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Aid and Oil in Papua New Guinea: Implications for the Financing of Service Delivery

Aaron Batten

Abstract

This paper measures the extent to which both donor finance and resource revenues have contributed to higher rates of expenditure in key development sectors of the PNG economy—social services (including health and education) and infrastructure, between 1975 and 2010. Estimated elasticities are then compared against a hypothetical revenue scenario to assess the potential contribution that post-2014 LNG revenue inflows may have on increasing the financing available to these sectors.

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1. Introduction

Papua New Guinea (PNG) has relied heavily on both foreign aid (henceforth 'aid') and the extraction of minerals (henceforth 'resources') as sources of government revenue during its post-independence era. The first section of this paper analyses how both these revenue sources have influenced government expenditure patterns during the post-independence period. This includes a comparison of the impact of budget support vis-a-vis project aid on financing core service delivery activities, as well as how aid has compared against resource revenues in financing the same. Estimated elasticities are then used to extrapolate what impact the commencement of an upcoming Liquefied Natural Gas (LNG) project may have on the expenditure composition of government and the financing available to these core service delivery priorities.

As shown in Chart 1, PNG's dependency on aid revenues has varied considerably over time. Between 1975 and the mid-1990s the portion of government revenue obtained through aid flows followed a long term decline - falling from a high of 60 per cent of total government revenue to 10 per cent. This occurred largely as a result of the scaling back of Australian general budgetary support and expanding domestic revenue sources. As Australia then expanded its programme of direct project support and a number of new donors entered the country, aid increased back to approximately 20 per cent of total government revenue for the latter half of the 1990s. With relatively constant nominal aid flows and a scaling up of alternative domestic source of government this proportion then fell back down to 10-15 per cent during the mid to late 2000s.

Resource revenues have also been volatile. In the early post-independence period the majority of revenues were obtained from new mining operations in Bougainville, which were contributing up to 10 per cent of total government revenue (Wolfers 1981). The early 1980s saw a period of reduced output from the Bougainville mine, leading to

dramatic decrease in resource revenues in the early-1980s. Resource revenues again increased in the mid-1980s as output picked up in Bougainville and a number of smaller mining operations began production – reaching 12 per cent of total government revenues by 1988. PNG's burgeoning resource sector then recorded another large setback in 1989 when a struggle for greater compensation and less environmental damage by local residents led to a closure of the mine in Bougainville. At half way through a 30-year lifespan, this single mining operation was generating approximately 15 per cent of government revenue – as well as 35 per cent of the country's total exports and 8 per cent of GDP (Stein 1991:7).

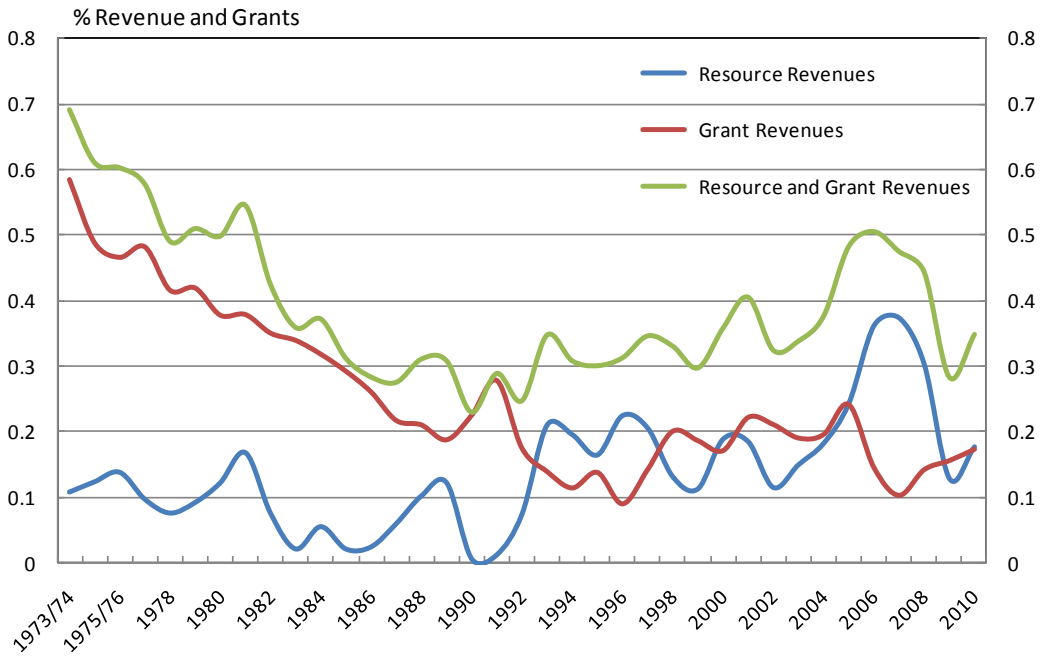
With the commencement of a number of new mining operations in the early 1990s[1] resource revenues again increased, fluctuating between 10 per cent and 20 per cent of total government revenues until 2002. From 2002, PNG began to benefit from its largest ever resource revenue boom with global prices for its major mining exports – principally gold and copper – reaching record highs. By 2007 resource revenues were contributing almost 40 per cent of total government revenue. With a moderation in global resource price levels and a scaling back of production at a number of mining operations this contribution moderated from 2008 onwards, reaching 35 per cent of total revenues in 2010.

Over the coming years, PNG's reliance on resource revenues is again expected to increase. This is attributable largely to the commencement of a large LNG gas project which is expected to begin making direct payments to government from 2014. Projections indicate that these revenues could be as high as K2bn for the first ten years of production (2014-2024) and K3bn thereafter – representing a 22 per cent and 33 per cent increase to total revenue and grants in the 2011 Budget, respectively (ACIL Tasman 2009, PNG Budget 2011). In contrast to increasing resource revenues, nominal aid flows are expected to remain relatively constant over the medium term with the 2011 Budget projecting total aid to decline marginally from 1.5bn in 2011 to K1.4bn in

[1] PNG's largest mining projects since independence have included Exxon Mobil LNG (2014 onwards, Southern and Western), Ok Tedi gold and copper (1984-present, Western), Panguna gold and copper (1975-1989, Bougainville), Porgera gold (1989-present, Enga) , Lihir gold (1997-present, New Ireland), Hidden Valley gold and silver (2009-present, Morobe), Ramu nickel and cobalt (2010-present, Madang), Misima gold and silver (1990-2004), Hidden Valley gold and silver (2009-present, Morobe). Other smaller gold and copper mining operations and current surveying include Simberi (New Ireland), Solwara (New Ireland), Tolukuma (Central), Wafi-Golpu (Morobe), Woodlark (Milne), Yandera (Madang), Kainantu (Central), Imwauna (Milne), Mt Bini (Central), Mt Kare (Enga).

2015 (PNG Budget 2011). This amount will maintain aid at approximately 14 per cent of total government revenue between 2011 and 2014. However, assuming aid flows remain constant and alternative domestic revenue sources increase as LNG payments begin; this will result in a significant decline in the proportion of total government revenue attributable to aid from 2014 onwards – most likely to less than 10 per cent of total revenue.

Chart 1: Resource and Grant Revenues as a Proportion of Total Revenue and Net Lending



Source: PNG Budget Documents (Various years); Batten (2010).

2. Literature Review

A heavy reliance on resource revenues can have many adverse impacts on the fiscal behaviour of a government. By obtaining revenue from a small number of mining operations rather than the population at large, resource revenues can weaken the economic and social management responsibilities of a government. A lack of accountability to domestic constituents can also weaken budgetary and revenue institutions, resulting in poor expenditure control, and poor quality public investment such as low levels of financing for development oriented activities (Moss et al. 2006:10).

The large, often opaque, revenues associated with mining operations can also promote intense rent-seeking amongst the political elite as they vie to expand access and control of these revenue inflows. This promotes further distortions in fiscal priorities. Resource revenues can also undermine government's incentive to establish a well-functioning tax bureaucracy as it finds it more politically appealing to rely on extracting than to increase taxes on domestic constituents. This creates a resource dependency further amplifying each of the above effects.

Many of these same arguments have also been leveled against aid as a source of government revenue. Aid can distort fiscal priorities by reducing the accountability of Government's to its citizens and eroding domestic institutions (Knack 2000). The unpredictable nature of aid revenues can contribute to the same damaging boom-bust expenditure cycles encouraged by a reliance on resource revenues. The potential for continuous financial bail-outs from donor organisations has also been associated with the moral hazard of encouraging less responsible debt management and lower levels of public savings (Franco-Rodreiguez et al. 1998). Some authors have even found that the unaccountable and unpredictable revenue associated with aid has posed a larger burden on the quality of recipient countries institutions than those revenues obtained from resource extraction (Djankov, Motalvo and Reynal-Querol 2005).

The criticisms of both resource and aid revenues have been particularly strong in the case of PNG. Curtin (2001) argues that the volatility in resource revenues to PNG has contributed to damaging boom-and-bust cycles in government spending which has undermined the quality of long term expenditure planning. Faal (2007:20) also concludes that resource revenues in PNG have encouraged undisciplined government expenditures, which has led to a large focus on non-productive activities. Further, Windybank and Manning (2003:12) argue that aid has enabled successive PNG governments to 'live beyond their means, encouraging irresponsible policies and postponing the need for reform'. Indeed, according to Windybank and Manning (2003), aid has not only perpetuated poor policies but also encouraged PNG's dependence on financial assistance as the expansive aid program became a surrogate government. This argument was also supported by Hughes (2003) and Hughes and Windybank (2005) who argue that aid has supported irresponsible fiscal behaviour.

More recently Batten (2010) estimated that as a result of being used for debt repayment and domestic revenue substitution, aid flows have had a weak effect on increasing expenditure levels in social service delivery sectors. Feeny and McGillivray (2009) also found that donor funds had been predominately used to finance unanticipated shortfalls in the recurrent budget rather than increasing levels of fixed capital investment.

To estimate the impact of both aid and resource revenues on the expenditure composition of the PNG government this paper draws on, and extends, the aid fungibility framework originally developed by Pack and Pack (1990).[2] This framework has been used in numerous country level studies to estimate the impact of aid on government choices for combinations of expenditure across sectors, subject to the budget constraints established by domestic revenues and the inflow of foreign aid (Pack and Pack 1990; Pack and Pack 1993; Tiwara 2007; Peterson 2007). Estimates then show how aid resources intended for one sector have influenced government expenditure both in that sector, and whether it has freed up resources to be transferred to other sectors.

This paper extends the aid fungibility framework to also take account of the impact of both budget support and resource revenues on the same system of interdependent fiscal equations. General budget support, whilst also being a component of aid, differs from project aid in the sense that it simply augments Government's consolidated revenue – in contrast to project aid which is allocated to a specific sector. Likewise, resource revenues are also treated as a simple augmentation of government's consolidated revenue – rather than as an allocation to a specific sector. Making this distinction between aid modalities is particularly important when analysing the fiscal effects of aid in PNG, as it has received approximately 57 per cent of its aid resources in

[2] An alternative approach used by authors such as Khilji and Zampelli 1991, Feyzioglu et al. 1998 and Swaroop et al. 2000 uses panel data to measure the impact of aid on expenditure patterns across a large sample of countries. A criticism of this approach however is that because individual recipient bureaucracies are likely to respond in vastly different ways to aid inflows, estimation results will aggregate the important heterogenous impacts of aid. Another criticism relates to the utility specification which these studies adopt for government preferences distinguishing between two types of expenditure—those to which aid is allocated and others which receive no aid. Authors such as McGillivray and Morrissey (2000a:421) argue that this assumption is acceptable only if there is reason to believe that these two types of expenditure can be separated within the government's utility function such that aid funds can only affect government consumption decisions through the fungible portion whilst non fungible aid has no impact. As Feyzioglu et al. (1998:34) highlight, this requires that 'aid affects the government's choice [over all public goods] only through the fungible portion; public goods purchased from the non-fungible part do not affect this choice'. Given the inter related nature of all these expenditures, however, there is no reason for this to be the case. In fact, one of the central features of categorical fungibility highlights that if aid funding of one sector increases, then the fungible portion of that aid allows government to increase all other expenditures.

the form of general budgetary support since independence. Further, almost 50 per cent of its remaining domestically generated revenues have been generated directly through resource extraction industries.

The following section develops a model that incorporates budget support as well as resource revenues into the typical project aid fungibility framework. This framework is then used to analyse how project aid, budget support and resource revenues (henceforth collectively known as windfall revenues) have each impacted on the PNG Government's expenditure behaviour since independence.

3. Model

The general approach taken by indifference curve fungibility studies has been to select a number of sectors, *i*, for which fungibility is a concern (typically pro poor expenditure sectors such as health and education). All the non *i*th sector expenditures are then placed into a 'general' expenditure category. Likewise, aid flows are classified on a sector basis such that all non *i*th sector aid flows are also included in a 'general' aid category. A system of simultaneous equations are then estimated such that:

$$ED_{i,t} = f(AD_{i,t}, AO_{i,t}) \quad (1)$$

$$EG_t = f(AG_{i,t}, AO_{G,t}) \quad (2)$$

$$REV_t = f(A_t) \quad (3)$$

Where $ED_{i,t}$ is government expenditure on development sector i at time t. $AD_{i,t}$ is project aid allocations made to development sector i at time t. $AO_{i,t}$ is the residual project aid allocations made to all development sectors other than sector i at time t. EG_t is general government expenditure made to all other non development sectors at time t. $AO_{G,t}$ is aid allocations not made to the general category at time t. A_t is total project aid allocations to all sectors which is equal to $\sum_i AD_{i,t} + AG_i$, where AG_i are general budget support grants at time t and REV_t is domestically generated revenue.

A limitation with this approach however, is that project aid intended for the non-*ith* sector is treated equally by the government in its decisions over inter sectoral transfers as general budget support. The problem with this assumption is that project aid

intended for the non-*ith* sector has still been allocated to a specific sector, whereas general budgetary support simply augments domestic revenue collection.

This means that budgetary support will be allocated entirely on the basis of government preferences whilst the portion of the non-*i*th sector project aid which is transferred will depend upon the degree to which the recipient government perceives it to be fungible. Given this, the inclusion of budgetary support in the residual project aid variable is likely to lead to an over estimate of the amount of fungibility taking place from these residual project aid allocations. For a country such as PNG which has received 57 per cent of its total foreign assistance in the form of budgetary support this issue is likely to be of particular importance. This paper thus estimates a model which both allows for divergent impacts between each of these types of aid delivery.

An additional question posited by this paper is how resource revenues impact on expenditure patterns, as such the below model also isolates the resource revenue component of domestic revenue collection. These resource revenues are treated in the same fashion as general budget support - an exogenous revenue inflows, independent of prior economic performance and free by the recipient government to be spent on any expenditure category.

The basic model to be estimated thus builds on Peterson (2007) and Pack and Pack (1990; 1993), but with the disaggregation of foreign grants into project aid and budgetary support and with the isolation of resource revenues from other domestic revenues. These additions also create a number of differences in the fungibility calculations which are discussed in the text.

The calculations focus on three categorical expenditure items—social services, which includes health and education expenditure, infrastructure and all remaining general expenditures. The basic model to be estimated thus consists of a system of interdependent fiscal relationships of the form:

$$ED_{i,t} = f(AD_{i,t}, AO_{i,t}, BS_t, RevX_t) \quad (4)$$

$$EG_t = f(AG_{i,t}, AO_{G,t}, BS_t, RevX_t) \quad (5)$$

$$REV_t = f(A_t, BS_t, RevX_t) \quad (6)$$

Where BS_t is general budget support at time t, and $RevX_t$ is resource revenue inflows from extractive industries and REV_t is all other non-windfall domestically generated revenues. All variables are measured in per capita natural logarithms in constant 1990 prices. This leads to the estimation of the following system of equations[3]:

$$lnESS_t = \beta_{1,SS}+\beta_{2,ESS}ASS_t+\beta_{3,ESS}AO_{SS,t}+\beta_{4,ESS}BS_t+\beta_{5,ESS}RevX_t+\varepsilon_{ESS,t} \quad (7)$$

$$lnEI_t = \beta_{1,EI}+\beta_{2,EI}AI_t+\beta_{3,EI}AO_{EI,t}+\beta_{4,EI}BS_t+\beta_{5,EI}RevX_t+\varepsilon_{EI,t} \quad (8)$$

$$lnEG_t = \beta_{1,EG}+\beta_{2,EG}AG_t+\beta_{3,EG}AG_{EG,t}+\beta_{4,EG}BS_t+\beta_{5,EG}RevX_t+\varepsilon_{EG,t} \quad (9)$$

$$lnRev_t = \beta_{1,REV}+\beta_{2,REV}A_t+\beta_{3,REV}BS_t+\beta_{4,REV}RevX_t+\varepsilon_{REV,t} \quad (10)$$

In each period the government must satisfy an inter-temporal budget constraint equal to:

$$REV_t + RevX_t + ASS_t+AI_t+AG_t+BS_t+DEF_t = ESS_t+EI_t+EG_t+DS_t \quad (11a)$$

Which upon aggregation of the project aid, expenditure and revenue variables simplifies to:

$$\sum_{u=REV,RevX} R_{u,t} + \sum_{I=1} A_{i,t} + BS_t + DEF_t = \sum_{I=1} E_{i,t} + DS_t \quad (11b)$$

Where DS_t is debt servicing costs and DEF_t is the government's budget deficit or surplus. As is standard in the literature, debt servicing is assumed to be exogenous and in this case included in the general government expenditure category, both to preserve degrees of freedom and to keep the model tractable.

Equation (11b) implies that the identities shown in Equations (7–10) are jointly determined and hence not independent of one another. This situation violates the OLS assumption of zero error term correlation and will lead to any OLS coefficient estimates

[3] The Bougainville crisis was a traumatic episode for the political, economic and fiscal management of PNG. Initial estimations sought to control for this event and to determine whether it has had any structural effect on the expenditure and revenue management of the PNG economy, by including a dummy variable into the estimations. This variable took the value of zero for 1974–88 and one for 1989–2010 however did not have any significant impact on the results so has been excluded in the final estimations. An organised reconciliation process began at the tribal level in the early 2000.

being both biased and inconsistent. To deal with this issue, a systems estimation procedure known as SUR is utilised. SUR is a version of multivariate linear regression developed by Zellner (1962) which solves the minimal error variance for the estimated parameters through the simultaneous estimation of the system of equations.[4] This procedure corrects for the correlation across the error terms in each equation, improving the efficiency of the coefficient estimates (Wooldridge 2002:144). [5] For the purposes of estimation, the budget deficit or net borrowing is taken as the excluded variable from the system of jointly determined equations to prevent the estimation of an identity in Equations (7–10).

For each of the expenditure Equations (7–9), a positive elasticity coefficient on the respective aid allocation variable ($\beta_{2,Ei} > 0 \;\; i = SS, I, G$) would indicate that an increase in aid funding results in increased categorical expenditures for each respective sector. On the other hand, a positive elasticity estimate on the other aid allocation variable ($\beta_{3,Ei} > 0 \;\; i = SS, I, G$) indicates a transfer of resources from other aid funded activities to that expenditure category. Likewise, a positive elasticity estimate on either the budgetary support coefficient ($\beta_{4,Ei} > 0 \;\; i = SS, I, G$) or the extractive resource revenue coefficient ($\beta_{5,Ei} > 0 \;\; i = SS, I, G$) indicates that an increase in these sources of government revenue leads to an increase in expenditure for that development expenditure category.[6] From these coefficients it is then possible to calculate:[7]

- The marginal impact of an increase in project aid allocated to each of the social services, infrastructure and general expenditure categories. As well as the impact of this project aid on expenditure levels in other sectors of the economy.
- The marginal impact of an increase in general budget support on the funding levels for the social services, infrastructure and general expenditure categories.

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[4] Seemingly unrelated regression estimates are obtained by first estimating a set of non-linear equations with cross-equation constraints imposed, but with a diagonal covariance matrix of the disturbances across equations. These parameter estimates are used to form a consistent estimate of the covariance matrix of the disturbances, which is then used as a weighting matrix when the model is re estimated to obtain new values of the parameters. These estimates are consistent and asymptotically normal and, under some conditions, asymptotically more efficient than the single equation estimates.

[5] Notably, estimating a system of equations simultaneously only improves the efficiency of the coefficient estimates if there is some connection between each of the equations of interest (Kennedy 2003:314).

[6] It should be noted that from a theoretical perspective it is also required that the sum of the budgetary support coefficients across all the expenditures not exceed 1.

[7] This approach builds on Pack and Pack (1990:192) and simulates the effect of a percentage increase in total foreign aid per capita (project aid and budgetary support) on each of the expenditure categories.

- The marginal impact of an increase in extractive resource revenues on the funding levels for the social services, infrastructure and general expenditure categories.
- The marginal impact of an increase in total windfall revenues (project aid, budget support and extractive revenues), allocated at historical averages, on the funding levels for the social services, infrastructure and general expenditure categories.

The first step in this process is to calculate the change in each of the expenditure categories, as well as non-windfall-revenues, which result from a simultaneous change in each of the categories of foreign aid. The initial categorical level of windfall revenue is equal to $\overline{WR_\iota}/\overline{WR}$, where $\overline{WR}$ is total windfall revenue and $\overline{WR_\iota}$ is the average level of windfall revenue given to category i across the period. For Equation (7) the elasticity effect with respect to social services project aid is equal to:

$$\frac{\partial lnESS}{\partial lnASS} = \hat{\beta}_{2,ESS}$$

where given that ESS and ASS are measured in natural logarithms, $\hat{\beta}_{2,ESS}$ represents an elasticity coefficient. This elasticity of education expenditures with respect to social services project aid can thus be written as:

$$\hat{\beta}_{2,ESS} = \frac{\Delta ESS_t}{\Delta ASS_t} \cdot \frac{ASS_t}{ESS_t}$$

$$\Rightarrow \frac{\Delta ESS_t}{\Delta ASS_t} = \hat{\beta}_{2,ESS} \cdot \frac{ESS_t}{ASS_t}$$

Multiplying this term by the proportion of an overall windfall revenue per capita increase which is allocated to the social services sector based on historical averages gives:

$$\frac{\Delta ESS_t}{\Delta ASS_t} = \hat{\beta}_{2,ESS} \cdot \frac{ESS_t}{ASS_t} \cdot \frac{\overline{WR}_{SS}}{\overline{WR}}$$

where $\overline{WR}$ is total windfall revenues and $\overline{WR}_{SS}$ is the average amount of total project aid given to the social services sector. This can then be rewritten as:

$$d\hat{E}SS_{ASS,t} = \hat{\beta}_{2,ESS} \cdot \frac{ESS_t}{ASS_t} \cdot dASS_t$$

where $d\hat{E}SS_{ASS,t}$ is the total change in social services expenditure from a prorated change in project aid allocated to the social services sector. Completing the same process for the infrastructure and general project aid variables as well as the general budgetary support and extractive revenue variables then gives the total effect of a marginal increase in windfall revenue on social services expenditures. This can be written as:

$$d\hat{E}SS_{ASS,t} = \hat{\beta}_{2,ESS} \cdot \frac{ESS_t}{ASS_t} \cdot dASS_t + \hat{\beta}_{3,ESS} \cdot \frac{ESS_t}{AO_{SSt}} \cdot dAO_{SSt} + \hat{\beta}_{4,ESS} \cdot \frac{ESS_t}{BS_t} dBS + \hat{\beta}_{5,ESS} \cdot \frac{ESS_t}{RevX_t} \cdot dRevX_t \quad (12)$$

where $d\hat{E}SS_{ASS,t}$ is the total change in social services expenditures from an increase in windfall revenues of all types—project aid given to social services, other project aid, budgetary support and extractive industries revenues—allocated at historical averages. Equally, the total effect of an increase in windfall revenues for the other expenditure and revenue items considered in Equations (7–10) can be written as:

$$d\hat{E}I_{AI,t} = \hat{\beta}_{2,EI} \cdot \frac{EI_t}{AI_t} \cdot dAI_t + \hat{\beta}_{3,EI} \cdot \frac{EI_t}{AO_{It}} \cdot dAO_{It} + \hat{\beta}_{4,EI} \cdot \frac{EI_t}{BS_t} \cdot dBS + \hat{\beta}_{5,EI} \cdot \frac{EI_t}{RevX_t} \cdot dRevX_t \quad (13)$$

$$d\hat{E}G_{AG,t} = \hat{\beta}_{2,EG} \cdot \frac{EG_t}{AG_t} \cdot dAG_t + \hat{\beta}_{3,EG} \cdot \frac{EG_t}{AO_{Gt}} \cdot dAO_{Gt} + \hat{\beta}_{4,EG} \cdot \frac{EG_t}{BS_t} \cdot dBS + \hat{\beta}_{5,EG} \cdot \frac{EG_t}{RevX_t} \cdot dRevX_t \quad (14)$$

$$dREV_t = \hat{\beta}_{2,REV} \cdot \frac{REV_t}{A_t} \cdot dA_t + \hat{\beta}_{3,REV} \cdot \frac{REV_t}{BS_t} \cdot dBS_t + \hat{\beta}_{4,REV} \cdot \frac{REV_t}{RevX_t} \cdot dRevX_t \quad (15)$$

The total effect of an increase in windfall revenues can then be compared against the marginal impact of an increase in extractive resource revenues on each of these expenditure categories, to determine whether aid, or resource revenues have had a larger impact on financing development expenditures in PNG. For the social services equation (7) this effect can be written as:

$$\frac{\partial lnESS_t}{\partial RevX_t} = \beta_{5,SSE} \text{ such that if } \beta_{5,ESS} > d\hat{E}SS_t$$

It can be said that an additional dollar of resource revenue has, in the past and according to historical averages, had a larger marginal impact on increasing social services spending than an additional dollar in aid revenue, also when allocated at historical averages between project aid categories and general budget support. This model thus has a number of important features which are useful in the analysis of the fiscal effects of windfall revenues in the PNG context. Firstly, it distinguishes between 'other project aid' and 'general budgetary support aid', reducing the potential for an upward bias in the fungibility estimates. Secondly, it disaggregates between extractive resource and non-extractive domestic revenue collection, allowing a comparison of how aid and windfall resource revenues have influenced the expenditure priorities of successive PNG Governments. Thirdly, it allows aid to all expenditure categories to influence the consumption choices of government in all, even non aid-receiving, sectors of the economy. Fourthly, it distinguishes between government expenditure and aid revenue according to their function rather than the recurrent and development classifications used in much of the literature. This distinction gives a more relevant assessment of the contribution of fiscal policy settings to key service delivery sectors such as health, education and infrastructure.

4. Data Collection

GDP, expenditure and revenue data is obtained from official PNG budget documents as described in Appendix 1. This paper uses the same methodology as established in Batten (2010) for the allocation of government expenditure by sector, with IMF (2010) being used for pre-2002 expenditure data and government budget documents being used for post 2002. In addition to aggregate revenue and expenditure the estimations also require a detailed matching of aid allocations with sectoral expenditures. The IMF (2010) and OECD DAC (2010) databases are not directly comparable and require an element of discretion on the author's behalf as to which expenditure is allocated to which sector. A full description of this can be found in Appendix 1.

As is typical within the literature, the OECD DAC (2010) database was used to obtain sectoral aid flows. Optimally, this aid data would record disbursements by sector

however only has a sufficiently complete time series of categorical expenditures on a donor commitment basis—with aid disbursement data only available at an aggregate level. To overcome this, Petterson's (2007) method is followed—sectoral commitment data is used to calculate the share of project aid going to each sector as well as the share being given as budgetary support each year. These proportions are then applied to the total project aid disbursements from PNG Budget Documents to give aid allocations by sector. Whilst there is little a priori evidence to suggest that certain types of aid would be disbursed more than others following donor commitments, a fundamental assumption of this paper is that aid disbursements by sector are allocated in the same proportion to which donor commitments are made. A full description of the alignment of sectoral aid flows to sectoral expenditure can be found in Appendix 2. This data is measured in US$ and converted into Kina with period average exchange rates.

The general budgetary support variable measures commodity aid and general unallocated program assistance and is taken directly from PNG Budget Documents. All nominal data are deflated into 1990 constant prices with the consumer price index and measured in per capita natural logarithms. A summary is presented in Table 1.

Table 1: Summary Statistics

	Label	Mean	Sum	Min	Max	Range	SD
Real GDP	**GDP**	**935.44**	**33,675.79**	**631.17**	**1,155.43**	**524.25**	**136.98**
Expenditure and Net Lending	**E**	**294.68**	**10,608.33**	**174.78**	**438.79**	**264.01**	**53.23**
Infrastructure Expenditure	E_I	23.39	841.90	0.00	58.82	58.82	12.96
Social Services Expenditure	E_SS	66.43	2,391.37	24.01	95.54	71.53	21.42
General Expenditure	E_G	204.86	7,375.06	33.10	296.31	263.21	42.17
Total Revenue and Grants	**Rev**	**271.66**	**9,779.89**	**146.21**	**346.32**	**200.10**	**36.83**
Resource Revenues	Rev_X	37.53	1,351.01	1.46	117.10	115.63	29.26
Grant Revenues	-	67.12	2,416.39	25.26	161.06	135.80	35.56
Budget Support	BS	49.55	1,783.63	0.00	161.06	161.06	49.03
Project Support	A	17.58	632.76	0.00	61.25	61.25	20.69
Infrastructure Grants	A_I	3.97	143.01	0.00	27.55	27.55	6.07
Social Services Grants	A_SS	4.51	162.46	0.00	24.97	24.97	6.19
General Grants	A_G	9.09	327.29	0.00	37.13	37.13	11.09
Other Infrastructure Grants	A_I_O	13.60	489.75	0.00	49.55	49.55	16.20
Other Social Services Grants	A_SS_O	13.06	470.30	0.00	43.98	43.98	15.61
Other General Grants	A_G_O	8.49	305.47	0.00	36.66	36.66	10.98
Bougainville Dummy	**DUM**	**0.28**	**10.00**	**0.00**	**1.00**	**1.00**	**0.45**

5. Estimation

The SUR estimation procedure accounts for the interdependent nature of these fiscal relationships, which allows the estimation procedure to correct for any simultaneity bias which may have occurred within a non-simultaneous equation framework.

The relationship between each of these equations is that the error terms in each of the 5 equations (7-11) are allowed to correlate.

Table 2: Impact of Windfall Revenues on Expenditure Categories

	(1)	(2)	(4)	(5)	$\frac{\overline{WRev_i}}{\overline{WRev}}$	$\frac{\overline{WRev_i}}{\overline{WRev}}$
	EXP_SS	**EXP_I**	**EXP_G**	**REV_NW**	**Full**	**2006-2010**
A_SS	0.064				0.04	0.07
	(0.063)					
A_SS_O	0.047				0.13	0.27
	(0.061)					
A_I		0.188			0.04	0.07
		(0.103)				
A_I_O		-0.151			0.13	0.26
		(0.111)				
A_G			0.081		0.09	0.20
			(0.085)			
A_G_O			0.002		0.08	0.14
			(0.074)			
A				0.048	0.17	0.34
				(0.047)		
BS	0.258	0.265	0.102	0.014	0.47	0.00
	(0.039)**	(0.089)**	(0.076)	(0.048)		
REV_X	0.014	0.075	0.150	-0.101	0.36	0.66
	(0.037)	(0.081)	(0.072)*	(0.044)*		
Bougainville Dummy	0.002	-0.469	0.004	0.163		
	(0.061)	(0.146)**	(0.126)	(0.080)*		
Constant	3.205	2.066	4.374	5.252		
	(0.253)**	(0.560)**	(0.488)**	(0.304)**		
Observations	36	36	36	36		

Standard errors in parentheses; * significant at 10% level; ** significant at 5% level; *** significant at 1% level. Ψ $\ln OA_i$ measures total project aid allocations less aid allocations from the dependent variable category (*i*). *Note:* For the purposes of estimation, the origin is re-based to +1 by adding one to each observation. A number of variables in a number of years have observations which are close or equal to zero. Taking the natural logarithm of these values would thus lead to them turning negative and also result in the low values of aid and expenditure allocations becoming more dispersed whilst the higher values become more compressed. In the estimation, this would give undue weight to the lower valued aid and expenditure observations which is likely to cause a bias in the results. Adding one to each of the observations also has the added advantage of allowing the inclusion of the zero valued aid and expenditure observations and allowing all values to remain strictly positive (Van de Sijpe 2007:36).

Table 3: Impact of Windfall Revenue Allocations on Expenditure Categories

	(1) Prorated change		(2) Change in expenditure/revenue $\Delta EXP_i = \beta_i \cdot \frac{\overline{A_i}}{\overline{A}} \cdot \frac{Ei}{Ai} \cdot \Delta A$				(3) Total change expenditure/revenue	
	$\frac{\overline{WRev_i}}{\overline{WRev}}$ Full sample	$\frac{\overline{WRev_i}}{\overline{WRev}}$ 2006-2010 Average	β_i	Ei/Ai[8]	ΔEXP_i Full sample	ΔEXP_i 2006-2010 Average	Full sample	2006-2010 Average
Social Services							(2a+2b)	(2a+2b)
a) A_SS	0.04	0.07	0.064	14.72	0.038	0.066	0.069	0.130
b) A_SS_O_{ss}	0.13	0.27	0.047	*5.08*	0.031	0.064	(2a+2b+2c)	(2a+2b+2c)
c) BS	0.47	0.00	0.258	*1.34*	0.162	0.000	0.231	0.130
d) Resource	0.36	0.66	0.014	*1.78*	0.009	0.016	(2a+2b+2c+2d)	(2a+2b+2c+2d)
							0.240	0.147
Infrastructure							(2a+2b)	(2a+2b)
a) A_I	0.04	0.07	0.188	6.14	0.046	0.081	0.011	0.011
b) A_I_O_I	0.13	0.26	-0.151	1.79	-0.035	-0.070	(2a+2b+2c)	(2a+2b+2c)
c) BS	0.47	0.00	0.265	0.49	0.061	0.000	0.072	0.011
d) Resource	0.36	0.66	0.075	0.65	0.018	0.032	(2a+2b+2c+2d)	(2a+2b+2c+2d)
							0.090	0.043
General							(2a+2b)	(2a+2b)
a) A_G	0.09	0.2	0.081	22.42	0.163	0.363	0.167	0.370
b) A_G_O_G	0.08	0.14	0.002	*24.03*	0.004	0.007	(2a+2b+2c)	(2a+2b+2c)
c) BS	0.47	0.00	0.102	*4.11*	0.197	0.000	0.364	0.370
d) Resource	0.36	0.66	0.150	*5.48*	0.296	0.543	(2a+2b+2c+2d)	(2a+2b+2c+2d)
							0.660	0.912
Non-Windfall Domestic Revenue							(2a+2b)	(2a+2b)
a) A	0.17	0.34	0.048	9.52	0.078	0.155	0.100	0.155
b) BS	0.47	0.00	0.014	3.38	0.022	0.000	(2a+2b+2c)	(2a+2b+2c)
c) Resource	0.36	0.66	-0.101	4.49	-0.163	-0.299	-0.063	-0.144

* Indicates that the total calculated change in expenditure level is significantly different from the prorated change in expenditure levels at a 5 per cent significance level.

6. Estimation Results

The results indicate that windfall revenue has had an important influence on overall expenditure and revenue patterns in post-independence PNG. For each additional Kina of windfall revenue, spending in social services has increased by 24 toea, infrastructure spending has increased by 9 toea, and general expenditure has increased by 66 toea.

[8] Such that for the education equation the following calculations are made for rows 1-3 respectively: 1) e_e/a_e 2) e_e/a_e_o 3) e_e/bs, 4) e_e/extractive rev

This overall impact does however mask substantial differences in how each of the three types of windfall revenues (resource, budget support and project aid) have impacted on each of these spending priorities. Firstly, budget support appears to have supported more productive expenditure patterns than an equivalent inflow of resource revenues. As shown in Table 3, for a given one Kina increase in windfall revenues 0.47 toea has on average been received in the form of general budget support. As a result of this 0.47 revenue inflow, social services expenditure is shown to have increased by 0.162 toea, infrastructure spending increased by 0.061 toea, and general government expenditure increased by 0.19 toea. The results also show that budget support has had had a relatively benign, slightly positive, impact on domestic non-windfall revenue collection.

In comparison, for a given one Kina increase in windfall revenues 0.36 toea has on average been received in the form of resource revenues. Of this 0.36 toea resource revenue inflow, just 0.009 toea has been allocated to social services, 0.018 toea allocated to infrastructure, whilst 0.296 toea has been allocated to general government expenditure. Further to this, resource revenue has also had a large negative impact on domestic non-windfall revenue collection. In short, 47 per cent of budget support revenues were allocated to social services and infrastructure activities, whilst the vast majority of resource revenues have been used to support general expenditures and a reduction in revenue collection from other domestic sources. As shall be discussed in the conclusion, one potential explanation for this result is the stronger accountability chains between government and donors than those that exist between government and citizens.

The final 17 toea of a given one Kina increase in windfall revenue has been received in the form of project aid, which unlike budget support is aid that has been allocated to a particular expenditure priority. Of this 17 toea, 4 toea has on average been allocated to social services, 4 toea has been allocated to infrastructure and 9 toea has been allocated to other general expenditure items.

Nearly all project aid funds allocated to social services have remained within the activities for which they were originally intended. Indeed for the 4 toea increase in

project aid allocated to this sector, total expenditure has increased by 0.038 toea.[9] Further to this, the results also suggest that there has been a diversion of project aid away from the general expenditure category and towards social services spending – with 13 toea in project aid allocated to the general expenditure category increasing social services spending by 0.031 toea.

For infrastructure, the 4 toea increase in project aid targeted to the sector leads to a 4.6 toea increase in infrastructure expenditure. This slightly larger increase in expenditure than the initial revenue inflow is known generally as the 'flypaper' effect whereby an aid inflow leads to a more than proportional increase in expenditure in that sector (Heller 1975; Pack and Pack 1990; McGillivray and Ahmed 1999).[10] A further result however is that the 13 toea of project aid allocated to other sectors of the economy have tended to encourage a diversion of funds, albeit small, away from the infrastructure sector – likely as a result of counterpart funding or other conditionality's being applied by donors in other sectors. This means that as a result of 17 toea in project aid, of which 4 toea is allocated directly to the sector, infrastructure spending has increased by an average of 1.1 toea.

The final and largest impact of project aid has been in the general expenditure category. Of the 9 toea which has been given directly to this category, expenditure has increased by an average of 16 toea. This result is a combination of the direct impact of project aid to the sector as well as the finding that aids being given to other sectors have been diverted towards general expenditure activities. The financing for these additional expenditure in the general expenditure category are likely to have come both from the diversion of funds away from other expenditure items as well as the small positive

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[9] It is also important to highlight that this result may be aggregating important 'within sector' expenditure reallocations. For example, government may alter education spending as a result of an inflow in health project aid, or vice-versa. Likewise, donor funding for one part of the health sector (i.e. maternal health) may impact on financing in another component of the sector (i.e. HIV funding). The degree to which this particular type of behaviour has taken place is not discernable from the results.

[10] One explanation for this effect is the ability of foreign aid to mobilise additional resources for government expenditures through, for example, improving tax collection or opening up new private sector sources of credit (World Bank 1998:64). McGillivray and Morrissey (2000) also argue that with imperfect information flows and weak expenditure management systems, aid inflows may be accompanied with misperceptions or 'illusions' regarding either the real or nominal value of the aid inflow, and the spending conditions attached (McGillivray and Morrissey 2000:3). For example, donors may deny funds due to the recipient's failure to meet certain conditionality agreements, following which the government may have to resort to additional borrowing to cover the expected revenue flow. Likewise, imperfect budgetary processes may overvalue the contribution of aid to a specific project or the aid inflow may require counterpart funding, both of which can also create a need for government to find additional funds. Equally, the government may also find that it has a lower need to borrow funds in the event that its public service under values the contribution of donor funds within a particular fiscal cycle.

impact which project aid is shown to have had on the collection of revenue, with 17 toea in project aid increasing domestic non-windfall revenue collection by 1 toea.

7. Implication of Future Revenue Sources on Service Delivery Funding

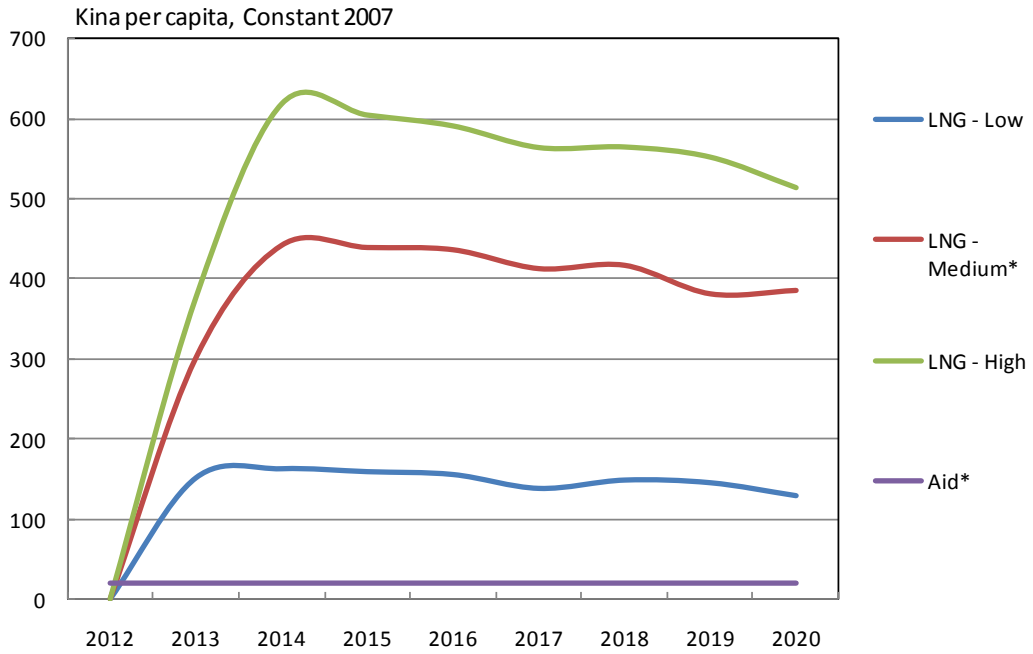
To date, the most rigorous assessment of the size of the revenue streams which may accrue to the PNG Government as a result of the LNG project has been carried out by ACIL Tasman (2009).[11] This report provides 3 scenarios; a low revenue scenario which is based on a long term oil price of $36 a barrel; a medium term scenario based on a long term oil price of $65 a barrel; and a high revenue scenario based on a long term oil price of $100 a barrel (ACIL Tasman 2009:5). The time profile of these revenue streams are converted into per capita terms[12] and shown in the Chart 2 below.

PNG is also expected to continue receiving substantial aid receipts in the foreseeable future. Given the unpredictable nature of donor support providing a long term estimate of how large those receipts is however more difficult. For the purposes of the following calculations an assumption is made that by 2012 aid flows have increased from their 2010 level by approximately 120 million Kina (20 Kina per capita) and then for the rest of the period keep pace with a population growth rate of 2.3 per cent per annum. Given Australia's commitment to double the size of its aid programme by 2015, this increase may in fact be an understatement.

[11] These estimates have come under some criticisms by various stakeholders for utilising overly optimistic assumptions, particularly in regards to the negative impact which he LNG project may have on other sectors of the PNG economy – not least because the report was commissioned by Exxon Mobile during its negotiations with Government.

[12] Assuming a constant 2.3 per cent per annum population growth rate from 2010 onwards.

Chart 2: Increase in Aid and Resource Revenues (2012 – 2020)



Source: ACIL Tasman 2009; aid figures are authors own assumptions.

What potential impact may these *new* revenue sources have on the composition of government spending?

To assess this question this section applies the previously described expenditure elasticities to a hypothetical revenue scenario which incorporates an increase in resource revenues. These calculations also include an assumed increase in aid resources which maintain the same proportional sector allocation as their 5 year (2006-2010) average. The calculations are shown in Annex 2.

It is important to highlight a number of assumptions underlying the calculations. These include: That there is no change in the prioritisation of donor funds, with project aid inflows based on their average allocations over the 5 year period 2006-2010; that all other revenue streams remain constant; that the calculated expenditure elasticity's remain constant across the entire 18 year period; and that future expenditure allocations are reflected by the expenditure decisions of past government and that those priorities remain constant across the full period. In this sense, the calculations do not represent projections of future expenditure levels but rather are used to illustrate what

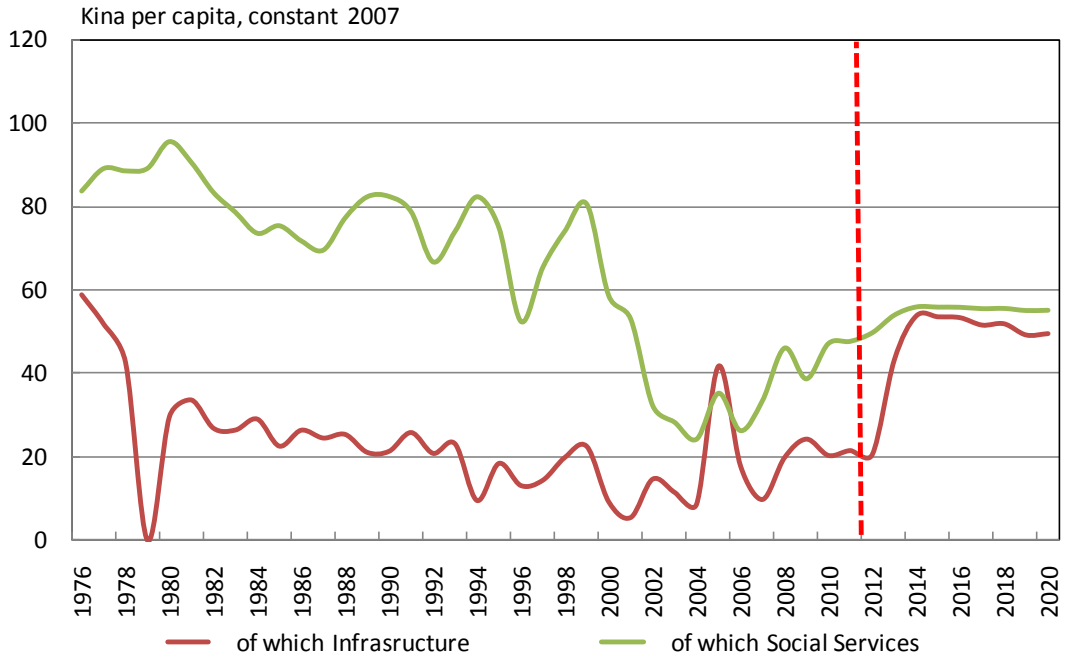
expenditure patterns would emerge if past policy choices were applied to future revenue scenarios. With these caveats in mind the results reveal a number of important insights for the potential impact of these future revenue streams.

First, as can be seen in Chart 3 the revenue increase scenario has a large positive impact on infrastructure expenditure, rising from K20 per capita in 2010 to approximately K50 per capita by 2014. This increase brings total infrastructure spending to levels comparable with the very early post-independence period and just over double the average rate of investment in infrastructure recorded for the decade spanning 2000-2010.

Second, the revenue increase scenario also has a positive impact on expenditure levels in the social services sector, but this effect is comparatively small in relation to the overall revenue increase. In this case total expenditure on social services increases from K45 per capita in 2010 to approximately K55 per capita by 2014. This increase brings total spending on social services to just over double those recorded during the early 2000's but is still well below those recorded in the early post-independence period which reached averaged approximately K80 per capita.

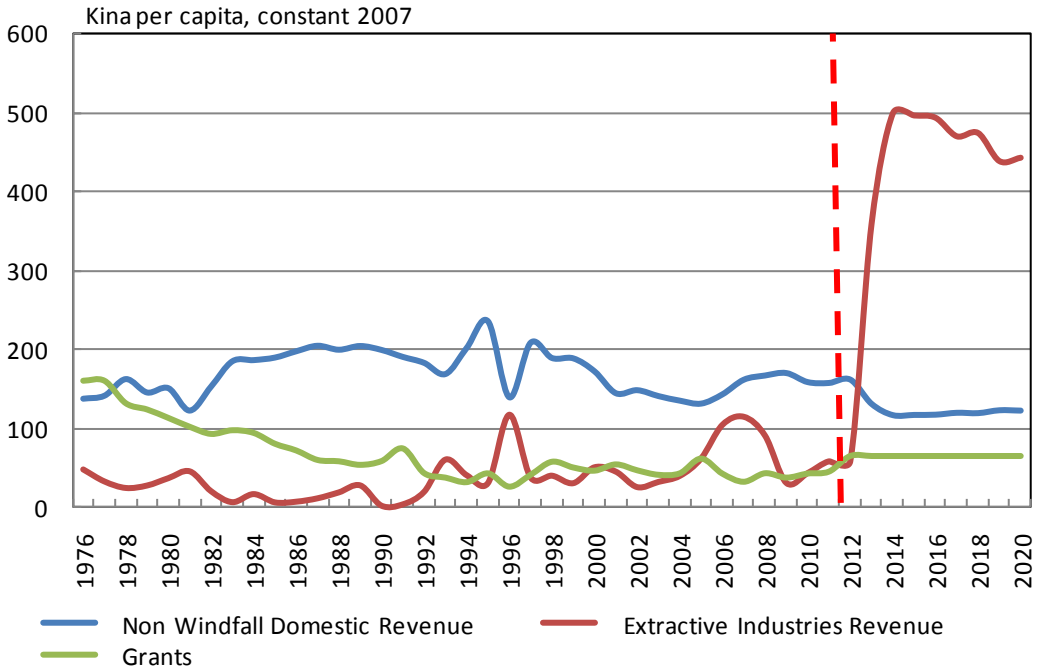
The final important result is that shown for non-windfall domestic revenue in Chart 4. This illustrates the potentially large negative impact which the substantial growth in resource revenues can have on the collection of revenues from alternative domestic sources. In this case, the resource revenue inflow elicits a decline in the collection of non-windfall domestic revenue from K160 per capita in 2010 to K120 per capita by 2014. So as total revenue and grants increase, the proportion of those revenues which accrues to both aid and resources is raised disproportionately– further increasing the Government's dependency on windfall revenue sources.

Chart 3: Impact of Revenue Composition on Future Government Expenditure



Source: PNG Budget Documents (1975-2010).

Chart 4: Impact on Revenue Composition



Source: PNG Budget Documents (1975-2010).

8. Conclusions

This paper has analysed a variety of issues related to the impact of both aid and resource revenue on expenditure in post-independence PNG. It has also assessed the relative impact of budgetary support vis-à-vis project-based aid on increasing expenditure in key service delivery sectors of the PNG economy and the extent to which funds allocated to these sectors have been diverted to other government activities. Estimated elasticities are then compared against a hypothetical revenue scenario to assess the potential contribution that post-2014 LNG revenue inflows may have on financing these service delivery sectors. In total, both aid and resource revenues have made a positive contribution to the overall funding levels of all expenditure categories in PNG since independence. This result does, however, mask a number of important differences between project aid and budgetary support across sectors.

Whilst the majority of project aid has been spent in the sectors for which it was intended there is little evidence to suggest that its impact has been any larger than general budget support. Indeed, for social services (which include health and education expenditure) an additional Kina in budget support has had a larger impact on expenditure than an additional Kina of project aid. This result supports the findings of Batten (2010) which utilised a dynamic framework to analyse the impact of aid on expenditure and debt behaviour of the PNG Government. It also supports AusAID (2003:27) which argued that 'funding for key sectors such as infrastructure, health and education was higher when PNG was receiving budget support than in more recent times'. The implication here is that government priorities matter most for how aid impacts on expenditure allocations, not donor aid modalities.

Both project aid and budget support has also had a small positive impact on the collection of domestic non-windfall revenue. For budget support in particular, this result is consistent with PNG's fiscal history as the large declines in budget support undertaken in the early post-independence period required the Government to increasingly rely on domestic revenue sources.

Resource revenues on the other hand have had a significant negative impact on the mobilisation of domestic non-windfall revenues, indicating that commodity boom periods are likely to be accompanied by a weakening of efforts to collect taxation from

other sectors of the economy. This result has particular significance in lieu of the upcoming inflow of resources from the LNG project. Avoiding a disproportionately large increase in resource revenue dependency will be a major challenge for PNG authorities.

The future revenue scenario calculations illustrate that if past expenditure responses to resource revenue inflows are replicated with the upcoming LNG revenue boom, then per capita funding for the social services sector is unlikely to surpass previous peak levels that were being recorded during the 70s and 80s. In contrast, infrastructure has been a large recipient of resource revenue inflows and a similar response to LNG revenue inflows would almost double long run average rates of investment in that sector.

The results also show that with a rapidly growing population and the projected high growth in resource revenues, aid flows will comprise an ever declining proportional share in PNG's total resource envelope. Donors have an important role to play in providing targeted interventions that improve the efficiency of public expenditure and alleviate constraints to growth, but their ability to influence aggregate recurrent expenditures in social services will decline.

Finally, it is important to highlight that past behaviour is not necessarily a guide to future expenditure patterns. Government's change and so do their policy decisions and expenditure priorities. Growing real per capita expenditure for health, education and infrastructure in the post-2002 commodity boom period is a positive indication that more priority is being place on these activities than in the past.

Maximising the impact of resource revenues on service delivery must also be balanced against the broader challenge of managing the many well-known risks that a resource project of this scale entails. Exchange appreciation and realignment of domestic production away from other tradable good sectors is the primary example. PNG will also have to remain vigilant against the negative patterns of political and institutional behaviour that are encouraged by large inflows of funds from resource extraction.

The Government has made good progress in managing these risks by creating a new sovereign wealth fund which will sterilise export earnings and promote a high level of accountability over fund usage. The sovereign wealth fund also places a large focus on smoothing expenditure over time. This is particularly important for service delivery

items such as health and education which are predominately recurrent in nature. Achieving a long term increase in funding to these sectors will thus be more dependent on the ability of the Fund to provide consistent and predictable revenues which allow budgetary planners to expand recurrent expenditure items without fear of eroding fiscal sustainability.

However, as PNG's history illustrates without sufficient political commitment to long term expenditure management institutional structures such as this can be easily abused. The most important factor therefore in transforming resource revenues into improved long term development outcomes will be the strengthening of domestic accountability mechanisms across all levels of government. At its core, these efforts should focus on strengthening of the domestic budget process, its oversight and the integration of the Government's Long Term Development Strategy objectives into medium term expenditure planning.

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Appendix 1: Full Description of Estimation Results

Impact of Windfall Revenues on Social Services Spending

For every 1 Kina of windfall revenues allocated at historical averages:

0.04 Kina has been given through project aid to Social Services. This has led to a 0.038 Kina increase in Social Services expenditure. Project aid to this sector has largely stayed where it was intended to go.

0.13 Kina has been given through project aid to sectors other than social services. This has led to a further 0.031 Kina increase in Social Services expenditure. This indicates project aid delivered to other sectors has freed up a small portion of domestic resources to be transferred to Social Services.

In total, 0.17 Kina of project aid allocated at historical averages (0.04 Kina to Social Services and 0.13 to other sectors) has led to an average 0.069 Kina increase in Social Services Expenditure.

0.47 Kina has been given in the form of General Budgetary Support. This has led to a 0.162 Kina increase in Social Services expenditure, indicating that approximately 34 per cent of Budget Support was allocated to Social Services expenditure.

In total, for an additional Kina in windfall revenues, the 64 per cent which has been received in the form of donor grants have, on average, led to a 0.231 Kina increase in Social Services expenditure.

0.36 Kina has been received in the form of resource revenues. These revenues have led to a 0.009 increase in Social Services expenditure, suggesting that on average 2.5 per cent of resource revenues have been allocated to Social Services (much lower than the proportion of Budget Support which was allocated to this sector).

In total, the combination of these results suggests, that following a 1 Kina increase in windfall revenues, received between project aid, budget support and resource revenues at their historical averages, Social Services expenditure will increase by 0.240 Kina.

Impact of Windfall Revenues on Infrastructure Spending

For every 1 Kina of windfall revenues allocated at historical averages:

0.04 Kina has been given through project aid to Infrastructure. This has led to a 0.046 Kina increase in Infrastructure expenditure. Project aid to this sector has thus largely stayed where it was intended to go and encouraged a slightly higher level of spending in the sector by Government.

0.13 Kina has been given through project aid to sectors other than Infrastructure. This has led to a 0.035 Kina decline in Infrastructure expenditure. This indicates

project aid delivered to other sectors has encouraged the Government to transfer its own resources away from the Infrastructure sector.

In total, the combination of these effects means that for 0.04 Kina in Infrastructure project aid and 0.13 Kina project aid allocated to other sectors, total expenditure in the Infrastructure sectors increases by 0.011 Kina, or approximately 25 per cent of the original project aid inflow.

0.47 Kina has been given in the form of General Budgetary Support. This has led to a 0.061 Kina increase in Infrastructure expenditure, indicating that approximately 13 per cent of Budget Support was allocated to Infrastructure expenditure.

In total, for an additional Kina in windfall revenues, the 64 per cent which has been received in the form of donor grants have, on average, led to a 0.072 Kina increase in Infrastructure expenditure.

0.36 Kina has been received in the form of resource revenues. These revenues have led to a 0.018 increase in Infrastructure expenditure, suggesting that on average 5 per cent of resource revenues have been allocated to Infrastructure (which is higher than the proportion of Budget Support which was allocated to this sector).

In total, the combination of these results suggests, that following a 1 Kina increase in windfall revenues, received between project aid, budget support and resource revenues at their historical averages, Infrastructure expenditure will increase by 0.090 Kina.

Impact of Windfall Revenues on General Spending

For every 1 Kina of windfall revenues allocated at historical averages:

0.09 Kina has been given through project aid to the General category. This has led to a 0.163 Kina increase in General expenditure. Project aid to this sector has thus had a large impact on mobilising additional Government resources in these expenditure categories.

0.08 Kina has been given through project aid to sectors other than general. This has led to a 0.004 Kina increase in General expenditure. This indicates project aid delivered to the General category has freed up a small amount of resources to be transferred to the General expenditure category. This implies that aid funds delivered to the Infrastructure and Social Services sectors has not freed up large quantities of funds to be transferred to other expenditure categories represented by the General category.

In total, the combination of these effects means that for 0.08 Kina in General project aid and 0.09 Kina project aid allocated to other sectors, total expenditure in the General sector increases by 0.167 Kina.

0.47 Kina has been given in the form of General Budgetary Support. This has led to a 0.197 Kina increase in General expenditure, indicating that approximately 42 per cent of Budget Support was allocated to General expenditure.

In total, for an additional Kina in windfall revenues, the 64 per cent which has been received in the form of donor grants have, on average, led to a 0.364 Kina increase in General expenditure.

0.36 Kina has been received in the form of resource revenues. These revenues have led to a 0.296 increase in Infrastructure expenditure, suggesting that on average 82 per cent of resource revenues have been allocated to General expenditure (which is higher than the proportion of Budget Support which was allocated to this sector).

In total, the combination of these results suggests, that following a 1 Kina increase in windfall revenues, received between project aid, budget support and resource revenues at their historical averages, General expenditure will increase by 0.660 Kina.

Impact of Windfall Revenues on Non-Windfall Domestic Revenue Collection

For every 1 Kina of windfall revenues allocated at historical averages

0.17 Kina has been received in the form of project aid, 0.47 Kina has been received in the form of general budget support and 0.36 Kina has been received in the form of resource revenues. Both budget support and project aid have had a positive impact on the collection of non-windfall revenue receipts. For budget support in particular, this result is consistent with PNG's fiscal history as the large declines in budget support undertaken in the early post-independence period required the Government to increasingly rely on domestic revenue sources.

Resource revenues on the other hand have had an overall negative impact on the collection of non-windfall domestic revenue. An additional inflow of 0.36 Kina in resource revenues leads to a 0.163 Kina decline in revenue collection from these other sources.

Appendix 2: Calculation of Expenditure and Revenue Changes from Increases in Aid and Resource Revenues

	Current Expenditure	Marginal Impact of Revenue Increase	Expenditure increase in 2012	Expenditure increase in 2013	Expenditure increase in 2014	Expenditure increase in 2015	Expenditure increase in 2016	Expenditure increase in 2017	Expenditure increase in 2018	Expenditure increase in 2019	Expenditure increase in 2020
IMPACT OF RESOURCE REVENUE INCREASE											
Infrastructure	20.36	0.08	0.00	22.62	33.16	32.96	32.74	30.98	31.29	28.61	28.93
Social Services	47.00	0.01	0.00	4.22	6.19	6.15	6.11	5.78	5.84	5.34	5.40
General	176.14	0.15	0.00	45.23	66.33	65.92	65.49	61.95	62.58	57.22	57.87
Domestic NW Revenue	158.60	-0.10	0.00	-30.46	-44.66	-44.38	-44.10	-41.71	-42.14	-38.53	-38.96
IMPACT OF AID INCREASE (5 YEAR AV.)											
Infrastructure	20.36	0.01	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Social Services	47.00	0.13	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
General	176.14	0.37	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40
Domestic NW Revenue	158.60	0.16	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10
NET IMPACT OF RESOURCE AND AID REVENUE INCREASE											
Infrastructure			0.22	22.84	33.38	33.18	32.96	31.20	31.51	28.83	29.15
Social Services			2.60	6.82	8.79	8.75	8.71	8.38	8.44	7.94	8.00
General			7.40	52.63	73.73	73.32	72.89	69.35	69.98	64.62	65.27
Domestic NW Revenue			3.10	-27.36	-41.56	-41.28	-41.00	-38.61	-39.04	-35.43	-35.86