of the corresponding figure for 1982. If growth is to be raised, then clearly the rate of investment has to rise significantly. The question then remains as to where this rise is likely to come from. Table 2 below reports the projected rates of growth of real GDP by sector as provided by the PNG-Department of Treasury. The projected rates of growth of GDP for the 2005 to 2010 period is well below the target rate, thus per capita GDP to 2010 as projected by the Department of Treasury will grow by a maximum of one percent per annum.

Table 2: Projections of the rates of growth of real sectoral and total GDP, 2005-2010.

	2005	2006	2007	2008	2009	2010
Agriculture, Forestry and Fishing	3.47	3.34	3.40	3.59	3.95	3.78
Oil and Gas Extraction	5.61	3.36	-8.92	-17.17	111.44	55.11
Mining and Quarrying	0.28	5.78	6.05	3.22	-8.06	15.27
Manufacturing	2.90	3.00	3.10	3.50	4.00	5.00
Electricity, gas and water	2.70	2.70	2.80	3.00	3.50	3.50
Construction	4.80	5.00	5.05	5.05	0.00	0.00
Wholesale and retail trade	2.70	2.70	2.80	3.05	3.50	4.00
Transport, storage and communication	3.00	3.00	3.00	3.50	4.00	4.00
Finance, real estate and business services	2.50	2.50	2.50	2.60	3.00	3.50
Community, social and personal services	1.70	2.20	2.20	2.35	2.50	2.50
Total GDP	3.2	3.1	3.3	3.6	3.1	3.2

Source: Department of Treasury, Port Moresby.

Table 3 below shows the composition of GDP, as projected by the PNG-Department of Treasury.

Table 3: Shares in GDP of the 10 major sectors, 2005 to 2010.

	2005	2006	2007	2008	2009	2010
Agriculture, Forestry and Fishing	0.37	0.37	0.37	0.37	0.37	0.36
Oil and Gas Extraction	0.03	0.03	0.03	0.02	0.05	0.07
Mining and Quarrying	0.09	0.10	0.10	0.10	0.09	0.09
Manufacturing	0.07	0.07	0.07	0.07	0.07	0.07
Electricity, gas and water	0.01	0.01	0.01	0.01	0.01	0.01
Construction	0.11	0.11	0.11	0.11	0.11	0.10
Wholesale and retail trade	0.07	0.07	0.07	0.07	0.07	0.06
Transport, storage and communication	0.02	0.02	0.02	0.02	0.02	0.02
Finance, real estate and business services	0.04	0.04	0.04	0.04	0.04	0.04
Community, social and personal services	0.14	0.14	0.14	0.14	0.14	0.13

Notes: Calculated using primary data from the Department of Treasury, Port Moresby. The columns do not total to unity, the discrepancy is of approximately 4 percentage points.

A target rate of growth of 6 percent in per capita income requires a near doubling of total investment as a proportion of GDP. If the structure of production were to remain unchanged (as suggested by the sectoral growth projections shown in table 2 above), then this doubling of investment would have to take place equi-proportionately across the sectors. Agriculture, Forestry, and Fishing, as the largest sector, would thus absorb the bulk of the increased investment.

Our calculations based on data for 2004 shows that an investment rate of 30 percent of GDP would equal to K4.1 billion. This is a 76 percent jump over the actual investment of K2.3 billion for the year. Thus, an additional K1.8 billion is needed to achieve the set growth target. The reality is that some K670 million of this additional investment would, at least over the short to medium term, be destined for the primary non-mineral sector. The pattern of investment over the longer term is likely to change as the secondary and tertiary sectors expand.

The second clear message from this analysis is that a significant rise in investment, absent any major structural changes within the economy, will entail large investments within the primary non-mining sector of the economy. The above would, at least, hold for the short to medium term since structural transformation has considerable inertia.

Rows 3 and 4 of table 1 show that the need for large increases in investment is tampered through increased productivity growth. ***The third major message from this analysis, therefore, is that a higher rate of productivity growth will substitute for some of the need for increased investment.*** This then begs the question of how productivity could be raised, even over the long term, in the economy. This issue is addressed briefly next.

4.   Policy Implications

The required rate of investment is lower for a higher productivity growth. This growth could materialise from a higher rate of growth of effective-labour and from the use of better technology such as higher yielding crops. An increased participation

in the workforce could also manifest itself as increases in effective labour without a change in the rate of population growth. Effective labour could also rise from a demographic shift with the bulge of the young population moving into working age and/or with better skilling of the incoming workforce. The effect of all of the above has been modelled as the growth of productivity of 2.5 percent per annum in Row 4 of Table 1.

A number of developing economies have grown rapidly by witnessing labour move from low productivity subsistence agriculture into higher productivity secondary and tertiary sectors of the economy. Labour gets drawn out of low productivity agriculture by the better rewards offered in manufacturing and service sectors of the economy. The recent growth in the coastal provinces of China and Vietnam provide a lot of anecdotal evidence in support of this proposition. The process in PNG has been somewhat the reverse of the above. Stagnant secondary and tertiary sectors have led to the primary sector acting as the reservoir for excess and often unskilled labour. The lack of employment opportunities has dissuaded investments into skill acquisition that in turn has exacerbated the problems of low investment in accumulation of human capital. The poor, and sometimes deteriorating education and health systems, moreover, have constrained access to better health and education facilities. ***The policy challenge here is to reverse the above-mentioned process.***

A rise in aggregate GDP often accompanies rapid structural transformation. The share of employment in the primary sector falls whilst output of the sector may actually rise leading to a rise in labour productivity in the primary sector. Growing secondary and tertiary sectors of the economy draw resources, labour in particular, out of the primary sector. The above raises the question of why both the secondary and tertiary sectors of the PNG economy have remained small and projected to remain so for the short to medium term.

Some 85 percent of the population live in the rural sector and draw their livelihood from the primary sector. Agriculture, fisheries, and forests accounts for some 37 percent of GDP. The above two statistics, given the projected growth rates in table 2, are unlikely to change soon. It therefore is imperative that over the immediate term strategies to boost investment in the primary rural sector of the economy be considered foremost. Accompanying the above could be a targeted strategy at improving access to basic healthcare and primary education, particularly within the rural sector. The impediments to investment have to be investigated with a view to relieving these in the hope of raising investments in the primary sector. Most of these impediments are well known; the challenge here is in targeting particular issues that give the maximum increase in agricultural output. As an example, infrastructure improvements into the coffee regions could give a larger return in terms of increased output relative to similar outlays within the copra producing regions. Analysis of this detail can only be undertaken within the planning office, but the basic principles are relatively simple to implement. The above does not amount to picking of winners but large investments into the primary sector are simply due to the prevailing absorptive capacity in this sector.

The K1.8 billion-question is where will these funds for investment come from. The bulk of the funds for the sort of increases in investment canvassed here would have to come from the global capital market given the limited domestic savings. These funds

would in all likelihood be sourced by the private sector given the high debt of the public sector and the comparative advantage of the private sector in investments for growth of production. Private foreign investments are also a major conduit for improved technologies and access to foreign markets. Such investments, however, are only likely to take place in the presence of security to person and property, a low credit risk that requires macroeconomic stability, and policy stability such that investments can be made with a long time horizon in mind. Public policy has a critical role in the provision of all of the above-mentioned preconditions.

Similar considerations have to be given to relieving the constraints to growth of the secondary and tertiary sectors. The reality, however, is that these sectors will take a lot longer to grow and it will be decades before these sectors are in a position to drive the growth of GDP. Similarly, the workforce of the future has to be equipped with education and skills to be able respond to income opportunities offered elsewhere.

5. Conclusions

This paper has used the neoclassical growth model to analyse the strategies for raising growth of income to a target rate of six percent per capita for the long term. The analysis, for tractability, has been confined to considerations of raising income rather than the redistribution of this income for bringing about an improvement in the wellbeing of the general population. The primary task at hand is one of first raising the rate of growth of income; this challenge precedes the challenge of redistribution so as to raise living standards. The latter issue remains on the research agenda, however.

The prevailing rate of growth of purchasing power parity (PPP) adjusted per capita income in PNG of around 0.5 percent per annum will see a doubling of the 2004 level of US$2,300 in another 139 years. Even then, the per capita income in PNG will be well below the current, that is 2004, level of per capita income in Fiji, Tonga, and Samoa. The above raises the need to break away from past rates of economic growth. Even at the target rate of growth of per capita income of 6 percent, the level of per capita income would double every dozen years. The question addressed in this paper is as to how this target may be achieved.

Clearly the rate of investment and the rate of productivity growth would both need to rise to achieve the stipulated growth target. The highly stylised neoclassical growth model used in this paper shows that investments would need to nearly double from the 2004-rate while productivity growth may have to increase ten fold if the set growth target of 6 percent is to be achieved. Most of the increased investment, at least in the short term, would have to take place within the non-mining primary sector. Over time, the economy may have to undergo structural change with labour moving out of the rural agricultural (subsistence) sector into the secondary and tertiary sectors of the economy. Such mobility would be enhanced through increased investment in human, physical, and financial capital. Policies conducive to such mobility would need to be in place well ahead in time.

Reefernces
Rao, B 2004. "The relationship between growth and investment", *Pacific Economic Bulletin* 19(3): 64-73.