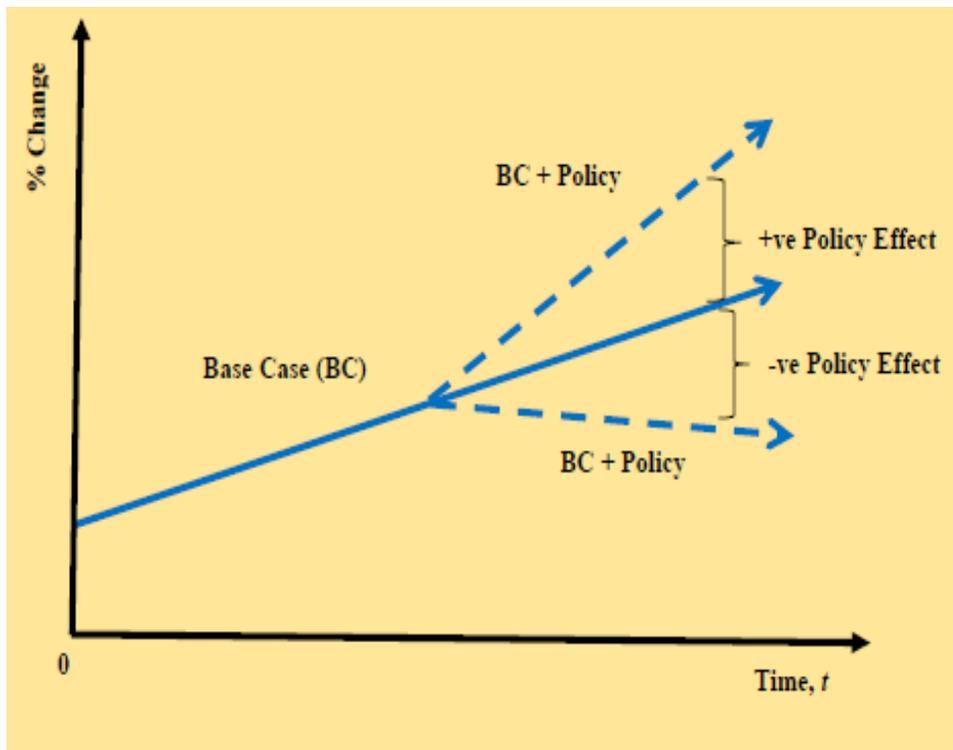


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MID-YEAR REVIEW AND FORECAST OF THE PNG ECONOMY

JULY 2015



The National Research Institute

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JULY 2015

by

Theo Levantis and Osborne Ogis Sanida

NRI
The National Research Institute

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Theo Levantis and Osborne Ogis Sanida

ACRONYMS

ADB	Asian Development Bank
BPNG	Bank of Papua New Guinea
CGE	Computable General Equilibrium
GDP	Gross Domestic Product
GRP	Gross Regional Product
IMF	International Monetary Fund
LNG	Liquefied Natural Gas
MYEFO	Mid Year Economic and Fiscal Outlook
NRI	National Research Institute
NSO	National Statistical Office
OPEC	Organization of Petroleum Exporting Countries
PNG	Papua New Guinea
PNGGEM	Papua New Guinea General Equilibrium Model
SWF	Sovereign Wealth Fund

EXECUTIVE SUMMARY

This report is the National Research Institute (NRI)'s contribution to public policy analysis and debate on the performance of the Papua New Guinea (PNG) economy. As a public policy think tank, the NRI is mandated to provide an independent analysis of the economic performance of the country. This is the first of an on-going series of reports on the review and forecast of the PNG economy that the Institute will undertake independently every six months (one in July and one in December).

For this report, first a review of the economic performance was done for the 1975-2014 period. Taking a look back (i.e. history) puts things into perspective, when discussing the prospects of the economy. Analysis on the past performance of the economy is done via trend analysis of various data/information from official sources.

The key conclusions from the historical analysis were:

- During the first three decades (1975-2004), the economy did not do well with an average real GDP growth rate of just 2.5 per cent, which was lower than the average population growth rate of 2.7 per cent.
- The non-mining average GDP growth rate (i.e. broad-based growth) was worse at just 2 per cent.
- During the next decade (2005-2014) economic performance was remarkable, growing at an average of 7.8 per cent, which was amongst the highest in the world. This strong growth was driven by both the upstart of the LNG project and strong growth in the non-mining sector driven by the key enablers (such as land, education, health, transport, electricity and communication infrastructures).

Forecasts were then done using the Papua New Guinea General Equilibrium Model (PNGGEM), the economy-wide model of PNG that has been developed over 20 years and used extensively in academic research and more recently by the PNG Government (see Appendix 1 for a summary of the model). The forecast period is 2015-2024.

The forecast results are determined by the assumptions adopted in the model. These assumptions are stated and justified in the Report (with the key ones re-stated in Appendix 2). The key results for the forecasts are as follows:

- **Economic growth:** GDP growth is forecast to grow at an average of 7.7 per cent per annum (with non-mining GDP at 7.3 per cent).
- **Commodity prices:** For most commodities that PNG produces, the outlook does not look promising due to lower oil, LNG, gold, copper and nickel prices, and weak prices for most agricultural commodities.

- ***Mining, oil and gas:*** The sector is likely to continue strong growth driven by the commencement of a new LNG project (Total LNG); Solwara 1 Project; and new mines, Frieda, Wafi-Golpu, Woodlark, and Mt Kare.
- ***Growth by demand, regions and sectors:*** In terms of demand, strong annual average growth is expected for all components, with exports the strongest at 12 per cent. For regional growth, the highest is expected to be the Islands region (8.8 per cent). For sector growth, all sectors are expected to have strong positive growth with the agricultural sector the highest at an average of 8.7 per cent per annum, driven by initiatives to invest in the enablers.
- ***Employment prospects:*** Over the next decade, employment is expected to rise by 431,000 fulltime equivalent jobs, which is to be mainly driven by the agriculture sector. The majority of the jobs are expected in the rural areas.
- ***Fiscal outlook:*** Deficit financing is expected in 2015 and 2016 and from 2017 onwards it is envisaged that fiscal tightening to account for the SWF will return the budget to a surplus. Consequently, public debt will decline with the fiscal tightening.

1. INTRODUCTION

This report is the National Research Institute (NRI)'s contribution to public policy analysis and debate on the performance of the Papua New Guinea (PNG) economy. As a public policy think tank, the NRI is mandated to provide an independent analysis of the economic performance of the country. This is the first of an ongoing review of the PNG economy that the Institute will undertake every six months (one in July and one in December).

Official government reviews and forecasts of the economy are done by the Department of Treasury and the Bank of Papua New Guinea (BPNG). The NRI's review of the PNG economy is not meant to compete with the official government reviews and forecasts but to provide an alternative and independent assessment of the economy.

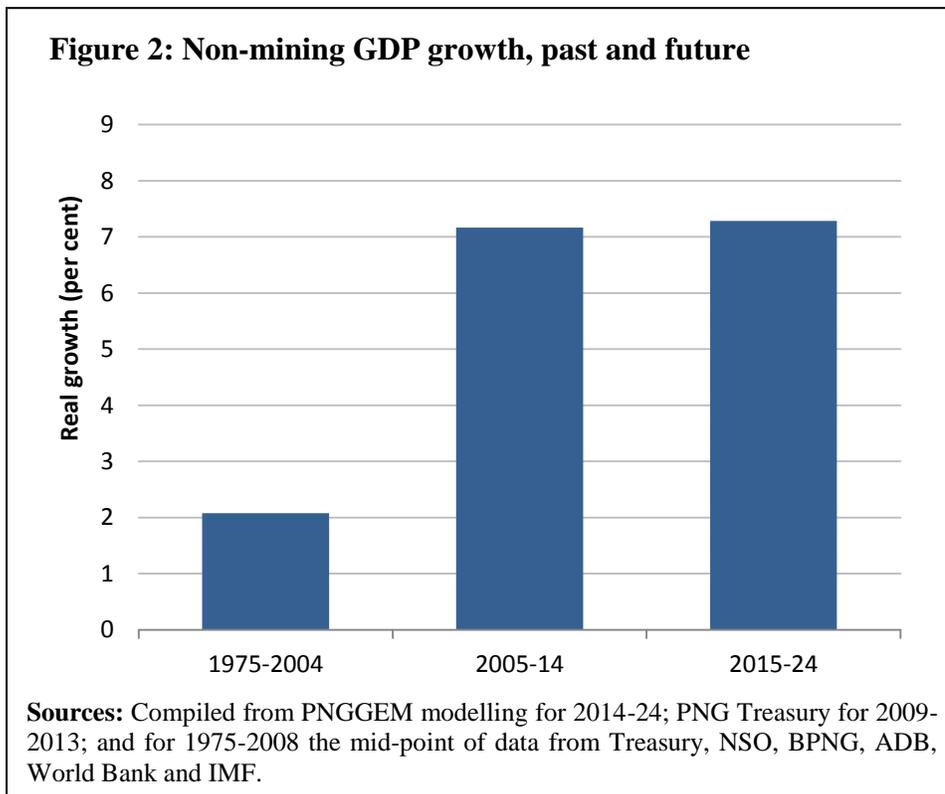
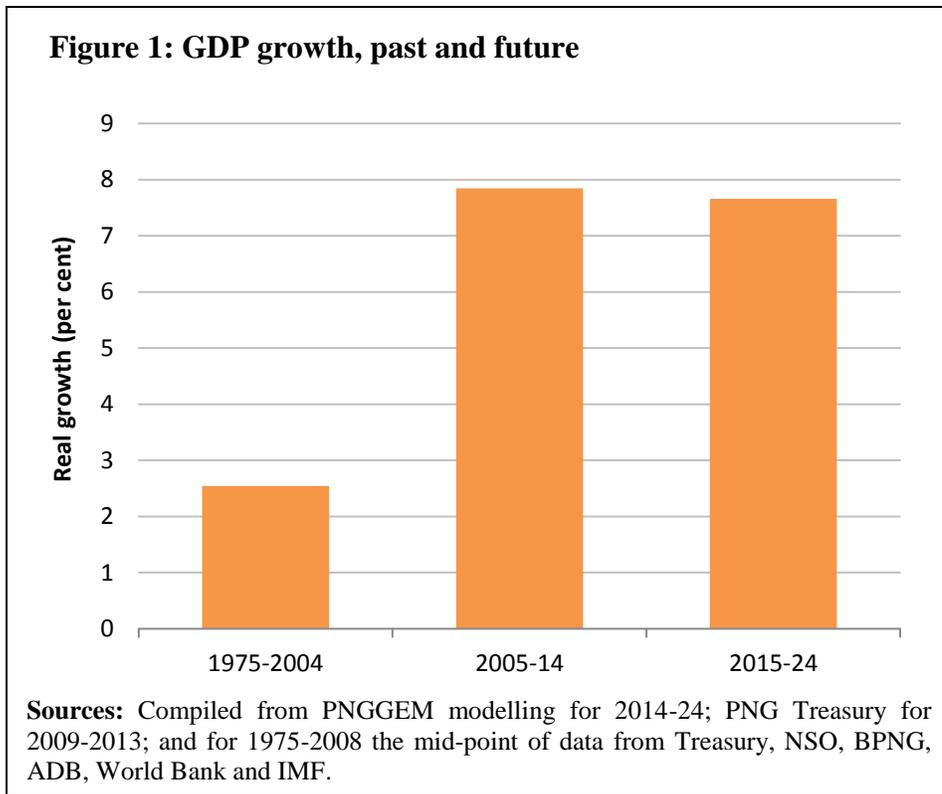
The update of the economy is done by looking at the past and future prospects. Past performance is done via trend analysis of various data/information. Forecasts are done using the Papua New Guinea General Equilibrium Model (PNGGEM), the economy-wide model of PNG that has been developed over 20 years and used extensively in academic research and more recently by the PNG Government. PNGGEM has an excellent forecasting record. For example, PNGGEM forecasts calculated in 2010 and presented in the PNG Development Strategic Plan 2010-2030 proved to be robust and reliable and substantially more accurate than official forecasts of the time. The key features of the model and assumptions (for this study) are provided in Appendix 1 and Appendix 2, respectively.¹

The rest of the report is organised into eight sections. Section 2 provides a historical context of the PNG economy. Section 3 discusses PNG's economic growth in the next decade. Section 4 provides a brief on the performance of PNG's commodities in the global market. In Section 5, we discuss the prospects for the mining, oil and gas sectors. An analysis of the growth by demand, regions and sectors is undertaken next in Section 6. Section 7 and Section 8, respectively, discuss the employment prospects (2015-2024) and the fiscal outlook (2015-2024). The last section concludes.

2. THE HISTORICAL CONTEXT OF THE PNG ECONOMY

Before examining PNG's economic prospects, it is well worth taking a look back to put things into perspective. The first three decades of independence did not go well for PNG. Economic growth averaged just 2.5 per cent from 1975 to 2004 — lower than the average population growth rate of 2.7 per cent (Figure 1). A better barometer of economic performance for the general population is non-mining GDP growth, and this fared even worse, averaging 2.0 per cent (Figure 2). These findings would be no surprise for the everyday Papua New Guinean with declining services and incomes typical over this era.

¹ Details of the model can be sourced from the model's documentation in Levantis (2004), which will be made available on the NRI website (www.nri.org.pg).



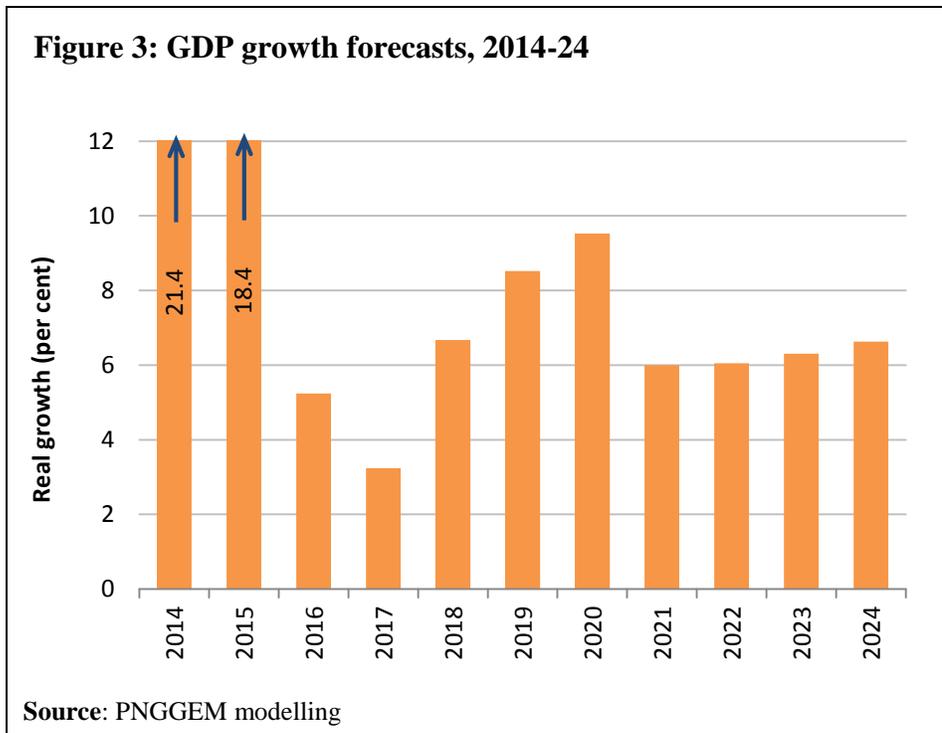
Against this backdrop, the transition over the most recent decade has been quite remarkable. Average GDP growth has lifted to 7.8 per cent, which is amongst the highest in the World. The LNG Project has played an important role in this with the investment phase and now production providing a big stimulus. But this only tells part of the story with the role of LNG often being overstated. After all, the stimulus in the previous era provided by the Kutubu Oil Project was at a similar scale as the LNG Project in relation to the size of the economy, yet in the 1990s when investment and production at Kutubu occurred, growth averaged only 5.0 per cent. More tellingly, non-mining GDP growth averaged just 3.0 per cent.

The big story is the surge in non-mining GDP growth which has lifted to an average of 7.2 per cent over the years 2005-2014 (Figure 2). This points to other factors underpinning the transition in the PNG economy and the key factors are what the Government refers to as the enablers — land, law and order, education, higher education, health, transport infrastructure, electricity infrastructure and communications infrastructure. Over the first three decades, progress on each of these enablers was either non-existent, or went backwards. The surge in non-mining GDP growth over the last decade coincides with a new found impetus to making progress on each of these enablers. A particular example is the surge in mobile phone access which has revolutionised society in PNG and provided profound benefits for business and investment across both rural and urban PNG.

In formulating the economic forecasts for the next decade, a presumption is that the progress being made will continue. The Government's long term planning agenda spelled out in Vision 2050 and the PNG Development Strategic Plan 2010-2030 points this way. If the drive to make progress against the enablers were to stop it is clear what would happen — the trajectory of the PNG economy would revert back to the stagnation of the first three decades and the forecasts reported here will be off-track. The forecasts are developed using PNGGEM.

3. ECONOMIC GROWTH IN THE NEXT 10 YEARS

Broad based economic growth as measured by non-mining GDP is forecast to average 7.3 per cent a year over 2015-2024 — continuing the trajectory of the previous decade (Figure 2). GDP growth is expected to more than match this, averaging 7.7 per cent and hence dropping only slightly from the previous decade (Figure 1). Much of this growth in GDP will occur in 2015 with growth expected to reach 18.4 per cent on the back of the first full year of LNG production (Figure 3). This World leading growth follows an even higher outcome expected for 2014 of 21.4 per cent.



The 2014 result is due to the early start-up of LNG production in May of that year with production reaching about half of expected annual production during the course of 2014. It is worth reflecting at this point that these figures demonstrate that the size of the economy will not double as a result of LNG production as was claimed in the media and in political circles when the LNG Project first entered its construction phase. Instead, the economy in 2015 will be about K11 billion larger than it would have been without the project, equivalent to a gain of about 30 per cent .

It is also important to clarify that these findings will differ significantly from official GDP figures. The methodology used in compiling the official GDP numbers is based on an economic structure that is about three decades out of date. As a result, for a number of years now, GDP has been understated in times when the minerals sector is strong, and has been overstated when the minerals sector is weak. The problem relates to both historical data and official forecasts. In 2014 and 2015, the statistical problem becomes a major discrepancy due to the size of the LNG Project. The error in these years could be 5 percentage points or more. The PNGGEM modelling methodology does not face these structural issues as it updates the economic structure each year.²

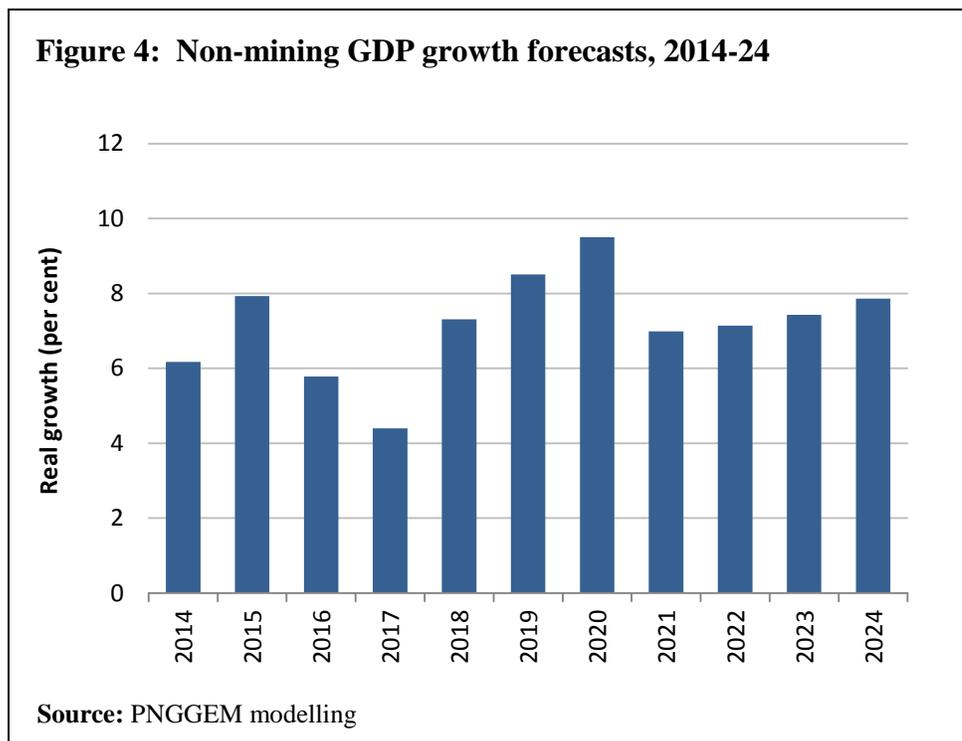
To give an idea of the problem, according to the figures reported in the 2015 Budget, the start up of LNG added about K4.4 billion to GDP in 2014. As this is the first time LNG is produced, it doesn't need to be "deflated" to put it into real terms. As such, LNG alone accounted for 12.9 per cent of real GDP growth in 2014 based on the 2015 Budget numbers. However, total real GDP growth was reported to be 8.4 per cent. This means that if the numbers are to be believed, then

² A separate paper will be prepared to provide detailed explanations on the differences in the methodology and how some improvements can be made. Relevant institutions like the Treasury Department, BPNG and NSO will be invited to comment.

the non-LNG economy shrunk by about 4.5 per cent in 2014. The error occurs because the LNG sector is shrunk in compiling the statistics so as to represent a much smaller part of the economy than is the reality.

These big rises in GDP for 2014 and 2015 won't be felt in PNG because most of the revenues from the project will remain abroad. The bulk of revenues that do come to PNG will be channeled into the Government Budget through taxes and dividends, and there is a lag time for this to happen of months, if not years. Consequently, a better representation of the performance of the economy in 2014 and 2015 are the non-mining GDP estimates for these years of 6.2 per cent and 7.9 per cent, respectively (Figure 4). These are still very strong results and reflect increases in Government spending and the linkages of LNG production to the domestic economy.

The estimate for 2014 compares with 1.2 per cent non-mining GDP growth reported by Treasury in the 2015 Mid Year Economic and Fiscal Outlook (MYEFO) (Department of Treasury, 2015). Reconciling the two estimates is difficult. If the Treasury estimates are correct it would mean the economy has turned down sharply compared to the trend rate of non-mining growth of 7.2 per cent recorded over the last decade. Deciphering such a large drop in economic activity is difficult given the sharp fiscal expansion that occurred in 2014. However, whatever number is correct is not possible to determine with any degree of certainty due to the very poor state of collections of economic statistics. The Treasury forecast for 2015 is similarly pessimistic with non-mining GDP growth of 3.3 per cent. It is claimed in the MYEFO that this is the “trend rate”, when clearly this is not true given that the average over the last decade was 7.2 per cent.



The outlook for 2016 and 2017 is less promising, largely as a result of the need for the Government to rein in spending. In 2016, GDP growth and non-mining GDP growth are forecast at 5.2 per cent and 5.8 per cent, respectively, and in 2017 these are expected to drop to 3.2 per cent and 4.4 per cent (Figures 3 and 4). Some anticipated mining start-ups over the years 2018-2020 (e.g. Frieda and Wafi-Golpu) should see growth build back up before settling at a sustained GDP growth rate in the next decade of about 6 per cent and a non-mining GDP growth rate of 7-8 per cent. However, the growth forecasts post-2020 should be thought of as conservative as the LNG Project led by the Total consortium has not been incorporated in the modelling, but is highly likely to proceed (discussed later).

One qualification explained earlier about the strength of these forecasts over the longer term is that the modelling assumes that the Government will continue to make progress on the enablers. Progress has been made over the last decade and there is no reason to suggest progress would not continue with the same impetus.

However, there is another qualification that could threaten growth. If the proposed Sovereign Wealth Fund (SWF) is structured so that large amounts of money are diverted from the Budget to build up the Fund, then the resources needed to continue to make progress against the enablers may not be available, in which case PNG will risk reverting back to the growth path of the first three decades after independence. The medium term outlook of the 2015 Budget points to this scenario with sharp cuts in funding outlined for the enablers whilst the Fund balance grows. The modelling analysis goes against the official outlook by assuming that it will not eventuate and so any deposits in the early years of the SWF will be relatively small. In the face of political realities and the importance of continuing to invest in the enablers, this scenario of large funds being diverted away from the enablers is considered unrealistic. The Organic Law for the SWF was passed by Parliament (76-4) on the 30th July 2015.

4. GLOBAL MARKETS FOR PNG'S COMMODITIES

For most of the commodities produced in PNG, the outlook for prices does not look promising. According to World Bank analysis, global prices across a broad range of agricultural commodities are expected to drop in 2015 as a result of lower oil prices. This is due to the high energy intensity of agricultural production and hence lower production costs. Amongst all the main tree crop exports of PNG, prices are expected to drop in 2015 and continue to be subdued over the next decade (Table 1).

Table 1: Prices for PNG's Commodities, 2014-25

		2014	2015	2016	2017	2020	2025
Coffee Arabica	US\$/tonne	4,473	3,547	3,430	3,480	3,430	3,335
Cocoa Beans	US\$/tonne	3,063	2,987	2,950	2,884	2,616	2,302
Coconut Oil	US\$/tonne	1,280	1,150	1,122	1,095	1,017	900
Palm Oil	US\$/tonne	739	655	673	683	628	672
Hardwood logs	US\$/M ³	282	252	262	266	281	334
Copper	US\$/tonne	6,863	5,971	6,046	6,090	6,220	6,677
Nickel	US\$/tonne	16,893	13,735	13,740	13,968	14,541	16,372
Gold	US\$/ounce	1,266	1,240	1,225	1,211	1,168	1,100
Oil	US\$/barrel	96.2	56.0	60.7	64.1	72.9	101.4
Natural Gas	US\$/MMBTU	16.5	12.7	12.7	12.8	13.1	14.1

Notes: IMF forecasts are sourced from the Research page on the IMF Website; World Bank forecasts are sourced from *Commodity Markets Outlook, April 2015*, available on the World Bank website. The forecasts from 2015-2020 are averages of the two sources, except for gold and coconut oil for which forecasts are only available from the World Bank. The 2021-2024 forecasts are based on midpoint of IMF and World Bank Estimates. The forecasts for 2025 are based on the percentage change forecasts of 2020-25 of the World Bank.

In 2014, Arabica coffee prices benefited from a drought in Brazil, but the spike in prices was temporary and prices are already returning to more normal levels (Table 1). Cocoa prices have been held back by the rapid growth of production in the Ivory Coast which now accounts for 40 per cent of global production. The outlook of continued healthy growth in production is expected to lead to a drop in prices of about 25 per cent over the next decade. However, like coffee, cocoa production can be unpredictable as natural weather events and disease often impact major producers without warning.

Palm oil prices are expected to continue their weak trend as a result of large increases in global production in recent years. Since 2005, global production has almost doubled. Another important factor is a drop off in global demand due to the increasing environmental concerns associated with palm oil – particularly as a result of clearing virgin rainforests, as happens in PNG. These circumstances have dashed earlier hopes of palm oil representing an environmentally friendly biofuel. Prices for log exports, are expected to show a steady rising trend over the next decade due to the declining availability of virgin forests, particularly with pressure faced by PNG and other countries to improve the sustainability of logging.

Copper prices have weakened in recent years due to large increases in supply that have more than matched a surge in demand from China. For 2015, a 13 per cent drop is expected before recovering over the rest of the next decade (Table 1). The drop in prices in 2015 is consistent with markets for other metals and is due to less robust growth in demand from China – by far the leading global consumer of metals.

Nickel prices have weakened even more as a result of a slowdown in the growth of demand for stainless steel, and a surge in supply. The recently commissioned Ramu nickel mine near

Madang is one of the mines that boosted global supply in recent years. A recovery in nickel prices is expected in the coming years, but prices will drop significantly in 2015.

Gold prices are less influenced by supply from mine production and more influenced by demand from financial markets and policy decisions on holdings of gold reserves by Central Banks. As markets have gradually become more stable and the outlook for the US and European economies have improved, gold prices have steadily declined as investors move to other more risky forms of investment. The ongoing issues with the debt crisis in Greece has helped to underpin gold prices. However, the long term outlook is for a further steady weakening of gold prices as the global economy continues to gradually improve.

After a number of years of high and stable oil prices of around US\$100 a barrel, prices have collapsed and are expected to average just \$56 a barrel during 2015 (Table 1). This is bad news for the profitability of PNG's oil industry, and it means that corporate tax revenue raised from the industry will be slashed. However, prices are forecast to steadily recover over the next decade, returning to the levels prior to the collapse.

The cause of the crash in oil prices has more to do with strategic manipulation of the market by the Organization of Petroleum Exporting Countries (OPEC) than any fundamental demand or supply issues. OPEC mainly comprises the big oil producers of the Middle East and their dominance of global production has come under threat from the rapid emergence of new supplies coming on the market, particularly from the United States. By increasing supply and forcing prices down, OPEC hopes to drive the emerging producers out of the market. Only a change in strategy or some other unforeseen supply disruption would see prices recover quickly.

Contrary to what has often been stated by economic commentators in PNG, there is no direct link between prices for oil and LNG. This is because PNG's LNG exports go to the East Asian market, particularly Japan, and are mainly used for electricity generation. There is therefore no direct link between the markets for East Asian LNG and for oil because gas and oil are not normally used as substitutes. There are three relatively unconnected global markets for gas — the East Asian market, the European market, and the North American market. Trade between these markets is almost non-existent and this is reflected in a sharp discrepancy in prices between the three markets — for example, gas prices in the East Asian market are more than 4-times higher than in the North American market.

But despite there being no direct link, sentiment for LNG prices in the East Asian market is still influenced by oil prices and in a twist of bad timing, prices have also dropped and are forecast to be 23 per cent below 2014 levels in 2015. The problem appears to be much worse for PNG's LNG exports. According to financial reports for Oil Search, a major shareholder in the LNG Project, the average actual price received for LNG exports in 2014 was US\$13.90 and for the first half of 2015, US\$10.20. These prices are close to 20 per cent below market spot prices (Table 1) and are likely to reflect contractual prices set some years ago at the time the LNG Project commenced. It is also possible that the contract prices are pegged in some way to oil prices. This would help explain why the LNG Project has failed to capitalise on the high prices available in East Asian markets. Given that exports of LNG in 2015 will be about K12 billion, the 20 per cent shortfall in prices has cost about K2.4 billion.

However, these weaker returns need to be put in the context of the high prices attained for LNG in the East Asian market over the last few years due to the nuclear catastrophe in Japan and the subsequent switch from nuclear power to LNG electricity generation. Japan is by far the World's biggest importer of LNG. With this in mind, the LNG Project was established within the context of much lower price assumptions for LNG. Prices are expected to recover only modestly over the next decade as electricity generation in Japan switches back to nuclear and as renewable technologies are increasingly adopted.

5. PROSPECTS FOR MINING, OIL AND GAS³

The ExxonMobil LNG Project has been a big success for the reputation of PNG as a good place to invest in mining and petroleum. Production began ahead of schedule and ramped up to full capacity quickly. In comparison, the establishment of the new LNG Projects in Northern Australia have been problematic and slow. Now, the next LNG project led by the French company Total has been officially declared by management as highly likely to proceed with production expected early next decade. The Total LNG Project will be of a similar scale to the ExxonMobil Project and will be low cost by international standards — half the cost of the Australian LNG projects — so should be both secure and highly profitable. This is promising for PNG as the main benefits to be derived from the project is the taxation of profits — as is the case for other mining and petroleum projects. The experience with the ExxonMobil Project points to a substantial impact for the PNG economy well before production starts during the investment phase.

In contrast to LNG, mining has not fared particularly well for PNG over recent decades. The Bougainville mine was shut down in the late 1980s, major environmental issues have surrounded the operation of the Ok Tedi mine, the Lihir Gold mine has failed to deliver any significant revenues to the Government despite tens of billions of Kina in gold being extracted and sold, and most recently, the Ramu nickel mine has had a problematic beginning and is unlikely to bring tax revenues for many years. The Hidden Valley gold mine is also unprofitable returning little to the State. Despite this track record, exploration activities have continued in PNG and there are some exciting prospects on the horizon.

The Frieda copper and gold project is at an advanced stage of planning and is looking likely to proceed. The project is located in Sandaun Province and is expected to be of a similar scale to the Ok Tedi and Bougainville mines – making it one of the World's largest copper and gold mines. The investment phase is likely to begin in 2017 or 2018. At the Bougainville copper and gold mine, there remains substantial resource reserves and mining potential and it also may come to production over the next few years, depending on how the ongoing negotiations proceed. Looking further ahead into the next decade, the Star Mountains copper project looks promising with its location near Tabubil allowing the project to take advantage of the existing infrastructure that has been set up for the Ok Tedi mine. The Wafi-Golpu copper and gold mine near Lae has

³ Information about mining, oil and gas prospects is obtained from publicly available annual reports and publications in corporate websites as well as announcements posted in the Australian Stock Exchange.

the potential to start operations at the beginning of the next decade and is expected to be close in size to the Frieda mine.

The Woodlark gold project on Woodlark Island is approved and ready for the investment phase. The anticipated production of about 110,000 ounces of gold a year makes it about one-sixth the size of the Lihir gold mine, but a relatively low cost structure should see greater profits and hence benefits for PNG. Located near the Porgera gold mine, the Mt Kare gold project is of a similar scale to Woodlark and at a similar stage of development, however, there have been difficulties in securing financing which is likely to delay the project well into the next decade.

After a number of years of stalled negotiations with the Government, the Solwara 1 offshore mining project in the Bismark Sea is back on track with an agreement which sees the State taking a 15 per cent stake. The experimental nature of the Solwara 1 Project has raised concerns about environmental risks and these have the potential to stall the Project. There may also be financial risks associated with the new mining technologies, with consequences for potential Government revenue. However, the mining proposal suggests that costs will be low. Construction of the mining vessel – which will be 220 metres long and the size of an aircraft carrier — has already commenced and mining is planned to start in early 2018. Production from the deep sea mine will mainly be gold with the output of the project anticipated to be roughly half that of the Lihir mine.

6. ANALYSIS OF GROWTH BY DEMAND, REGIONS AND SECTORS, 2015-2024

Exports in real terms are anticipated to jump by nearly 30 per cent in 2015 following a 48 per cent surge in 2014 on the back of the LNG Project (Table 2). The result will be exports of about K25 billion in 2015 with nearly half coming from LNG exports. Over the next decade, export growth is expected to be modest apart from the years 2018-2020 when new mining developments will give exports a boost (Table 2). The rapid rise in Government spending in recent years is expected to end abruptly in 2016 and 2017 due to the need to contain the Budget deficit and this will have a cascading effect throughout the economy. As a result, imports are expected to fall in 2017 and there will be no growth in consumption. A resumption of normal growth in Government spending and the new mining developments at the end of the decade are expected to lead to a return of healthy growth across consumption, investment, exports and imports over 2019-2020, before settling on a more modest trajectory in the next decade.

Table 2: Forecast real growth in key macroeconomic variables

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Consumption	4.1	4.4	5.6	0.2	5.3	7.7	9.2	4.2	4.6	4.9	5.4
Investment	-3.0	3.6	7.2	6.4	9.1	11.6	15.1	1.5	2.7	3.5	4.0
Govt spending	7.8	12.6	1.9	-6.1	4.9	6.2	7.0	5.1	5.0	5.1	5.3
Exports	48.4	29.3	4.4	2.8	6.8	10.8	12.3	4.1	4.1	4.4	4.7
Imports	3.8	4.5	3.7	-3.1	5.8	10.2	13.2	0.1	0.9	1.4	1.8

Source: PNGGEM modelling

The distribution of growth across the regions of PNG is expected to be quite even according to the PNGGEM modelling analysis. Economic output in 2015 as measured by non-mining Gross Regional Product (GRP) is forecast to reach a healthy 7.6 per cent in the Southern region, 6.7 per cent in the Highlands, 8.5 per cent in Momase, and 8.1 per cent in the Islands region (Table 4). The robust growth across the regions is underpinned by the ongoing expansion in Government spending in the enablers as well as the economic linkages to the LNG Project. Non-mining rather than total GRP is considered the best measure of regional economic health since the main economic beneficiary of mining, oil and gas output is normally the central Government, not the provinces.

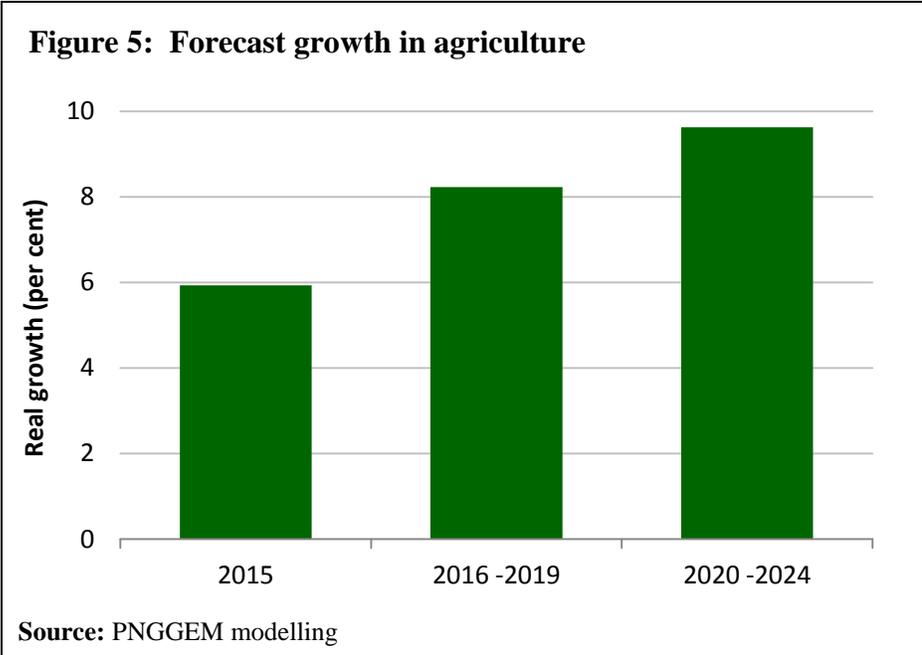
For the rest of the decade over the years 2016-2019, growth in non-mining GRP will drop a little across all of the regions as a result of the cuts in spending by the National Government (Table 4). Growth is expected to resume on a higher path from 2020-2024 in line with national patterns.

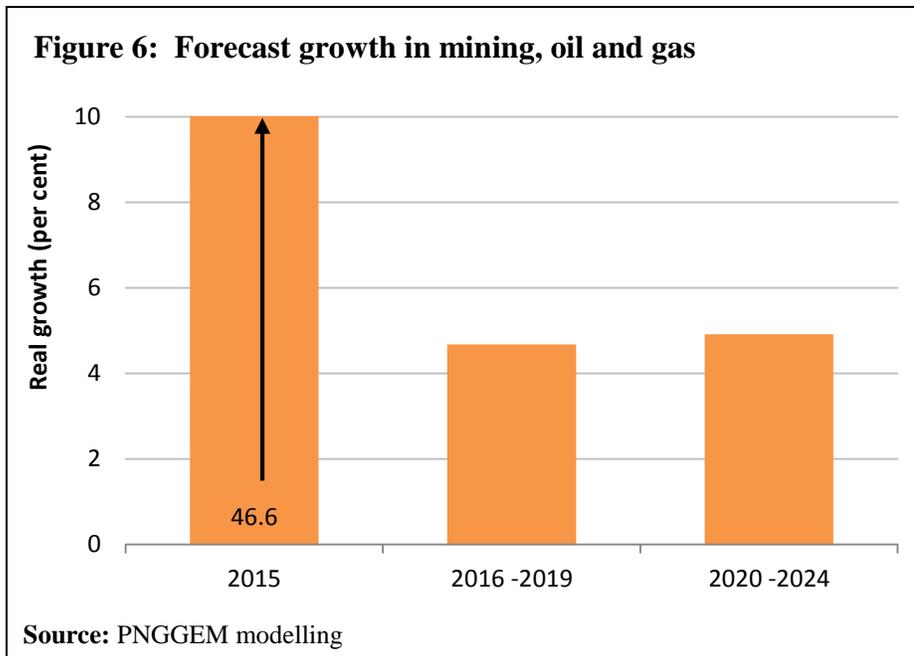
Table 3: GRP forecasts				
Region	2015	average 2016-19	average 2020-24	average 2015-24
Southern	8.1	6.2	7.5	7.0
Highlands	31.7	3.8	5.8	7.6
Momase	9.0	7.4	7.9	7.8
Islands	5.0	10.7	8.1	8.8
Source: PNGGEM modelling				

Table 4: Non-mining GRP forecasts				
Region	2015	average 2016-19	average 2020-24	average 2015-24
Southern	7.6	6.4	7.6	7.1
Highlands	6.7	6.4	7.7	7.1
Momase	8.5	6.6	7.7	7.3
Islands	8.1	7.6	8.6	8.2
Source: PNGGEM modelling				

For total GRP, more volatile results are expected, reflecting developments in mining, oil and gas across the regions. For example, the surge in Highlands GRP of 31.7 per cent in 2015 is due to the LNG Project (Table 3). Mining developments — particularly the deep sea mining project — are expected to bolster average GRP growth for the Islands region over 2016-2019. Weaker total growth for the Highlands region over the next decade reflects a lack of any new developments in mining, oil and gas — although the modelling assumes that the Total LNG Project is not going ahead.

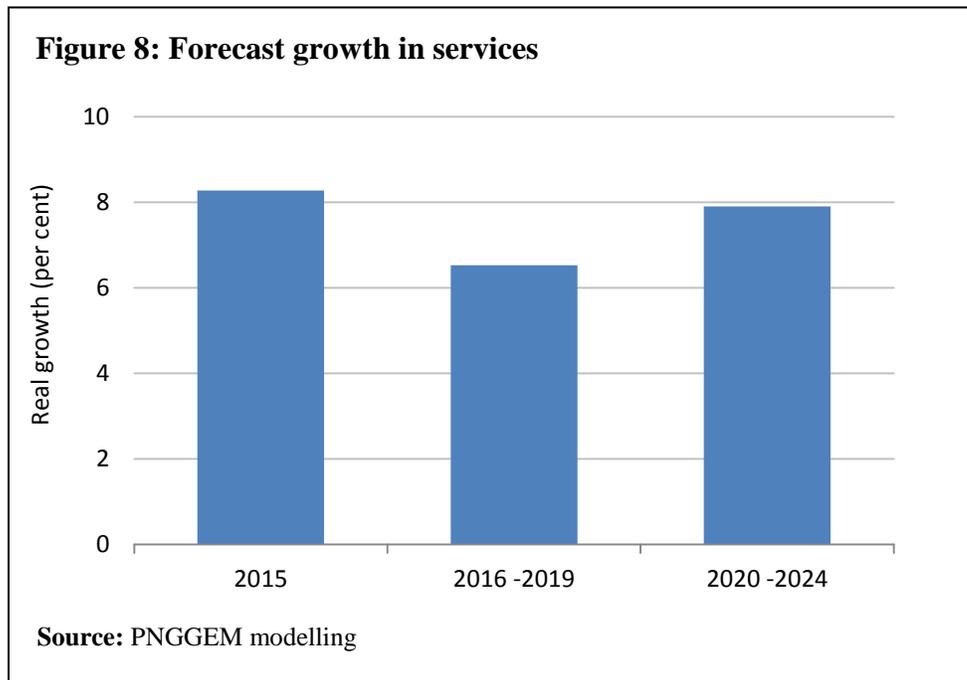
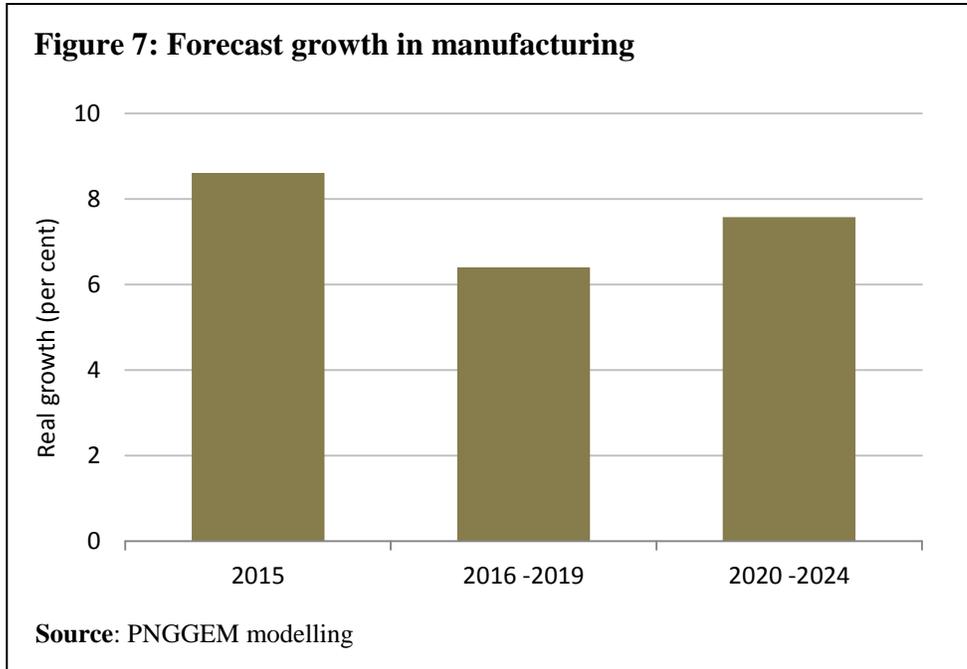
Growth in agriculture is expected to be steady in 2015, but lagging growth in other parts of the economy as a result of weaker prices across the range of tree crop exports (Figure 5 and Table 1). Despite continued weakness in commodity prices, growth is expected to pick up to an average of 8.2 per cent over 2016-2019, rising to a robust 9.6 per cent in the first part of the next decade. This optimistic forecast growth is driven by the assumption that the initiative to invest in the key enablers will continue, with rural PNG being a big beneficiary of improved infrastructure, land reforms, better law and order and better education outcomes. The accelerated growth in the next decade is partly driven by the productivity benefits of the first wave of secondary school graduates from the current education initiatives.





The mining, oil and gas sector of the economy is forecast to grow by 47 per cent in 2015 on the back of the first full year of production of the LNG Project (Figure 6). This follows a 86 per cent increase in 2014 when the LNG Project commenced. The sector is now nearly three times the size that it was before the Project in 2013. The build up of production at the Ramu nickel project is another contributor and has helped underpin the strong growth in GRP forecast for the Momase region in 2015. Gold and copper production is expected to be stable in 2015 with improved production from the Porgera mine expected to be offset by declines at the Tolukuma mine. Looking ahead over the next decade, modest average growth is expected for mining, oil and gas underpinned by the new projects discussed earlier, including the Frieda mine, Woodlark, and offshore mining. In the event that the Total LNG Project proceeds, the sector would grow further by 50 per cent or more.

Strong growth above 8 per cent is forecast for both manufacturing and services in 2015 (Figures 7 and 8). Higher Government spending is a key driver, but also the LNG Project due to its linkages through input purchases from these sectors. For the decade ahead, both manufacturing and services are expected to follow the overall trend for non-mining GDP with a dip over the years 2016-2019 followed by a recovery over 2020-2024 (Figures 7 and 8). The transport industry will be a particularly strong performer over the next decade as a result of the anticipated investments in transport infrastructure.

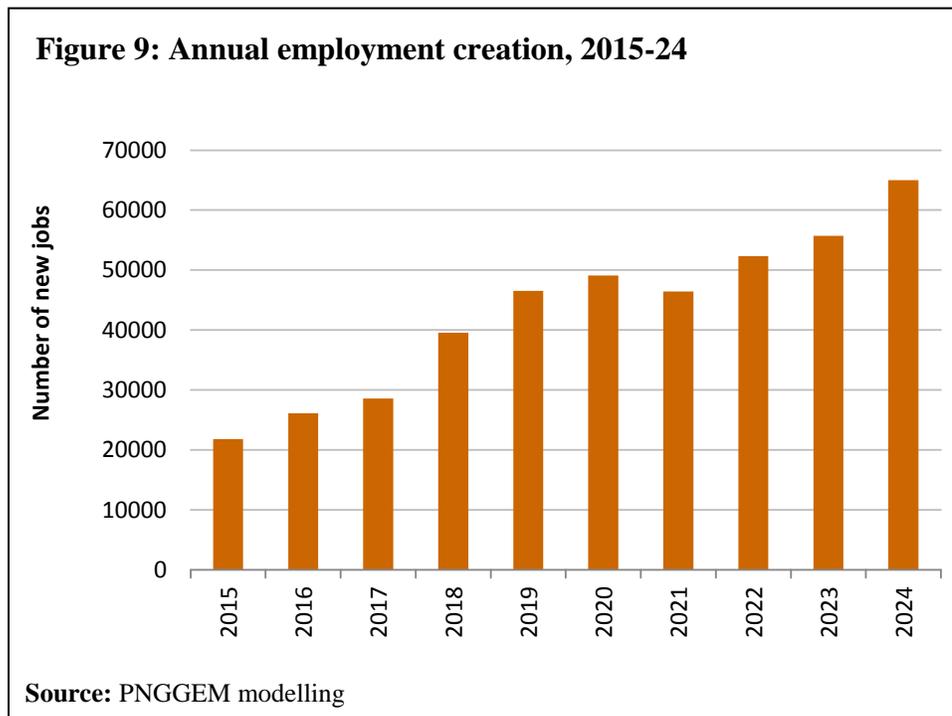


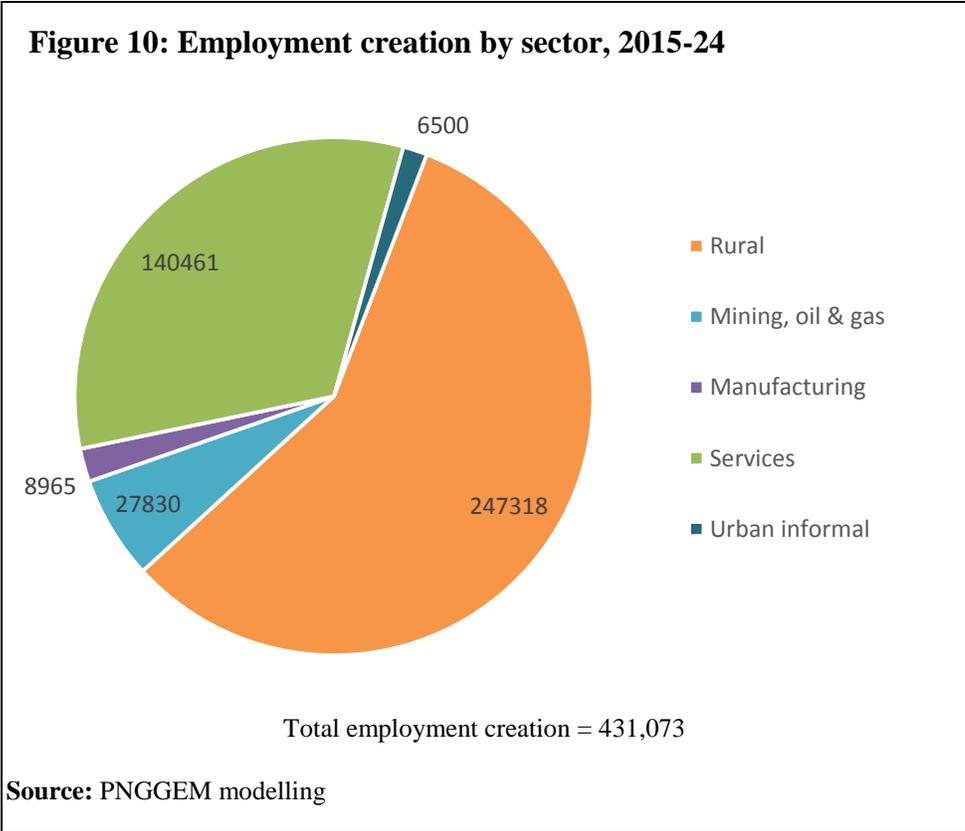
7. EMPLOYMENT PROSPECTS, 2015-2024

Over the next decade, employment is expected to rise by 431,000 full-time equivalent jobs (Figure 10). In 2015, economic growth is dominated by the capital intensive LNG Project, so only moderate employment growth is expected (Figure 9). Relatively weak employment growth for 2016 and 2017 is forecast in line with weaker economic growth. From 2019, employment growth of about 50,000 a year is expected, increasing to over 60,000 by 2024.

The driver of the steadily increasing rate of employment growth is the agricultural sector. Agriculture in PNG is labour intensive and with the economic performance of the agricultural sector forecast to steadily improve over the next decade, growth in total employment is forecast to move in line.

At more than 247,000 full-time equivalent jobs, the bulk of employment creation over the next 10 years is anticipated in rural areas, including informal self-employment in the village settings where most people live (Figure 10). About one-third of job creation will occur in the services sector — especially in transport, construction and commerce. The mining, oil and gas, and the manufacturing sectors are not expected to be major sources of employment creation.





8. THE FISCAL OUTLOOK, 2015-2024

The LNG Project would normally be expected to provide the Government with a significant boost in revenue during 2015 and a further boost in 2016 as corporate taxes and dividends from the Project flow in. However in the MYEFO report, LNG revenues appear to be absent with no explanation provided. This is considered unrealistic and more than likely reflects a timing and forecasting issue where LNG revenues are not reported because of uncertainty over their timing and their value.

The Treasury is faced with a difficult challenge over these next two years as it deals with predicting the flow and the timing of the revenues from the LNG Project. The challenge is now all the more difficult due to the drop in LNG prices outlined earlier. Adding more complexity is that sales are negotiated months or years in advance under various price formulas. This was discussed earlier, with sharply lower prices currently being received for PNG’s LNG exports compared to market prices. As a result, the formulation of the next Budget and the delivery of the 2015 Budget will proceed in an environment of uncertainty with respect to revenues and the Budget deficit. This has implications for meeting the challenge of financing the deficit and of setting an appropriate level of Government expenditure.

For the PNGGEM modelling, a lag time of revenue flows of about one year is assumed. On this basis, Government revenue, excluding foreign aid grants, is forecast to be K2.7 billion higher in 2015, reaching K13.1 billion (Table 5). Another sharp increase to K15.1 billion is forecast for 2016. Government spending, excluding grants, is expected to be K14.8 billion in 2015 resulting in a substantial Budget deficit of about K1.7 billion. A much sharper deficit is forecast in the MYEFO due to the assumption that LNG revenues will not come in during 2015.

The Budget deficit is expected to drop to K0.8 billion in 2016 as expenditure is contained to K15.9 billion. Beyond 2017, fiscal tightening with Budget surpluses are assumed in the modelling so as to reign in the deficit and fund the proposed SWF. Revenue is expected to continue at levels of 24-25 per cent of GDP while Government debt is expected to decline in accordance with fiscal tightening. The surge in GDP from the LNG Project will help bring down the debt to GDP ratio to 33 per cent in 2015 – assuming LNG revenues are secured during 2015 (Table 5).

These forecasts going beyond 2015 differ quite significantly to those presented in the 2015 Budget. There are two main reasons for this. First, the Budget contains very weak forecasts for GDP growth not seen since the early 2000s, and this has clear implications for lower forecast revenue collections. Second, the Budget revenue numbers are not *bottom-line* numbers as they exclude deposits in the proposed SWF. In other words, in the Budget, revenue that is diverted to the SWF is not considered as revenue in the Budget calculations. The Government debt forecasts reported here are also bottom-line (inclusive of the SWF) whereas in the Budget calculations, the SWF balance is not included in the calculations of net-debt. The bottom-line numbers are reported here because they give a true picture of revenue and net debt accruing to the Government.

Table 5: Bottom-line (inclusive of SWF) Fiscal forecasts – excluding foreign aid grants

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Budget deficit (K million)	-1729	-773	543	543	543	543	543	543	543	543
Budget deficit (% of GDP)	-3.5%	-1.4%	0.9%	0.9%	0.83%	0.7%	0.6%	0.6%	0.5%	0.5%
Spending (K million)	14,792	15,904	15,677	17,382	19,528	22,097	24,170	26,421	28,935	31,737
Total revenue (K million)	13,063	15,131	16,220	17,925	20,070	22,640	24,713	26,964	29,478	32,280
Tax revenue (K million)	11,726	13,738	14,541	15,924	17,662	19,773	21,459	23,316	25,393	27,724
Tax revenue (% of GDP)	23.5%	25.3%	25.1%	25.0%	24.7%	24.4%	24.4%	24.4%	24.5%	24.5%
Govt debt (% of GDP)	33.3%	32.0%	29.1%	25.5%	22.0%	18.7%	16.7%	14.8%	13.1%	11.5%

Source: PNGGEM modelling

Note: The Budget deficit numbers for 2016-2024 are based on assumptions of Government policy on the deficit level. For 2015, the deficit is calculated by PNGGEM according to the expenditure levels outlined in the Budget. Government debt is net of deposits in the SWF, and revenue is inclusive of revenues that are diverted to the SWF.

9. CONCLUSION

This report provided a review and forecast of the performance of the PNG economy. It commenced by looking at the historical context of the economic performance over the 1975-2004 period and 2005-2014 periods. During the first three decades (1975-2004), the economy did not do well with an average real GDP growth rate of just 2.5 per cent, which was lower than the average population growth rate of 2.7 per cent. The non-mining average GDP growth rate (i.e. broad-based growth) was worse at just 2 per cent.

During the next decade (2005-2014) economic performance was remarkable, growing at an average of 7.8 per cent, which was amongst the highest in the world. This strong growth was driven by both the upstart of the LNG project and strong growth in the non-mining sector driven by the key enablers (such as land, education, health, and transport, electricity and communication infrastructures).

Once the historical context was set, forecasts were then made for the next decade (2015-2024) using the PNGGEM. The areas and expected performances are as follows:

- **Economic growth:** GDP growth is forecast to grow at an average of 7.7 per cent per annum (with non-mining GDP at 7.3 per cent).
- **Commodity prices:** For most commodities that PNG produces, the outlook does not look promising due to lower oil, LNG, gold, copper and nickel prices, and weak prices for most agricultural commodities.
- **Mining, oil and gas:** The sector is likely to continue strong growth driven by the commencement of a new LNG project (Total LNG); Solwara 1 Project; and new mines, Frieda, Wafi-Golpu, Woodlark, and Mt Kare.
- **Growth by demand, regions and sectors:** In terms of demand, strong annual average growth is expected for all components, with exports the strongest at 12 per cent. For regional growth, the highest is expected to be the Islands region (8.8 per cent). For sector growth, all sectors are expected to have strong positive growth with the agricultural sector the highest at an average of 8.7 per cent per annum, driven by initiatives to invest in the enablers.
- **Employment prospects:** Over the next decade, employment is expected to rise by 431,000 fulltime equivalent jobs, which is to be mainly driven by the agriculture sector. The majority of the jobs are expected in the rural areas.
- **Fiscal outlook:** Deficit financing is expected in 2015 and 2016 and from 2017 onwards it is envisaged that fiscal tightening to account for the SWF will return the budget to a surplus. Consequently, public debt will decline with the fiscal tightening.

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APPENDIX 1: KEY MODEL FEATURES

This Appendix presents the key features of the PNGGEM which include its structure; database; industry and commodity classifications; equations; and variables, coefficients and parameters. We describe each briefly below. The details of the model can be found in the model's detailed documentation (see Levantis 2004) and will be made available on the NRI website, including the model code.

Model structure

The structure of the model refers to its theoretical dimensions. The theoretical structure of the PNGGEM is based on the Walrasian general equilibrium condition, whereby aggregate supply and aggregate demand for commodities is equal under competitive market conditions. The PNGGEM represents the Walrasian condition on the basis of the circular flow of funds, where the value of the supply of goods is equated to the value of the demand for goods. This is represented by the following:

$$Y + M = I_{\text{int}} + C + I_p + G + I_g + X ,$$

where: Y = production (domestic); M = Imports; I_{int} = Intermediates; C = Consumption (household); I_p = private investment; G = Government consumption; I_g = government investment; and X = Exports.

The left hand side constitutes the supply of goods (produced domestically and imported) while the right hand side constitutes demand for goods by the various demanders. Using this Walrasian condition, in the PNGGEM, the economy is disaggregated into five main sectors: production sector, household sector, government sector, external sector, and finance sector. These five sectors form the core equations of the model, upon which other equations of the model are then derived.

Database

In order to be used for economic analysis, a Computable General Equilibrium (CGE) model requires a database. The database provides the starting point for any simulations that are done using the model. The database represents the observed state of the economy for a particular year (known as the *base year*). Based on this database, changes to (or impacts on) the economy can then be determined via simulations of the model.

In a typical CGE model, the database is an input-output (IO) table that contains information on demanders and suppliers in the economy. From the demand side, the database contains information on expenses incurred by producers, industries, households, exporters, government, and the change in inventories. On the supply side, the database would contain the incomes earned by suppliers in the form of income and corporate taxes (for government), wages/salaries (for labour), capital returns, and production tax, and other costs.

The database represents the Gross Domestic Product (GDP) from both the expenditure (demand) side and income (supply) side. The expenditure side is represented by the conventional GDP

identity (C+I+G+X-M) while the supply side constitutes the sum of total factor payments, total taxes on production, and the total value of other production costs.

For this study, the base year used for the database is 2013. The database is extensive and has been built over many years from many sources of information. Each year the database is updated with key information taken from the Budget Papers and the economic database available on the Bank of Papua New Guinea (BPNG) website.

Industry and commodity classifications

A CGE model classifies the industry and commodities for an economy. In the PNGGEM, the PNG economy is disaggregated into 43 industries and 38 commodities. The 43 industries are classified under 4 sectors: village, formal rural, formal urban, and “murky”.

The village sector comprises 6 industries, which are all traditional rural-based:

- traditional agriculture;
- smallholder coffee;
- smallholder cocoa;
- smallholder palm oil;
- smallholder copra; and
- smallholder other tree crops.

The formal rural sector comprises 9 plantation-type and fishing industries:

- plantation coffee;
- plantation cocoa;
- plantation palm oil;
- plantation copra;
- plantation other tree crops;
- plantation fruit and vegetables;
- other agriculture;
- fishing; and
- forestry.

The formal urban sector comprises 26 industries, which make up the modern sector of the economy:

- gold mining;
- Ok Tedi Mine;
- other mining;
- petroleum;
- quarrying;
- timber processing;
- food processing;
- beverages and tobacco;
- metals and engineering;

- machinery, repairs;
- chemicals and oils;
- other manufacturing;
- road transport;
- water transport;
- air transport;
- education;
- health;
- electricity and garbage;
- building and construction;
- commerce;
- hotels, accommodation;
- restaurants, fastfood;
- finance and investment;
- government administration and defence;
- other private services; and
- security services.

The murky sector comprises of an “informal retail” industry which represents street-vending type of activities in the urban areas; and a “crime” industry to enable the model to capture economic costs associated with criminal activity.

Equations

The equations of the model determine how variables are related to each other and how the model is solved. There are 14 blocks/groups of equations (for more details see Appendix 1.1. in Levantis 2004):

- Block 1: The core equations based on the Walrasian equilibrium;⁴
- Block 2: Commodity, industry and factor price equations;
- Block 3: Industry output and demand for inputs;
- Block 4: Labour market conditions;
- Block 5: Capital, investment, and land equations;
- Block 6: Household sector equations;
- Block 7: Provincial Governments;
- Block 8: National Government;
- Block 9: Exports and foreign currency flows;
- Block 10: Commodity market clearing equations;
- Block 11: External costs of crime;
- Block 12: Macroeconomic aggregates;
- Block 13: Output and value added summaries; and
- Block 14: Productivity.

⁴ These are the five core equations based on the five main sectors of the economy.

Variables, coefficients and parameters

The equations of the model (in the different blocks presented above) are made up of variables, coefficients and parameters (see Appendix 5 in Levantis 2004 for details). Variables are quantities that can assume different sets of values. In a CGE model like the PNGGEM, examples of variables include GDP, employment, exports, imports, etc. Coefficients are what the model solves when a simulation is performed. They include tax coefficients, price coefficients, quantity and value coefficients, share coefficients, and other coefficients that are used to explain other coefficients. The parameters of the model consist of various elasticities of demand, supply and substitution. Parameters affect the magnitude of the results. Parameters can either be sourced from the literature (i.e. from previous studies of economies with similar characteristics to the country under investigation) or from econometric tests (if there is sufficient time series data).

APPENDIX 2: KEY ASSUMPTIONS FOR THIS STUDY

The results of an economic model are determined by the assumptions adopted. For this particular study, the key assumptions are as follows:

- Commodity prices – as outlined in Table 1;
- Production profiles for mining, oil and gas – as outlined in section 5, especially LNG production reaching 55 per cent of capacity in 2014 and 100 per cent in 2015;
- Budget deficit assumptions – as outlined in Table 5;
- Government initiatives to address the enablers continue – including initiatives to increase the reach of education, build up the capacity of higher education, build infrastructure, commit resources to addressing law and order, and continue to implement the National Land Development Program; and
- In this modelling exercise, it was assumed that any deposits to the SWF from the (current) LNG Project will be relatively small in the early years of the SWF. The rationale for this is that if large amounts of money are diverted from the budget to the SWF, then the resources needed to make progress for the key enablers may not be available. At the time of the release of this report, we were aware of two related developments:
 - i). In the MYEFO, there was no information on the status of the LNG money; and
 - ii). The Organic Law on the Sovereign Wealth Fund was passed (July 2015).

Currently, we do not know the status of the revenues from the LNG project. However, in the second modelling report for the year, which will be released in mid-December, 2015, we hope to incorporate the updated information on the LNG money and the SWF into the model.

