

Targeting growth in Papua New Guinea

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This article uses the standard neoclassical framework to compute the rate of investment necessary to achieve a sustained growth rate in per capita income of 6 per cent annually. The analysis presents three messages: the rate of productivity growth must rise if the target rate of growth is to be realised; a significant rise in investment, absent major structural changes, will entail large investments within the primary and rural non-mining sector of the economy; and higher productivity growth will ease the need for very large increases in investment.

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Aggregate GDP, that is, the money value of all goods and services produced in Papua New Guinea, grew by 2.7 and 2.8 per cent in 2003 and 2004, respectively. This is welcome news given the contraction in GDP in the three years from 2000 to 2002. However, the positive rates of growth for 2003 and 2004 are only marginally greater than the 2.5 per cent rate of annual increase in Papua New Guinea's population and thus insufficient to provide significant increases in per capita income for several generations of Papua New Guineans. 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 gross national income (GNI), it will take some 306 years for per capita incomes in Papua New Guinea to catch up with the 2004 level of per capita income of Fiji of US\$5,700. Even this would not be a significant achievement, given that Fijian incomes are far from being high in comparison to other developing economies.

These comparisons clearly demonstrate the need for Papua New Guinea to break away from the low rate of growth in income of the past. The focus of the analysis here is the consideration of strategies for raising the rate of growth of income. This article assumes a target growth rate of per capita income of 6



per cent per annum. Together with an annual population growth rate of 2.5 per cent, this target implies that aggregate GDP would need to grow on average by 8.5 per cent. The target rate of growth of income is well above historical rates, but the majority of the population is likely to remain poor unless a break is made from the past. Even with per capita growth in income of 6 per cent annually, the income level would only double every 12 years. If this target is achieved, then the current level of per capita income of US\$2,300 will double to US\$4,600 by 2006. This would still leave Papua New Guinea behind 2004 levels of per capita income in Fiji and Samoa.

A significantly higher rate of growth than that experienced in the past is critical to raising the welfare of the general population, but this on its own is not sufficient for widespread improvements in wellbeing. The fruits of growth would need to be equitably distributed to improve wellbeing in the wider population—an issue that deserves attention, but only after a higher rate of income growth is achieved. Raising the rate of growth, therefore, has priority over redistribution.

The following analysis employs a neoclassical growth framework to model the growth process in Papua New Guinea and to draw implications from the model. There are two major findings from this analysis: the rate of growth of total factor productivity in Papua New Guinea would have to be increased several fold and the rate of investment would have to be doubled if output growth is to be raised to the target level. The latter is somewhat easier to address via implementation of policies, and this is considered first. Raising productivity growth will entail significant restructuring of the economy and this issue is taken up second.

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.

This analysis takes the Hicks-neutral form of the neoclassical production function, that is,

$$Y = AF(K,L) \quad (1)$$

where the function F is assumed to be positive, and concave. The Cobb-Douglas representation of Equation 1, satisfying all of these assumptions, is given by

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

where Y 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 output-elasticities of capital and labour, respectively.

We can differentiate Equation 2 to obtain the growth accounting identity

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

where a ' $\hat{}$ ' 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 Equation 3 is an identity, the rate of growth of capital is deduced by rearranging terms in Equation 3 as follows

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

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 Equation 4, the gross investment ratio, as

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

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, the growth rate 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.

Simulation results on the 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 income is set at 6 per cent per annum; the population growth rate is set at 2.5 per cent, which implies that the target for the rate of aggregate GDP is 8.5; the rate of depreciation is set at 10 per cent; the labour force growth rate is set at 2.5 per cent; and the capital–output ratio is assumed to

be 2.0. 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 : 1.5, 2.0 and 2.5. Labour’s share in output, β , is assumed to be 65 per cent, with the residual 35 per cent of output, α , assumed to accrue to owners of capital. The sensitivity of the required rate of investment is tested in the simulations reported below by varying the values of the above-mentioned parameters.

Table 1 provides the results of six simulations based on separate assumptions about the parameters in Equation 5. In each row the values shown in bold are calculated after the values of the remaining parameters are taken as given. The first row shows the value of g , the rate of productivity growth, given the rate of growth of income in 2004.

Row 1 shows that if capital growth equals the rate of growth of income,¹ then productivity growth for 2004 was a mere 0.2 per cent. This rate of productivity growth is particularly low in comparison with other developing countries. The first message from this analysis is that the rate of productivity growth would need to be raised some ten-fold if the target rate of growth is to be realised. How this may be done is discussed later.

Rows 2 to 4 impose annual productivity growth rates of 1.5, 2.0, and 2.5 per cent,

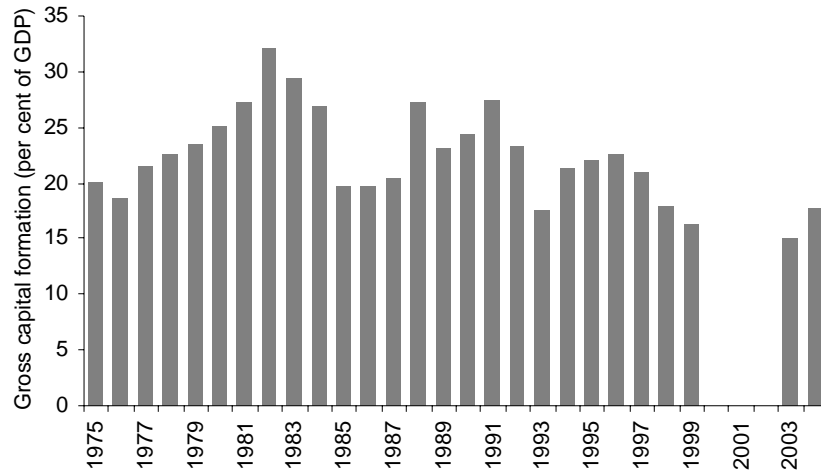
Table 1 Implied investment rates given a range of parameter values

Row	\hat{Y}	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.



Figure 1 Gross fixed capital formation in Papua New Guinea, 1975–2004 (per cent of GDP)



Note: Data for 2001 are not available.

Source: World Bank, 2005. *World Development Indicators*, World Bank, Washington, DC. Available online at <http://www.worldbank.org> (accessed 8 December 2005).

respectively. Even if by some miracle, Papua New Guinea achieves a rate of productivity growth similar to that of other well performing developing economies, the prevailing rate of investment is well below the rate required to achieve the set growth target of 6 per cent. The last column shows that the prevailing investment rates would have to nearly double if Papua New Guinea were to achieve the set growth target.

Gross capital formation peaked in 1982 at 32 per cent but has since fallen with the 2004 figure of 17.7 per cent just 55 per cent of the corresponding figure for 1982. If growth is to be raised, clearly the rate of investment has to rise significantly. The question remains as to where this rise is likely to come from. Table 2 reports the projected rates of growth of real GDP by sector as provided by Papua New Guinea's Department of Treasury. The projected rates of growth of GDP for the period from 2005 to 2010 are

well below the target rate; thus per capita GDP to 2010 will only grow by a maximum of 1 per cent per annum.

A target rate of growth of 6 per cent 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), this doubling of investment would have to take place equi-proportionately across the sectors. Agriculture, forestry and fishing, the largest sector, would thus absorb the bulk of the increased investment.

Calculations based on data for 2004 show that an investment rate of 30 per cent of GDP would equal to K4.1 billion. This is a 76 per cent increase 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. This 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 reduced if there is higher 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 conclusion begs the question of how can productivity be raised, even over the long term.

Policy implications

The required rate of investment is lower, given higher productivity growth. The productivity growth could materialise from a higher rate of growth of effective labour and from the use of better technology such as higher yielding crops. 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 per cent per annum in Table 1.

A number of developing economies have grown rapidly as the result of labour movement from low productivity subsistence agriculture into higher productivity secondary and tertiary sectors of the economy. Labour

is drawn out of lower productivity agriculture by the better rewards offered in the manufacturing and service sectors of the economy. The recent growth in the coastal provinces of China and Vietnam provides anecdotal evidence in support of this proposition. The process in Papua New Guinea 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 investment in skills acquisition that, in turn, has exacerbated the problems of low investment in the 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 is to reverse this 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 rise, leading to a rise in labour productivity in the sector. Growth in the secondary and tertiary sectors draws resources, labour in particular, out of the primary sector. This characterisation of a growing economy raises the question of why the secondary and tertiary sectors of Papua New Guinea's economy have remained small and are projected to remain so over the medium term.

Some 85 per cent of the population live in the rural sector and draw their livelihood from the primary sector, while agriculture, fisheries and forests account for some 37 per cent of GDP. Given the projected output growth rates (Table 2), these figures are unlikely to change soon. It is imperative, therefore, that strategies to boost investment in the primary rural sector are developed. Accompanying this could be a targeted strategy aimed 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 investment in the primary sector. Most of these impediments are well known; the challenge is in targeting obstacles whose removal will give the maximum increase in agricultural output. As an example, infrastructure improvements in the coffee growing regions may give a larger return from increased output relative to similar outlays within the copra producing regions. Analysis of this detail can only be undertaken within the National Planning Office, but the basic principles are relatively simple to implement. This exercise would not amount to 'picking winners'.

The K1.8 billion-question is where will these investment funds come from. The bulk of the funds would have to come from the global capital market, given Papua New Guinea's limited domestic savings. These funds would, in all likelihood, be sourced from 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-term 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 it will be decades before these sectors will be in a position to drive the growth of GDP. Moreover, Papua New Guinea's future workforce has to be equipped with the education and skills to be able to respond to income opportunities offered elsewhere.

Conclusions

This article uses the neoclassical growth model to analyse the strategies for raising the per capita growth of income in Papua New Guinea to a target rate of 6 per cent over the long term. The analysis is confined to considerations of raising income growth rather than how to redistribute this income

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	3.5	3.3	3.4	3.6	4.0	3.8
Oil and gas extraction	5.6	3.4	-8.9	-17.2	111.4	55.1
Mining and quarrying	0.3	5.8	6.1	3.2	-8.1	15.3
Manufacturing	2.9	3.0	3.1	3.5	4.0	5.0
Electricity, gas and water	2.7	2.7	2.8	3.0	3.5	3.5
Construction	4.8	5.0	5.1	5.1	-	-
Wholesale and retail trade	2.7	2.7	2.8	3.1	3.5	4.0
Transport, storage and communication	3.0	3.0	3.0	3.5	4.0	4.0
Finance, real estate and business services	2.5	2.5	2.5	2.6	3.0	3.5
Community, social and personal services	1.7	2.2	2.2	2.4	2.5	2.5
Total GDP	3.2	3.1	3.3	3.6	3.1	3.2

Source: Papua New Guinea Department of Treasury, Port Moresby.



Table 3 Shares in GDP of the 10 major sectors, 2005 to 2010 (per cent)

	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: The columns do not total to unity, the discrepancy is approximately 4 percentage points.

Source: Calculated using primary data from the Department of Treasury, Port Moresby.

to bring about an improvement in the wellbeing of the general population. The challenge of raising the rate of growth of income precedes the challenge of redistribution. However, the latter issue must be on the research agenda.

The prevailing rate of growth of purchasing power parity (PPP) adjusted per capita income in Papua New Guinea of around 0.5 per cent 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 Papua New Guinea would still be well below the current, that is 2004, level of per capita income in Fiji, Tonga, and Samoa. Even at the target rate of growth of per capita income of 6 per cent, the level of per capita income would only double every 12 years.

Clearly the rate of investment and the rate of productivity growth both need to rise to achieve the growth target. The highly stylised neoclassical growth model used shows that the investment rate would have to nearly double from the 2004 rate, while productivity growth may have to increase ten-fold. At least in the short term, most of the increase in investment would have to take place within

the non-mining, primary sector. Over time, the economy would undergo structural change with labour moving out of the rural and agricultural sector into the secondary and tertiary sectors. Such labour mobility would be enhanced through increased investment in human, physical, and financial capital. Policies conducive to labour mobility need to be in place well ahead of time.

Note

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

References

- Rao, B., 2004. 'The relationship between growth and investment', *Pacific Economic Bulletin*, 19(3):64–73.
- World Bank, 2005. *World Development Indicators*, Washington, DC. Available online at <http://www.worldbank.org> (accessed 8 December 2005).