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**How Poor is Papua New Guinea?  
How Rich Could it Be?**

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## **Resource Management in Asia-Pacific**

### **Working Papers**

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# **How Poor is Papua New Guinea? How Rich Could it Be?**

## **Abstract**

Several recent commentators (notably Gibson 2003 and Chand 2004) have stated that as many as 37 per cent of Papua New Guineans are living below the poverty line. This is based on deeply flawed conclusions from the 1996 household survey conducted by Gibson and Rozelle. When erroneous assumptions made in that survey are corrected, the Gibson-Rozelle data indicate that fewer than 12 per cent were subsisting at below a minimum level of dietary energy. Many commentators have also asserted that Papua New Guinea's growth performance has been poor and getting worse, with national income growing at less than population growth. In fact since independence in 1975 national income per head has grown at over 3.5 per cent per annum, i.e. well above population growth. Thus national income per head has increased from A\$374 per head in 1974/5 to A\$1035 in 2003. That means Papua New Guinea's growth of GDP per head over this period has been faster than Australia's 2.4 per cent per annum. However it remains true that Papua New Guineans generally are far from rich and that the economy's growth has been slower than it should have been. The second part of the paper suggests that average incomes would grow much more rapidly if the country's main primary resource, its forests, were developed to their full potential subject to both sustainability and reasonable conservation of biodiversity. Data will be provided showing that plantation forestry could deliver exports worth more than the country's total mineral exports in 2003 from an area of only a seventh of the total under forests. Suggestions for necessary legal and institutional changes for this to occur conclude the paper.

To give short answers to the questions in my title:

1. Papua New Guinea is a poor country, but not as poor as often stated.
2. Papua New Guinea could and should be a rich country, given its enormous human and renewable natural resources, were it not all too often for “stupid white men” (and women) in international aid organizations and NGOs who have combined with its own bureaucracy to prevent full development of both the most important of those resources, its people and its forests.<sup>1</sup>

### **How Should We Measure Poverty in Papua New Guinea?**

Papua New Guinea’s own official data on both its population and its national income have several defects, resulting in unreliable estimates of its national income per head:

1. The population given by the 1980 census must have been an underestimate if the 2000 census was sound, since the latter shows many more persons alive aged 20-29 than were alive aged 0-9 in 1980, and likewise there were more aged 35-39 in 2000 than had been alive aged 15-19 in 1980 (see Figures 1 and 2). Alternatively, the 1980 census was sound, and the 2000 census provides a seriously exaggerated estimate of the population.
2. GDP data since 1997 are estimated by the Bank of Papua New Guinea, because the National Statistical Office no longer publishes measured data. Use of 1983 as the base year for the published estimates of “real GDP” in 2003, when 1983 was an exceptionally good year for the economy, is questionable, and a range of average GDP over, say, three years would provide a more reasonable base year.
3. But just as it makes no sense to express Australia’s current national income per head in, say, 1900 or even 1983 prices, so also for Papua New Guinea, the government’s data stating current income at 1983 prices has little meaning. The Australian Bureau of Statistics uses only the previous year as the base for its indices of changes in real income per head.
4. Gibson (1995) has shown how the published CPI exaggerates inflation since its weights have not been changed since 1977, and the same may be true of the sectoral deflators used to represent changes in 1983 prices since then.

If, as suggested by the 2000 census, the 1980 census undercounted the population, then statements of per capita GDP at that time will be exaggerated, and produce a low estimate of growth of GDP per head since that time. Alternatively, if it is the 2000 census that gives an overcounted population, as is plausible, since the 1995 *Organic Law on Provincial and Local-level Governments* introduced a population basis for grants to the provinces from the national government, creating an incentive for inflating population growth (seen also in electoral rolls), then that also results in understated growth of per capita income. Restating the 2000 population to secure conformity with the 1980 census (see Appendix), GDP per capita in 2003 rises to K2701 or A\$1168 for an annualised growth rate from 1974/5 in PNG kina of 7.06 per cent, and in Australian dollars of 4.07 per cent per annum. Even on the official population figure for 2003, the rate of growth of GDP in Australian dollars (current prices) since 1974/5 is 3.63 per cent per annum (see Table 1).<sup>2</sup>

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<sup>1</sup> Filer (2004) has shown that the effect of the World Bank’s interventions in regard to forestry has been to prevent proper exploitation. Less well documented is the Bank’s successful opposition to expansion of education, whereby its insistence on user pay fees has set back attainment of universal primary schooling and its direct prohibitions prevented expansion of upper secondary education in the 1980s and tertiary education in the 1990s (see Curtin 1991).

<sup>2</sup> The World Bank’s “atlas method” yields per capita national income of only US\$510 in Papua New Guinea in 2003 (*Papua New Guinea at a Glance*, 15 September 2004), even though any Papua New Guinean with only the official average income in 2003 of K2393 would have been able to exchange that for US\$674 at his/her bank with a minimum of fuss. It is worth noting that the World Bank’s use of the US dollar for international income comparisons over time is unwise, given its role as an international reserve currency, whereby its

Recent commentators like Chand (2004) and Hughes (2004) dwell on these figures and stress that, at best, per capita incomes have not improved for many years, because population growth at the claimed inter-censal rate of 2.66 per cent per annum between 1980 and 2000 has equalled or exceeded annual growth in total national income and GDP. But over the whole period since independence, GDP per capita in Australian dollars (which was at par with Papua New Guinea's currency in 1975) has increased by 3.5 per cent per annum, which is both better than implied by most commentators -- and better than Australia's 2.5 per cent growth of per capita income over the same period -- if also certainly below both the country's potential growth rate and the rates achieved in countries to the north.

The Australian dollar equivalent of current price national incomes in Papua New Guinea in 2003 is preferred here to the government's data using inflation adjusted GDP data because of problems with the inflation adjustments. Moreover, there is evidence, first, that in 1974/5, when Papua New Guinea had the same currency as Australia, relative prices were not out of line, and second, that since Papua New Guinea floated the kina in 1994, domestic prices have adjusted to Australian equivalents, so that the kina is no longer overvalued as it was for most of the period from 1975 to 1994. Thus Australian dollar conversions are no longer as unrealistic as they were before 1994.

Deriving average incomes from a country's total GDP is of course only half the story, because the average conceals the dispersion of income around the mean and therefore provides no information on the degree of inequality within a country, such as the relative numbers of rich and poor and how rich or poor they are respectively. Gibson and Rozelle (1998) have provided the most detailed answers to these questions with estimates of both the proportions of the urban and rural population that are living in poverty and of the extent of their poverty.

Their approach to measuring poverty is to attempt to value Papua New Guineans' production for their own subsistence, and then to judge whether that affords an adequate or only a poverty standard of living. Duncan and Temu (1995: 37) had suggested that the value of subsistence production in the national accounts is usually underestimated, for example, at only K396 million in 1989, and that it is likely to contribute more than half of commercial agriculture's share of GDP. Gibson and Rozelle (1998: 19) support this view by indicating a value of total rural household food production of K1.3 billion in 1995. But that apparently large amount reduces to only K362 per person of Papua New Guinea's rural population in 1995, i.e. less than one kina per person per day (equal to US\$0.70 in 1995, so less than the US\$1.00 per person per day considered by the World Bank to be the bare minimum for survival). Bourke has assembled some new estimates of staple food crop production in Papua New Guinea in 2000, arriving at a total of 4.5 million tonnes, yielding a per capita calorie consumption of nearly 3,000 without taking into account consumption of imported foods. Bourke (2004) suggests that the value of the domestic crops may be estimated from the amount of rice that would yield the equivalent level of calories, namely 1.19 million tonnes, worth K2.73 million at the wholesale price of rice in Papua New Guinea in 2000, or about K1.5 (about US\$0.4) per person of the total population per day, and so less than the Gibson and Rozelle estimate for 1996.<sup>3</sup>

It should however be noted that such per capita income data, which average total subsistence production over the rural population as a whole, conceal considerable variations. Apart from some quite large coffee farms, like those around Goroka described by Benediktsson (2002), and the oil palm block holders in West New Britain that generate substantial cash incomes in addition to basic

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exchange value is as much determined by the central banks of Japan and China as by the Federal Reserve. That is why Australian dollar comparisons may give a more reliable trend over time.

<sup>3</sup> Bourke's figure could be considered an under-estimate of the value of domestic food production in Papua New Guinea, since it uses the wholesale rather than retail price of rice.

food self-sufficiency, compensation paid to landowners in the main mining project areas provides substantial cash income. In other areas there is little or no cash income, and especially in those areas dependent on sago, consumption levels in terms of protein and carbohydrates are also low. In yet other areas, for example in Mare (Morobe Province), incomes from inland fishing of between K5034 and K6965 per family are reported by Grieg-Gran and Guijt (1998). In the Tari basin of the Southern Highlands, Yamauchi (2000) found calorie consumption rates for men from 2300 in dry upland areas to 3586 in flat wetlands (and from 2100 to 2900 for women respectively).

Gibson and Rozelle (1998: 41) found from the urban household surveys conducted between 1985 and 1990 that the headcount of poverty on the “upper poverty line” (which includes non-food items) was 21.5 per cent, and for the “food poverty line”, 6.6 per cent. Their 1996 survey led them to raise these estimates by large fractions. But the derivation of their revised poverty lines is questionable (see below). Perhaps their most important -- and most neglected -- finding was that poverty thus defined was inversely related to level of education, and especially if that included post-school diplomas or degrees, and to wage employment or having an own business, and directly related to unemployment and large households.

The later Gibson and Rozelle estimates for 1996 were picked up by Satish Chand (2004: 1) with his assertion that “37 per cent of the population [of Papua New Guinea] lived below the poverty line where the poverty line was set at an income level of K461 per adult”. However, he was misled by his sources, including various World Bank reports (1999a and 1999b) that uncritically adopted the Gibson-Rozelle results.

Those authors are noted statisticians, and taken as a whole, their survey broke new ground in poverty studies, but it began with a seriously flawed assumption that, when corrected, removes the headline findings that have been seized on so avidly by Chand amongst others. Their core assumption deems that all with incomes insufficient to achieve a prescribed minimum food calorie consumption level of 2200 calories per day are living in poverty (Gibson and Rozelle 1998: 45; 2003: 161). But that poverty minimum of per adult equivalent daily consumption of 2200 calories is usually considered a normal rather than poverty level of food consumption. Even the FAO, notorious for exaggerating food deficits, distinguishes between “average calorie requirement” and “minimum calorie requirement” (Svedberg 2002: 11), with the former at between 2100 and 2220 and the latter at between 1790 and 1880 (for various regions of the world). Using FAO minima would of course greatly reduce the proportion of Papua New Guineans deemed by Gibson and Rozelle to be living in food poverty to probably less than 12 per cent, as they showed (1998: 37) that even the bottom quartile (25 per cent) of households enjoyed consumption of 1955 calories per day per adult equivalent -- well above the FAO minima (see also World Bank 1999b: 77).<sup>4</sup>

Gibson and Rozelle (1998) did not in practice measure calorie consumption, but derived it by calculating the minimum income needed to purchase the calorie minimum from cost estimates of food baskets containing the calorie minimum priced at urban levels, with the latter subject to a wide margin of error (see Table 2 for their base-line costing of the calorie consumption minimum). They then developed three different poverty lines: the upper poverty line of K461 income per adult equivalent including both food and non-food consumption, with 37 per cent of the population not achieving this; a lower poverty line, at K399 with 30 per cent not achieving it; and the food-only poverty line, at K302, with 14 per cent not attaining it. The first two of these poverty lines included larger or smaller quantities of non-food items respectively. All three lines maintained 2200 calories as the poverty minimum level of food consumption.

One difficulty with the above estimates is that they are not always confirmed in other papers by Gibson *based on the same survey*. For example, Gibson (2000b: 408) states that “approximately 42 per cent (sic) of the population did not meet a target food energy requirement of 2000 (sic) calories per

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<sup>4</sup> See Svedberg (2002) for a detailed account of statistical flaws in the FAO’s derivations of both its minimum calorie consumption benchmark and its computation of proportions not attaining it.

person per day” -- whereas Gibson and Rozelle (1998) had stated that 37 per cent did not meet the 2200 level. More serious is the lack of correspondence between the food consumption data set out in Gibson and Rozelle (1998: 49) and in Gibson (2000a: 41), again citing the same 1996 survey. Thus the former shows sweet potato consumption *per adult equivalent* of 242.7 kg a year (national average), and the latter shows 260 kg *per person*, which when converted to adult equivalents (for the actual proportions of the population aged more than 6 or less than 7) amounts to 289 -- over 46 kg more than the 1998 figure. An even bigger discrepancy applies to rice (8.4 kg and 34.4 kg per adult equivalent in the 1998 and 2000 versions respectively). Sweet potatoes and rice are the main sources of calories, so these are not trivial discrepancies, and with such divergent reporting from purportedly the same survey data, it is clear that not much reliance should be attached to the Gibson-Rozelle and Gibson conclusions on the extent of food poverty in Papua New Guinea.

Another major problem with the Gibson and Rozelle survey is that it derives monetary valuations of its postulated minimum diet when in reality most food consumption of the majority of Papua New Guineans is own-produced by themselves as subsistence farmers and is therefore not priced to cover the costs of transport to, and sales in, urban areas (including wholesale and retail margins) (Gibson and Rozelle 1998: 55). Hence the stated minimum income per adult (needed to attain the supposed minimum diet of 2200 calories at market prices) is likely to exaggerate the cost of minimum subsistence levels. The basic fallacy underlying the Gibson-Rozelle analysis is their failure to appreciate that most rural Papua New Guineans are subsistence farmers who are free to grow as much as they believe they need to eat, so it is reasonable to assume they mostly succeed and that therefore they cannot be deemed always to be living in food poverty.

Nevertheless, whilst clearly there is not such general poverty as to signify widespread malnutrition, there is evidence of localised malnutrition, particularly of children. Mueller (2000) showed that children in areas dependent on banana, sago, and taro were more likely to be stunted or showing other symptoms of malnutrition than children in areas where there was more access to imported cereals as well as locally grown foods like cassava and sweet potato. Muntwiler and Shelton (2000) cited incidence of children with moderate to severe malnutrition at Onamuga in the Eastern Highlands of 22 per cent in 1997, and 67 per cent in the more remote village of Misapi in 1998. Similar wide variations are found in the Tari valley, where males in the low flatlands had energy intakes of 3586 calories per day (cf. Gibson’s 2200 minimum per adult equivalent), whilst intakes of those in the hilly drylands were 2320 (Yamauchi 2000). Mutambek and Tumana (2000: 453) reported a high incidence of moderate to severe protein-energy malnutrition of children in Sandaun Province in the 1990s, but their figure of 28,500 children aged under 5 years presenting at health clinics with such malnutrition exceeds the total population of such children in the province (21,900 in 1990).

Chand (2004) also cited World Bank data on various social indicators that he uses to contrast Papua New Guinea’s performance unfavourably with that of some of its South Pacific peers. But the World Bank is not a primary source. Genuine primary sources are to be preferred, as noted by Sugden (2004, Table 1). Using published census data from 2000 and other primary sources (National Statistical Office 2003), Sugden reports an infant mortality rate of 64 per thousand births in 2000, considerably lower than Chand’s 79 per thousand births, not good but not quite so bad either -- and even that figure is difficult to square with Papua New Guinea’s claimed population growth rate of 2.66 per cent between 1980 and 2000 (but see corrections above).

Chand’s Table 1 also cites data for GDP per capita of Papua New Guinea and its regional peers. Such comparative data are critically dependent on current exchange rates, and produce unreal results such as average income in the Solomon Islands being allegedly higher than in Papua New Guinea in the very year its government and economy virtually ceased to exist, leading to its *de facto* recolonisation in 2003 (by Australia).<sup>5</sup> These comparisons are only meaningful if performed on a

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<sup>5</sup> In US dollar terms, Papua New Guinea’s GDP rose by 18.6 per cent in 2003 over 2002, but that was partly due to the 9 per cent appreciation in the average kina/US dollar exchange rate. The Solomons’ higher GDP per capita figure largely derived from its unrealistic exchange rate in 2002, and at its 2003 exchange rate its

purchasing power parity basis, and such data do not exist for the countries in question (other than dubious imputed, not data-based, estimates by the World Bank).

### **How Rich Can and Should Papua New Guinea Be?**

Helen Hughes (2004: 1) proposes economic reforms that “could put Papua New Guinea on an annual growth path of 7 per cent a year that would double its GDP every decade”. That is certainly not an unreasonable ambition, since such rates have been and are being achieved by many countries in South-east Asia, including Malaysia, Singapore, and Thailand, not to mention China. Moreover, when Papua New Guinea’s total GDP growth rate, as measured in Australian dollars, has been nearly 6 per cent per annum since 1975 (as shown above), 7 per cent ought to be attainable. But the ambition seems unlikely to be attained if all of Hughes’ advice is followed, as she advises against relying on development both of mineral resources, such as the Gas-to-Queensland project, because such projects “create only economic rents that provide revenues for a swollen government and public services”, and renewable resources like timber, because of the “depredations of timber exporting companies” (ibid: 2-3). These are rather sweeping statements -- the government does manage to pay some 30,000 teachers, many of whom do teach rather than absent themselves (which is a problem in non-mission schools in many rural areas), and the “depredations” of timber exporters have been much exaggerated, as will be shown below.

Hughes goes on to show how Papua New Guinea’s merchandise exports per capita, at US\$324 in 2002, are a small fraction of those of Botswana and Malaysia, yet in decrying the Somare government’s attempts to revive growth of mineral resource exports, ignores the fact that Botswana’s exports are dominated by diamonds with a much higher per capita value than Papua New Guinea’s total mineral exports, whilst Malaysia’s include a significant contribution from logging, which Hughes, like the World Bank, is wholly opposed to in Papua New Guinea. Although log and sawn timber exports are now less than 2 per cent of Malaysia’s total exports, they were ten times larger than Papua New Guinea’s in 2002. Moreover Malaysia’s total exports of logs, sawn timber, wood products, pulp and paper, rubber and products amounted to a staggering US\$8.8 billion in 2002, compared with just over US\$200 million for Papua New Guinea (forty times less) -- but the World Bank and others advise Papua New Guinea against even contemplating development of its largest resource which could well rival Malaysia’s timber industry given half a chance.

Helen Hughes also (2004: 1) endorses the conclusions of Satish Chand (2004), emphasizing the apparent zero growth of per capita income in 2003, and adding the claim that “[mineral] resource revenues have also led to waste and corruption, subsidising a small political elite at the expense of investment in roads, health, and education”. With many commentators following Chand in anticipating closure (because of reserve depletion) of all Papua New Guinea’s current mineral projects except Lihir Gold Ltd by 2012, Hughes looks to land tenure reform and massive expansion of the oil palm plantation sector as both the source of compensating export revenues and the drivers of her 7 per cent growth rate target, with her claim that oil palm exports could grow at 30 per cent a year and replace oil and mining as the country’s biggest exports.

Michael Bourke (2004) has demonstrated the improbability of this being feasible with the following data:

The [average] FOB value of crude oil and minerals in 2001, 2002 and 2003 was K5155.4 million  
 The [average] FOB price for palm oil for this period was K1095/tonne. Production of palm oil is about 3 tonnes per hectare of planted oil palm. PNG exports of palm oil in 2003 were

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GDP per capita in US\$ has declined to well below Papua New Guinea’s -- but again the only meaningful comparison would require data on relative prices. Dowrick and Quiggin (1994) have advised against use of constant price series of GDP for international comparisons of countries at a similar level of development, as “they may not be indicative of welfare rankings when relative prices vary”.

326,900 tonnes. Hence PNG would need to produce 4,700,000 tonnes of palm oil to totally replace crude oil and minerals [from over 1.5 million hectares compared with the present 108,000 hectares].

If anything Bourke was too kind to Hughes -- his demolition would have been complete if he had noticed that her projected growth rate for Papua New Guinea's oil palm exports would within 15 years imply output greater than current world consumption -- and as a result a collapse in the world price. By then the area under oil palm would have to be over 7 million hectares -- another implausibility, as Bourke points out.

Bourke's evaluation is that there is not enough suitable land to permit the massive expansion of oil palm production needed to replace revenue from oil, gold, and copper. However, Kenya's larger agricultural exports from a smaller area than is available in Papua New Guinea, including US\$1 billion in horticultural exports, despite a much larger population needing to be fed, suggests that there is scope for significant increases in palm oil and other agricultural production, if not to the extent needed to replace mineral revenues. But it would be necessary to go beyond the present mix of subsistence agriculture and smallholder cash crop production.

Ironically, the primary industry that really could replace Papua New Guinea's mineral exports if they dwindle almost to nil by 2015, as some (e.g. Hughes 2004) believe is likely, is that which already covers most of the country's landmass -- namely its forests. Yet exports of forest products, mainly 2 million cubic metres of logs, already contributed K415.8 million (5.3 per cent) to total exports of K7.79 billion in 2003, compared with palm oil's K421.3 million, despite the World Bank-imposed export tax system (see below). Forest product exports would have been even smaller if the World Bank had succeeded in its demands that the government should close the Vailala and Wawoi Guavi projects (in Gulf and Western Provinces respectively) as part of its undeclared but obvious intention of terminating all logging in Papua New Guinea (Filer 2000, 2004).

Meanwhile, Sweden, unimpeded by the World Bank, has been logging at rates of up to 70 million cubic metres a year for the last decade, 35 times more than Papua New Guinea with its much larger forested area (369,000 square kilometres compared with Sweden's 244,000 square kilometres). Moreover, Sweden's forestry industry adheres closely to its Standard for Forest Certification, and sets limits to the annual cut to ensure biodiversity and sustainability. Were Papua New Guinea to attain Sweden's level of output, and there is no reason why it could not, given its equal -- possibly superior -- suitability for softwood pine forestry, then its logging exports could be worth K13 billion, nearly double *total* exports in 2003, which would therefore much more than compensate for the projected decline in mineral exports after 2010.<sup>6</sup>

New Zealand is another country that owes much of its high standard of living to its development of its forestry resources, with annual production of 2.5 million cubic metres of sawn timber and 15.6 million cubic metres of roundwood that was used in the production of 2 million tonnes of wood pulp and paper a year in the 1990s. Thus New Zealand's loggers produced nearly ten times as much as Papua New Guinea's in the 1990s, but from a forested area that is only seven per cent of the country's smaller total land area. In 1993 26,750 persons were engaged in timber related industries - - about three times more than in the whole of Papua New Guinea's mining industry. New Zealand's exports of forest products (excluding newsprint) contributed 10 per cent of its total exports in 2002, and amounted to NZ\$3.5 billion (about K6.6 billion, more than Papua New Guinea's *total* exports in 2002).

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<sup>6</sup> Sweden's total land area is 450,000 square kilometres, and its population is 9 million (July 2004). Sweden produced 17 million cubic metres of softwood lumber and 35 million cubic metres of softwood logs in 2003. Sweden also produced nearly 1 million cubic metres of temperate hardwood.

Interestingly, the share of natural forests in New Zealand's production of roundwood dropped from 6 per cent in 1988 to one per cent by 1993, with plantations more than compensating, since total output increased by 50 per cent in that period. This is a natural progression that has hardly begun in Papua New Guinea, in part at least because of the difficulty in securing government approval and landowner participation in the required transition, as plantations with their long rotations require long-term leases if investors are to come forward and finance them.

A recent New Zealand case study provides yet more evidence of Papua New Guinea's failure to develop its forestry resources to their full potential. A plantation including the Kaingaroa Forest near Mount Maunganui acquired by Fletcher Challenge Forests in 2001 was projected to yield log sales of 4.5 million cubic metres of radiata pine and other species in 2004, and a further 0.8 million cubic metres of manufactured timber products -- all this from 162,173 hectares, or about 5 per cent of Papua New Guinea's forested area. The log sales alone were projected to be worth NZ\$427.5 million, about A\$388 million or K947 million, compared with Papua New Guinea's total log exports worth K370 million in 2003 (Fletcher Challenge Forests 2002: 94-95).

In another example from New Zealand, Fletcher Challenge Forests has been successful in both its owned and its leased plantations, and in 2000 earned US\$88.8 million from sales of 1.48 million cubic metres of log sales grown on just its owned 110,000 hectares. If Papua New Guinea produced as much *pro rata* from only 5 million hectares of its total forest area of well over 30 million hectares, its log exports would be worth US\$4 billion, or K13.5 billion, more than double its actual mineral exports in 2003.<sup>7</sup>

Even more pertinent, in terms of both opportunity and difficulty, is Fiji's experience. Its total indigenous forest area is around 760,000 hectares (of which 200,000 hectares is production forest, with standing volumes of 30 cubic metres per hectare or more, 260,000 hectares non-commercial forest, and 300,000 hectares protection forest on steep slopes).

Fiji has established comparatively large plantation forests. Around 45,000 hectares are under pine (managed by Fiji Pine Ltd), whereas about 50,000 hectares has been planted with broadleaf species such as mahogany (managed by Fiji Hardwood Ltd) (GTZ 2002). The Government of Fiji had begun planting pine on degraded grasslands in the 1950s, in an effort to rehabilitate the land and prevent further soil erosion. The areas planted are leased from local landowners. During the 1970's, Fiji Pine carried out plantings on the two main islands, Viti Levu and Vanua Levu. The long-term objective of this programme was to supply a timber-processing plant in Fiji to supply domestic and export markets. Simultaneously, small-scale plantings were being encouraged at village level in remote areas of the two main islands and the smaller more distant islands. These plantings were supported by the extension services of Fiji Pine Ltd., aiming to promote planting of pine on unproductive land and to maximise the returns from these plantations for the landowners.

In the early 1980s, Fiji Pine Ltd set up Forest Development Service Ltd to administer the timber-processing plant at Drasa (western Viti Levu), which would be responsible for processing timber from all large-scale plantations within a 100-mile radius. Small-scale plantings have reached maturity and are ready for harvesting. Unfortunately, they tend to be outside the 100-mile radius of the Drasa plant and, with the small volumes available, harvesting and processing are difficult and expensive. The former Fiji Pine Commission was corporatized in January 1991. Fiji Pine Ltd is now a public company wholly owned by Government and landowners, and headed by a Chief Executive who reports to a Board of Directors. There are two fundamental questions: whether it can be both financially viable and economically efficient. Although it has a modest operating profit, it has not

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<sup>7</sup> This calculation uses the price obtained by Fletcher Challenge's log exports (mainly radiata pine) of US\$60 per cubic metre in 2000, compared with the average price (f.o.b.) of US\$73 for Papua New Guinea's exports of tropical hardwoods in 2000 (see Fletcher Challenge Forests 2000 and Bank of Papua New Guinea *Quarterly Economic Bulletin*, December 2003).

reached the point where it can meet operating costs, development expenditure and debt service obligations from internal revenues. If concessional finance is secured and if the Vanua Leva resource is developed (52,000 hectares of plantation) and exploited, the company will achieve its modest target financial rate of return of 3 per cent (DFID 2004).

The above summary account of Fiji's forestry -- based on reports by the aid agencies GTZ (2004) and DFID (2004) -- leaves out the political dimension in which efforts by an American entrepreneur, Marshall W. Pettit, in association with the Fijian businessman George Speight, to take over and amalgamate Fiji Pine and Fiji Hardwood led directly to the partially abortive coup attempt by Speight in 2000, after he had been blocked by the then prime minister from achieving his aims (Kahn 2000). Politics aside, the main economic problem appears to be the low level of profitability at Fiji Pine, which largely stems from low yields because of poor soils, extended droughts with associated fire hazards, and the small scale of operations, with only around 45,000 hectares of pine and mahogany respectively planted. The potential for much larger areas to be planted in Papua New Guinea, along with better soils and higher rainfall, would suggest that the Fijian model of direct landowner participation in ownership and management could be successfully transplanted.

It has to be said that landowner problems could be as fraught in Papua New Guinea as in Fiji in 2000. But while efforts by landowner companies in the former to involve themselves directly in extractive logging have all been failures, that was largely because such ventures were all based on logging the natural forest and did not contemplate plantation forestry. For example, Mullins (1994: 44-72) has described how the Kumil timber project in Madang province failed despite the setting up of a landowner company (Ulingan Development Corporation, UDC, in which 74 clans had a total of 76 shares) to receive the government's timber permit in 1984. UDC then engaged a succession of logging contractors who all failed to deliver on expected log harvest targets, mainly because of a combination of falling world prices, exacerbated by the strong kina policy (so that kina values of realised export values were less than the US dollar equivalent at the time), with the very low yields (at best only 36 cubic metres per hectare) and extremely mixed range of species in the Kumil area (Mullins 1994: 52-53). Leedom (1997) provides an account of similar failures of cooperation between landowners and the logging contractor at the Hawain logging project in East Sepik -- but again the low achieved yields (only 13 cubic metres per hectare) meant that the project's cash returns disappointed all the stakeholders. By contrast, New Britain Palm Oil Ltd has successfully expanded its area of operations in partnership with local landowners, demonstrating that where there is potential profitability for all, landowner concerns need not be an obstacle.

The potential for plantation forestry in Papua New Guinea will be evident from the yield data from the *Silvicultural Manual for the Solomon Islands* (Chaplin 1993). Planting logged areas at a rate of 100,000 hectares a year, with a conservative rotation of 20 years, and logging old growth prior to planting to finance working capital, by 2025 it would be possible to harvest 100,000 hectares a year, which at an average yield of 250 cubic metres per hectare -- 7 times larger than at Kumil -- generates timber of 25 million cubic metres a year, worth US\$2.5 billion at only \$100 per cubic metre (as against the US\$200 per cubic metre earned by Malaysia's kwila exports in 2004 -- kwila being a species that is also widespread in Papua New Guinea). That exceeds the value of Papua New Guinea's mineral exports in 2003, and would use only 3 million hectares of the 15-30 million potentially available for plantations.<sup>8</sup>

This demonstration that Papua New Guinea's forest resource has the capacity to yield much more than the total income the country currently derives from mineral exports seems to be so politically incorrect that the income generating potential of plantation forestry could not be mentioned either in the World Bank's loan appraisal (2000) or in the Ausaid/ANU *Rural Development Handbook* (Hanson et al. 2001). The latter hardly refers to forestry in any province, and not at all in Madang,

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<sup>8</sup> Sohngen et al. (1999) cite mean timber yields (annual increment rates in cubic metres per hectare per annum) of 17.4 in Oceania and 11.43 in Asia-Pacific in 1990; these imply rotations of between 15 years and 22 years to achieve harvests of 250 cubic metres per hectare.

where the Gogol woodchip project eventually led to significant landowner participation in timber production for the Jant woodchip mill in Madang town. Yet the gross export value *per hectare* of forestry was as much as US\$36,000 in 1997 (PNGFP 1998), and from coffee only US\$1,642.<sup>9</sup> But then authors of recent World Bank reports on agriculture and forestry in Papua New Guinea seem wholly unaware of the concept of yield that most Papua New Guinean subsistence farmers appreciate rather well.<sup>10</sup> Even the Papua New Guinea Forest Authority (2004) recognises that its klinkii pine plantation at Bulolo has yields at least ten times larger than those of most natural forest logging operations, at around 250 cubic metres per hectare against, for example, the 26 cubic metres that was hoped for by the Rimbunan Hijau logging project at Hawain in East Sepik, where its actual yield in 1993-94 was only 13 cubic metres per hectare (Leedom 1997: 63). Yet the Forest Authority has made no attempt either to replicate the Bulolo plantation elsewhere on its own account or to encourage a shift to plantation silviculture by the resource owners themselves.

Not one of the many fine full-colour maps of each province's subsistence agriculture and land potential in the *Rural Development Handbook* shows either the topography or the extent of forested areas. Both are surely critical for assessing the scope for yet more subsistence agriculture, and especially for determining the trade-offs between forestry activities and agriculture when both compete for the same land. Hopefully, a future second edition would address this by collating the forestry location maps from the *National Forest Plan 1996* with the maps in the *Handbook*. Comparing the maps for Sandaun Province (see Figures 4 and 5), one may note how the potential for forestry just inland from the coast east of Aitape would not compete with the main agriculture in the province, which is low intensity sago production in the most populous area around Lumi, south of Aitape. The *Handbook* fails to mention either the poor quality of subsistence based on sago or the potential of plantation forestry to generate employment and high cash income per hectare, despite concluding that the people of Sandaun have "very low incomes, poor access to services [and] have few opportunities to improve their livelihoods" (Hanson et al. 2001: 229).

The neglect of forestry in the *Rural Development Handbook*, with its focus on smallholder agriculture, is less surprising than the absence of any specific measures to raise incomes from forestry either in the World Bank's proposal in 2000 to offer a Forestry and Conservation Loan Agreement to Papua New Guinea of US\$17 million or in the (2004) report of its Forestry Review Team to the government's Inter-Agency Forestry Committee. The World Bank's Project Appraisal claimed that the loan would generate financial and economic rates of return of 21 per cent per annum. That seems unlikely when its main components consist of allocating US\$6.4 million to improving landowner decision-making through training workshops and seminars, and US\$4.68 million for "technical assistance" to the government's Office for Environment and Conservation. A further US\$7.26 million of the project loan will fund the Forest Authority to expand its "inspection and monitoring" (World Bank code for prevention, see Filer 2004) of forest operations (World Bank 2000: 36-40). Given that the proposed loan requires payment with interest at the World Bank's usual commercial fixed spread rate, commitment fees (0.85 per cent per annum for the first 4 years), and front-end fee (1 per cent or US\$0.1736 million), the Government of Papua New Guinea has done well not to proceed with this project, with its highly unlikely capacity to generate sufficient tax revenue to enable the government to repay the full loan which with interest could well be US\$35 million. We suggest below that the Government should request the World Bank to consider revising the project so as to provide seed funding for establishment of at least five plantations, since

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<sup>9</sup> Equivalent figures for 2003 are US\$13,950 for timber and US\$520 for coffee.

<sup>10</sup> For example, the World Bank's (1997) report on 'accelerating agricultural growth' in Papua New Guinea never discusses yields of alternative crops either relative to each other or to plantation forestry. Likewise, the earlier World Bank report on the forestry sector also fails to compare the opportunity costs of plantation forestry with those of agriculture in a country whose primary resource endowment is forests whilst downplaying the prospects for the former (World Bank 1990: 26) and ignoring them completely in its section on "maximizing returns to the forestry sector" (ibid: 29).

there would be some prospect of these generating tax revenues (from both the profits of the plantation companies and the incomes of their employees). Fletcher Challenge Forests provided for taxes of US\$15 million in 2000, but the Bank's loan appraisal never mentions any tax being generated by its project for the good reason that there could be none -- least of all from the advisers it was proposing to fund from the loan's technical assistance component (US\$7.37 million).

Colin Filer (2000) has documented the repeated efforts of the Papua New Guinea government to engineer replacement of log exports by processed timber products, as urged by the Barnett Inquiry. Lacking that theology, New Zealand's Fletcher Challenge Forests sold 3.5 million cubic metres of logs in 2000, and only 0.6 million cubic metres of manufactured products, directing more than half of its logs to processors in Japan, Korea, and other industrial countries, while less than half was taken up by industry in New Zealand. In general, it is difficult for exporters of raw materials to know in detail the specific requirements of consumers in importing countries for the finished product, which presumably explains why New Zealand's exporters have been content to export raw rather than finished products.

The New Zealand data possibly provide a measure of by how much the World Bank should offer to compensate Papua New Guinea, annually, for its proposed cessation of all logging. A more constructive approach would be for the World Bank to recognize that the New Zealand model has much more to offer all participants than its own preference for a complete ban on logging. The Kaingaroa forest largely comprises Crown (i.e. State) land but with options that could allow it to revert wholly or partly to Maori ownership, subject to conditions allowing the licensee (then Fletcher Challenge) to complete all the existing rotation and harvesting of all the crop of that rotation (Fletcher Challenge Forests 2000: 67). By contrast, most forest licences issued in Papua New Guinea have no certainty, being either terminable at will by the Government whenever it has been required to do so by the World Bank or subject to penal export tax rates also imposed by the World Bank in its 1996 Structural Adjustment Programme -- and for that reason there has been little incentive for licensees either to undertake sustainable logging of natural forest or to replant on a plantation basis (Filer 1998: 367-8).

Now if Papua New Guinea chose to follow the example of countries like Malaysia, Sweden, and New Zealand by exploiting its largest resource to its full potential, what would need to be done to begin that process? The first step would have to be repealing the 1991 Forestry Act, and reverting substantially to the legislation previously in place, notably the Forestry (Private Dealings) Act. The 1991 Act grew out of what in retrospect seems the half-baked Barnett Report, with its exhaustive -- not to say exhausting -- exposure of alleged depredations by foreign logging companies. On closer inspection, much of Barnett's evidence of transfer pricing was false, mainly because he failed (apart from a cursory mention) to allow for freight costs when comparing c.i.f. log import prices in Japan with f.o.b. export prices in Papua New Guinea. Malaysian and Papua New Guinean log export prices tracked each other very closely in the 1980s and showed the same difference from Japan's import prices (see Figure 3).<sup>11</sup>

Ironically, real evidence of transfer pricing emerged after the World Bank required Papua New Guinea to impose a progressive export tax in 1997, resulting in sharp reductions in both volumes and declared prices as compared with Malaysia's at the same time. The effective marginal rate of the log export tax is easily as much as 110 per cent of normal profits, for a normal gross profit margin on sales value of K100 per cubic metre could be 30 per cent, but the log tax rises to 30 per cent of marginal sales value when prices rise to between K110 and K130 per cubic metre, 50 per cent between K130 and K150, and finally 70 per cent on the excess of prices above K200 (as of 2000);

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<sup>11</sup> Duncan (1994: 20) also concluded there was very little evidence to support Barnett's claims of either transfer pricing or under-reporting of volumes exported prior to 1994.

there have been slight adjustments since then).<sup>12</sup> That explains why *declared* log prices have fallen since the Bank's tax came in from as much as \$170 per cubic metre in 1996 to as low as US\$70, with a consequent loss of foreign exchange earnings as well as tax proceeds far below what they would be in a more honest system, based on corporate tax at PNG's current rate of 25 per cent for non-mining profits.<sup>13</sup>

The export tax system imposed by the World Bank is a levy that is more than proportionate with rising prices of log exports above a very low level. Now all economics tells us that:

1. Sales taxes like GST should be levied at a flat percentage rate, as with the 10 per cent GST in Australia and Papua New Guinea.
2. Export taxes are not very clever, given that most countries seek to encourage exports.

Indeed, most GST systems exempt exports entirely, by providing for refunds of GST paid on exporters' inputs. The World Bank (1999a: 67) recognized this, but excused its progressive export tax on the grounds that the country's Internal Revenue Commission (IRC) was not capable of collecting corporate taxes from the log exporters. A simpler solution to that problem would have been to use the US\$1 million the Bank spends on consultants in the Forest Authority to provide the same number of tax auditors to the IRC. Even just one would be enough to see to it that Rimbunan Hijau paid its due taxes on its 60-80 per cent share of total log exports.

The World Bank's reaction (1999a: 66-67) was both cynical and dishonest -- it claimed that the fall in log exports in 1998 and 1999 was not due to its tax but to the regional economic crisis of 1997-98. But Malaysia's strong forest product exports in those years give the lie to the World Bank's assertion.

Some authors, including both Duncan (1994) and the World Bank (2000), justify penal log export tax rates as the means whereby the Papua New Guinea Government can capture "resource rents" whenever prices rise above prescribed levels. Ironically, the same authors and many others decry rent-seeking behaviour by Papua New Guineans, especially putative landowners in the mineral project areas. Garnaut and Clunies Ross (1983) proposed progressive mineral taxation (known as the "additional profits tax" with rates rising to 75 per cent for petroleum projects) for the same reasons and secured its adoption in Papua New Guinea, albeit in a modified form which means that it has seldom been operative. Mainstream economics deplores *all* rent-seeking and sees the perfectly competitive model as the means whereby it can and should be eliminated, since optimal levels of production will not be attained while rents persist. Mainstream economics proposes, instead of rent-seeking taxation, use of lumpsum transfers from rich to poor to secure desired income redistribution, since such transfers do not affect production levels. Papua New Guinea's standard

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<sup>12</sup> Fletcher Challenge Forests' revenues were only 6 per cent and 13 per cent larger than operating costs in 1999 and 2000 respectively. Had it been subjected to even the World Bank's lowest 15 per cent tax rate on its exports it could have been put out of business (Fletcher Challenge Forests 2000: 27).

<sup>13</sup> It has been claimed (by Jim Douglas amongst others) that the World Bank's initial forest revenue system might not have had the severe impact on declared export volumes and prices after 1997 had it been imposed as originally intended on US dollar export prices rather than the Kina equivalent price applied by the Papua New Guinea Forest Authority and Customs, especially when the Kina was depreciating rapidly (see Table 3). However, it is likely that higher rates would have been charged if the US dollar price had been the applicable base following the fall in international prices in 1998 -- using the declared log prices below US\$100 since 1998 as the tax base, the Bank's progressive tax rates would have generated zero revenue. That is why, when the tax base was changed to US dollars in the 2004 Budget, the nominal rates were drastically changed to match the lower US dollar prices (compare Tables 3 and 4).

corporate tax system is consistent with this approach, with a flat rate of 35 per cent on foreign mining companies' profits even though it secures only a proportionately high revenue yield when profits are high.<sup>14</sup> The underlying naiveties in the Garnaut and Clunies Ross case for additional profits taxation are, first, that it is inimical to profit maximization (attainable only with flat rate corporate taxes) because of its progressive character, and second, their failure to appreciate that since public companies sooner or later distribute profits to their shareholders, it is taxation of the latter that may be used to achieve social objectives.

## Conclusion

This paper has shown the enormous potential of Papua New Guinea's forest industry for generation of vastly higher incomes for a high proportion of the country's population. Within a seminar paper's confines of time and space it has not been possible to include a discussion of how land tenure issues might complicate the development of plantation forestry in Papua New Guinea, but these are taken up in Curtin (2003) and Curtin and Lea (n.d.). Fingleton (2004) argues that Papua New Guinea cannot be viable without customary land groups, while Hughes argues that it cannot be viable while full property rights are denied to agricultural producers (see Gosarevski et al. 2004). Both are probably wrong: the expansion of oil palm planting in areas not owned but directly managed by New Britain Palm Oil Ltd shows that individual land titling is not a necessary condition for commercial large scale production, whilst clearly the existence of thousands of incorporated land groups has done little for production in most of the country. New Britain Palm Oil's leasing arrangements could well serve as a model for plantation forestry.<sup>15</sup>

The production and other data cited above from New Zealand and Solomon Islands showed how it is feasible for Papua New Guinea to generate exports from plantation forestry to a value double its present total exports. Doubling exports would of itself generate at least a proportionate increase in national income and GDP and thereby a doubling of average incomes from the present (2003) US\$673-760 (depending on actual population) or A\$1035-1169 to about US\$1400 or A\$2200 (discounting growth from any other source). That could be achieved within 10-15 years if plantations were developed on the rotation basis that the World Bank's first forestry report (1990: 24) considered feasible. Ironically, given the World Bank's later hostility, that would also allow Papua New Guinea to achieve most of the "Millennium Development Goals", such as reductions in the 1990 levels of infant mortality by two-thirds and attainment of universal primary education.

To achieve such an outstanding result would require the following actions:

1. Repeal of the restrictions in the *Forestry Act* 1991 on customary landowners' ability to negotiate timber sales agreements, and replacement of the Act by new legislation to provide for (i) enabling provisions for landowners to enter into long term leasing arrangements including to their own wholly or partly owned plantation companies, (ii) public auctioning of timber rights exclusively to public companies registered in Papua New Guinea and listed on the Port Moresby Stock Exchange, with special voting rights for

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<sup>14</sup> Mining company taxation in Papua New Guinea comprises a profits tax of 35 per cent and a dividend withholding tax for non-residents of 17 per cent, for an all-in rate of 46 per cent, on which foreign shareholders will usually be able to claim tax credits in their home countries. The structure is different for petroleum and for new mining projects post-2000.

<sup>15</sup> This author's paternal and maternal ancestors have for over 500 years been tenants of first the abbots of Glastonbury (in Somerset, England) and then since 1539 of the royal and secular expropriators of the abbots. With secure long-term tenancy agreements they have not been deterred from successful farming until the present. Neither Fingleton nor Hughes seems to be aware of the concept of tenancy.

landowners as “Class A” shareholders being a possibility, and (iii) public auctioning of logs offered for sale to exporters by the public companies in (ii).<sup>16</sup>

2. Amendment of the *Land Groups Incorporation Act* to provide for re-registration of those Incorporated Land Groups Act with a prescribed minimum level of fully paid-up capital as public companies under the *Corporations Act*.
3. Cancellation of all log export taxes, and increased staffing of the Internal Revenue Commission to undertake annual tax audits of all firms engaged in the forest industry in order to secure compliance with the *Taxation Act*.
4. Requisition to the World Bank to redesign its proposed Forestry and Conservation Project loan of US\$17 million to contribute to the startup costs of say five commercial forestry plantation projects and the establishment costs of arboreta in areas of exceptional biodiversity.

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<sup>16</sup> Duncan (1994) made a similar proposal.

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## Appendix

### Reconciliation of Papua New Guinea's 1980 and 2000 Population Censuses

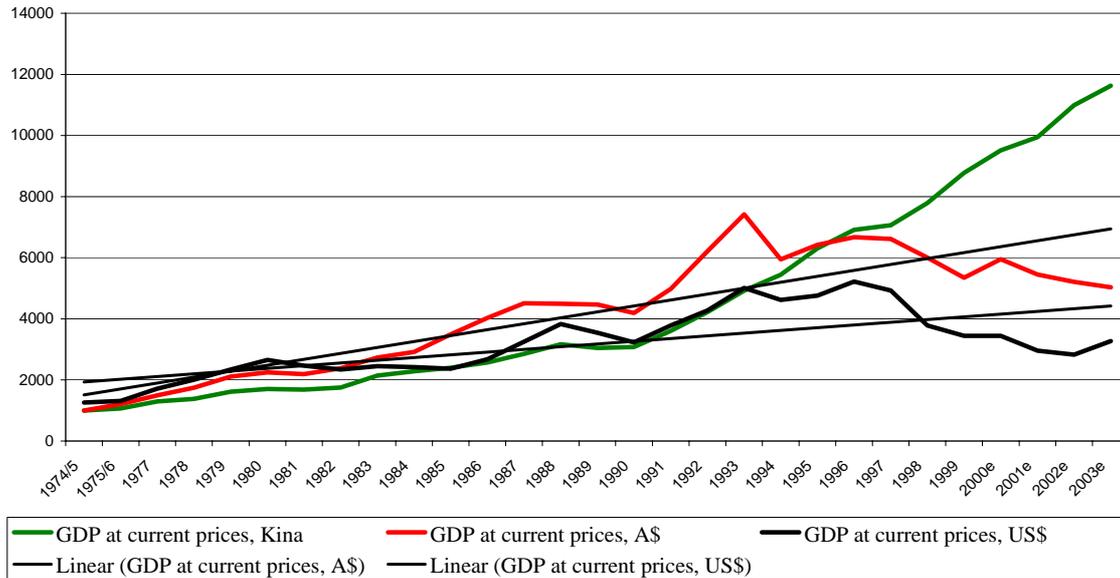
The 1980 Census is generally considered to be the most reliable of the three censuses since Papua New Guinea became independent in 1975. The 1990 census was of a generally high standard, but inter-censal comparisons between 1980 and 1990 are complicated by the absence of data from the North Solomons province (Bougainville) because of its attempted secession in 1989. This led to the return to the rest of Papua New Guinea of many migrant workers from cocoa plantations and the Panguna copper mine as well as many Bougainvilleans, especially public servants, resulting in some inflation of the 1990 population in the other 18 provinces and the National Capital District. Hayes shows how the population in 1990 aged 10-19 was recorded as larger than that aged 0-9 in Papua New Guinea (minus Bougainville) in 1980, and that there was a generally lower than normal level of attrition between other 1980 age-groups and their counterparts in 1990 (Hayes 1996, Table 2.3 and p.20). That is an indication of net migration from Bougainville to the rest of Papua New Guinea in 1989. This suggests that one needs to use the 1980 census as the benchmark for deriving a corrected population of Papua New Guinea in 2000, using (unlike Hayes) the total population in 1980, as by 2000 Bougainville had returned to the fold (at least for the census in most districts).

In Figure 1, the evident over-enumeration of the 2000 census is depicted by comparing age-groups in 1980 with their counterparts 20 years older in 2000. In Figure 2, the 2000 population is restated using the E0=40 UN Far East model's table of survival ratios (see Hayes 1996, Table 3.1).<sup>17</sup> However while use of life tables enables us to estimate the survivors from each 5-year cohort alive in 1980 still alive in 2000, it does not provide guidance on numbers aged 0-9 in 1990 and 2000 respectively. Raising numbers aged 0-9 in 1990 for all Papua New Guinea by 5 per cent to allow for children born in Bougainville between 1980 and 1990, and using the enumerated numbers in that age-group in 2000 produces a population of only 4.5 million in 2000, rather than the claimed 5.17 million, but one that is at least consistent for all those aged more than 19 in 2000 with the numbers aged 0-9 in 1980. The implied population growth rate between 1999 and 2000 is then 2.15 per cent per annum, and that seems more consistent with Papua New Guinea's relatively high infant mortality rate than the supposed 2.66 per cent growth rate indicated by the unadjusted 2000 Census.

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<sup>17</sup> Hayes (1996) contains only the female survival ratios, so the corrected 2000 Census is subject to further adjustment. The E0=40 survival ratios were selected because they imply a somewhat smaller population for Papua New Guinea (minus Bougainville) in 1990 than was enumerated, by 35,000, thereby roughly allowing for the net migration from Bougainville to the rest of Papua New Guinea in 1989.

**Chart 1 Papua New Guinea's GDP at current prices  
in Kina, A\$, and US\$**



**Table 1  
GDP growth in Papua New Guinea and Australia 1975-2003**

<b>1. Papua New Guinea</b>	<b>1974/75</b>	<b>2003</b>	<b>1975-2003 % pa</b>
1.1 National Income (GDP), current prices, K Mn.	1004.10	12,947.50	9.13
1.21 Population, million	2.68	5.41	2.51
1.22 Population, 2003 adjusted	2.68	4.79	2.08
1.31 GDP per head, Kina, official 2003 population	374.31	2,393.25	6.63
1.32 GDP per head, Kina, adjusted 2003 population	374.31	2,701.59	7.06
1.41 GDP per head, A\$, official 2003 population	374.31	1,035.32	3.63
1.42 GDP per head, A\$, adjusted 2003 population	374.31	1,168.71	4.07
1.51 GDP per head, US\$, official 2003 population	470.55	673.94	1.28
1.52 GDP per head, US\$, adjusted 2003 population	470.55	760.77	1.72
1.61 GDP, current prices, A\$	1004.10	5,601.09	6.14
1.62 GDP, current prices, US\$	1262.25	3,646.02	3.79
<b>2. Australia</b>			
2.1 GDP, A\$, current prices	67,105.00	193,184.00	3.78
2.2 GDP per capita, A\$	4,970.74	9,706.00	2.39

Sources: Bank of Papua New Guinea 1998; Treasury, Budget 2005; author for adjusted 2003 population  
Australian Bureau of Statistics 5206, *National Income, Expenditure and Product*, June 2004;  
ABS Australia Yearbook 2001

Source: Bank of Papua New Guinea 1998, 2003

**Table 2**  
Scaled poverty line food baskets, national average quantities

	Ave grams per AE per day	Ave kg per AE per year	Kcal per kg	Edible fraction	Kcal per AE p.d. (edible portions)
Sweet Potato	665	242.73	1144	0.84	639.04
Cassava	70	25.55	1295	0.87	78.87
Taro	183	66.80	1117	0.84	171.71
Yam	58	21.17	1140	0.81	53.56
Banana	302	110.23	1165	0.65	228.69
Sago	119	43.44	3313	1	394.25
Coconut	103	37.60	3837	0.65	256.89
Rice	23	8.40	3830	1	88.09
Lamb & mutton	1	0.37	3780	0.84	3.18
Pork	7	2.56	3290	0.84	19.35
Chicken	1	0.37	2040	0.72	1.47
Other meat	13	4.75	2480	0.99	31.92
Fish	5	1.83	1398	0.74	5.17
Sugar cane	131	47.82	678	1	88.82
Other fresh fruit	24	8.76	433	0.83	8.63
Peanut	1	0.37	5516	0.69	3.81
Aibika	38	13.87	350	0.5	6.65
Other veg. & nuts	157	57.31	521	0.74	60.53
Potato	1	0.37	750	0.8	0.60
Betel nut	17	6.21	1100	0.4	7.48
Flour	2	0.73	3433	1	6.87
Tinned meat	1	0.37	1921	1	1.92
Tinned fish	2	0.73	1820	1	3.64
Milk	0	-	4924	1	-
Sugar	2	0.73	3935	1	7.87
Bread	1	0.37	2370	1	2.37
Biscuits	1	0.37	3674	1	3.67
Dripping	1	0.37	8741	1	8.74
Eggs	0	-	2374	0.96	-
Tea etc	0	-	484	1	-
Snack food	0	-	5026	1	-
Salt, spices, sauces	1	0.37	205	1	0.21
Soft drink	1	0.37	466	1	0.47
Beer	0	-	347	1	-
Other alcohol	0	-	1929	1	-
Meals out					29.00
Totals	1931				2,213.42

Source: Gibson and Rozelle 1998 Table 1, p.49 (items in red are locally produced; items in blue are either imported or produced from imported materials).

**Table 3**  
**Log export tax regimes in Papua New Guinea 1995-1999**  
*(Kina log price as tax base)*

	<b>1995</b>	<b>1997</b>	<b>1999</b>
<b>1. Prices, K/m3, fob</b>	<b>K/m3</b>	<b>K/m3</b>	<b>K/m3</b>
@ fob price US\$100/m3	132.54	143.45	285.71
@ fob price US\$200/m3	265.08	286.90	571.43
<b>2. Tax payable, levied on Kina prices</b>	<b>K/m3</b>	<b>K/m3</b>	<b>K/m3</b>
@ fob price US\$100/m3	41.35	36.90	130.5
@ fob price US\$200/m3	82.70	131.33	330.5
<b>3. Net after tax export Value</b>	<b>K/m3</b>	<b>K/m3</b>	<b>K/m3</b>
@ fob price US\$100/m3	91.19	106.55	155.21
@ fob price US\$200/m3	182.37	155.57	240.93
<b>4. Net after tax export Value in US\$</b>	<b>US\$/m3</b>	<b>US\$/m3</b>	<b>US\$/m3</b>
@ fob price US\$100/m3	68.80	74.28	54.33
@ fob price US\$200/m3	137.60	108.45	84.33
<b>5. Tax payable, levied on US\$ price, payable in kina</b>	<b>K/m3</b>	<b>K/m3</b>	<b>K/m3</b>
@ fob price US\$100/m3	41.35	23.67	47.14
@ fob price US\$200/m3	82.70	101.13	201.43
<b>6. Exchange Rate, US\$/Kina</b>	0.7545	0.6971	0.35

*Sources: Filer 1997, p.231; Hunt 2001, p.43*

**Table 4**  
**Log export tax regime 2004**  
*(US\$ fob export price tax base)*

<b>Bottom of bracket</b>	<b>Top of bracket</b>	<b>Marginal Rate/m3</b>	<b>Amount US\$</b>	<b>Eff rate %</b>
0.00	22.60	0.10	2.15	9.50
22.60	27.60	0.24	3.34	12.08
27.60	32.63	0.43	5.49	16.82
32.63	37.65	0.48	7.87	20.91
37.65	50.20	0.52	14.43	28.74
50.20	100.00	0.62	45.08	45.08
100.00	150.00	0.62	75.91	50.60
150.00	200.00	0.62	106.73	53.37

*Source: Treasury, 2004 Budget*

Fig. 1 Population by age-group in 1980

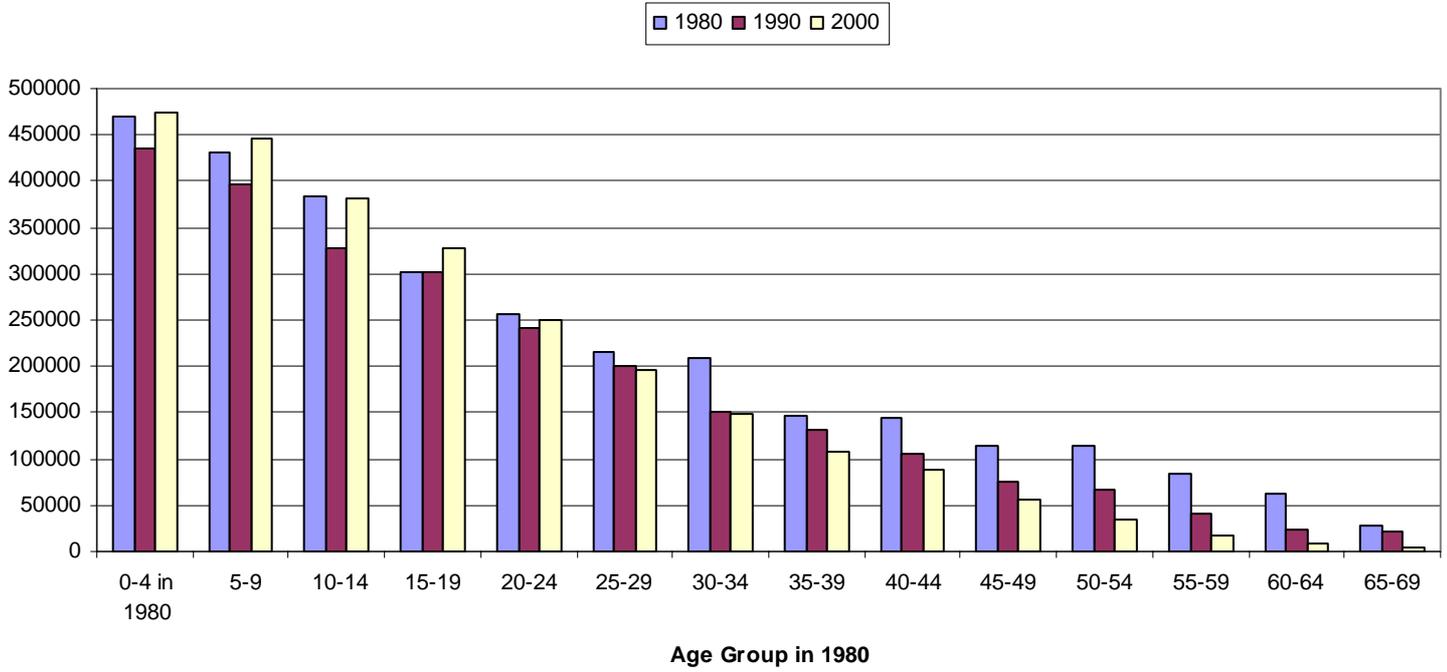
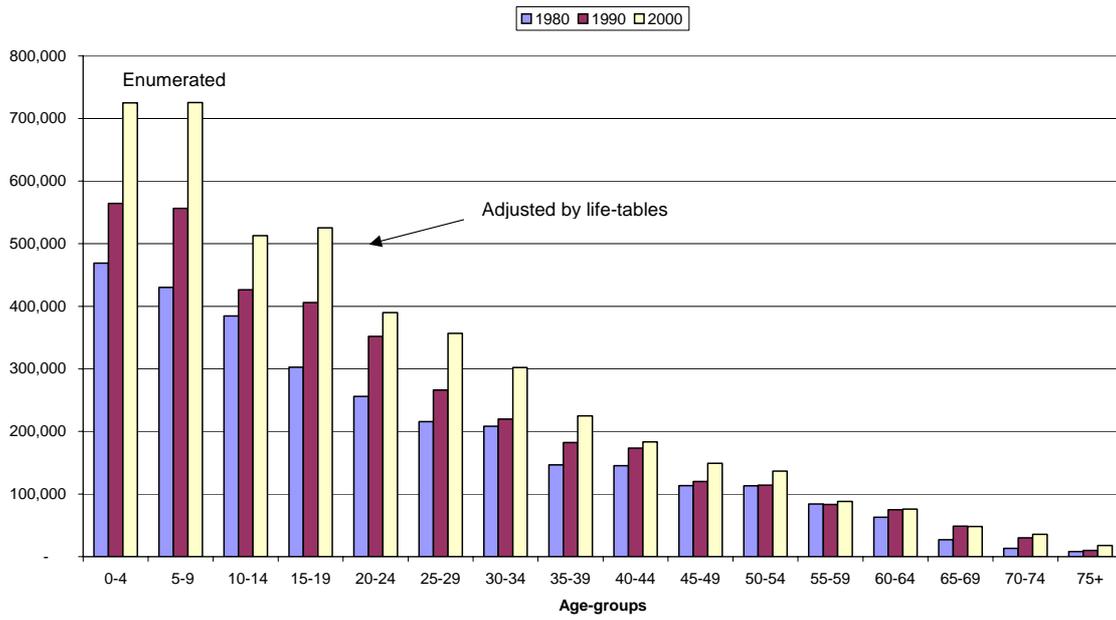


Fig.2 Census 1980 and Censuses 1990 and 2000 as adjusted by Life Tables



**Fig.3**  
**Japan's log import prices (cif) and export prices (fob) of Malaysia & Papua New Guinea**

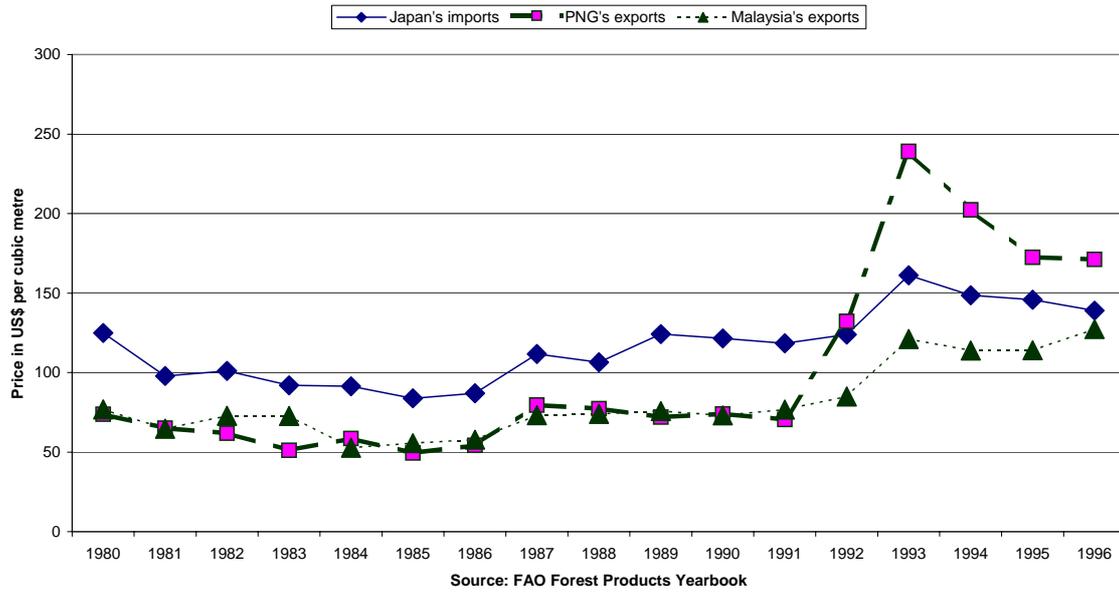


Fig.4 Sandaun Province - Subsistence agriculture

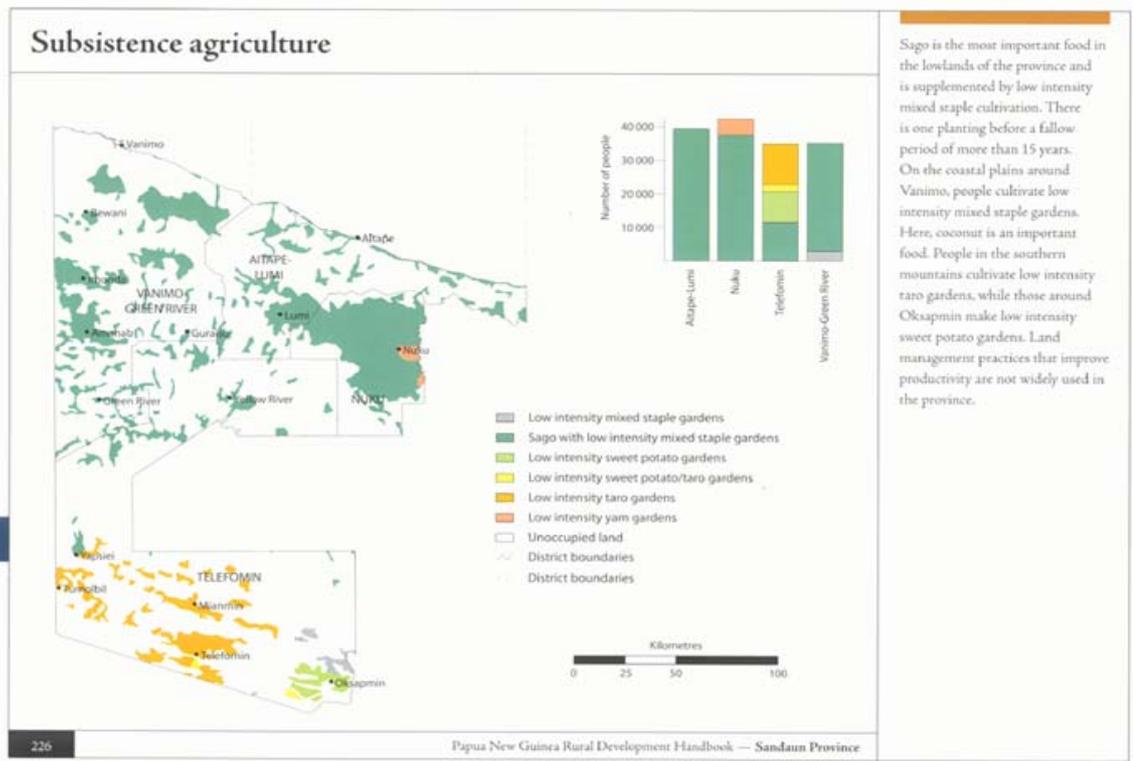


Fig.5 Sandaun Province - Forest Resource Map

