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Papua New Guinea Sovereign Wealth Fund: The efficacy of the withdrawal formula

Summary

This paper explains the efficacy of the withdrawal formula for stabilisation contained in the Organic Law on Sovereign Wealth Fund (SWF), that was passed by the National Parliament in July 2015. The key findings are:

i. the withdrawal formula is opaque even to a numerically literate audience;
ii. the withdrawal formula fails to achieve the stipulated aim of macroeconomic stabilisation and could do the very opposite; and
iii. the use of the proposed formula can lead to the exhaustion of the stabilisation fund.

The opaqueness of the formula for withdrawals from the SWF is to the cost of transparency that is necessary for public scrutiny and critical to the mitigation of the risks of mismanagement of the SWF that may lead to its exhaustion.

Introduction

A Sovereign Wealth Fund (SWF) for Papua New Guinea was enacted by the National Parliament through the 'Organic Law on Sovereign Wealth Fund' (the Organic Law henceforth) in July 2015. The primary motivation for the creation of the SWF was to provide a means to prudent macroeconomic management for sustainable development using large and lumpy inflows of resource rents in the form of the proceeds from the exports of Liquefied Natural Gas (LNG). The first of the two large LNG projects came on stream in May 2014 and is estimated to have a project life of 30 years while construction is underway for the second LNG project (IMF, 2010; Osborne, 2014)[1].

These, together with other potentially large natural resource projects, will bring in lumpy capital inflows and with it the challenges of managing volatile, uncertain (delete and?) revenues from an exhaustible resource for sustainable development. It is worth noting right at the outset that the conduct of counter-cyclical fiscal policy is the responsibility of the parliament through the national budget. The role of the SWF is to provide a reservoir that can be tapped into as mandated by the withdrawal formula contained in the Organic Law. For this, the balance in the SWF must remain healthy. The SWF

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The integrity of a SWF as an instrument for prudent macroeconomic management rests on fiscal institutions and enforcement mechanisms built into its design which weigh against the risks of mismanagement. The fiscal rules governing the deposits into and withdrawals from the SWF are meant to promote long-term savings whilst lending the resources to the national budget for spending during cyclical down drafts. The recently passed Organic Law provides the rules for deposits into and withdrawal from the SWF. My focus here is on the latter only.

The proposed legislation pertaining to the SWF is complex and contains provisions for management of the fund, the distribution of the benefits, and the replenishments of the funds spent. These issues have been analysed in considerable detail elsewhere (see Osborne, 2015), while a detailed commentary on the history of the organic law is given in Osborne (2014). The NRI has taken lead in explaining the weaknesses in the design of the SWF, having made a written submission to the Parliamentary Committee charged with the responsibility of considering the draft SWF Bill before its final reading (NRI, 2015). The NRI's submission to the Parliamentary Committee stated that the withdrawal formula is complex and thus not amenable to close scrutiny by the public of the performance of the SWF.

The SWF created through the Organic Law is to contain two components; namely a 'Stabilisation Fund', and a 'Savings Fund' (Page 3, paragraph 4, of the *Organic Law on Sovereign Wealth Fund* 2015). The objectives of the SWF are to provide support to:

> "(a) macroeconomic stabilisation;
> (b) inter-generational equity; and,
> (c) asset management in relation to assets accrued from mineral and petroleum receipts" (Page 3, paragraph 5, of the *Organic Law on Sovereign Wealth Fund* **2014**? (2015? see above).

Thus three separate objectives of the SWF are to be pursued through the operation of two funds. The mathematical implications of the above will be explained in Section 4.

The withdrawal formula is reproduced as equation (1) below:

$$W_t = Y_{t-2}\left\{\frac{1}{5}\left[\sum_{s=2}^{6}\left(\frac{X_{t-s}}{Y_{t-s}}\right)\right]\right\} \qquad (1)^2$$

where

W_t is the Kina value of withdrawal from Stabilisation Fund in year t;
Y_t is the Kina value of non-mineral and non-petroleum fiscal receipts in year t;
X_t is the Kina value of mineral and petroleum fiscal receipts in year t; and,
s denotes the time lag in years in the calculation of the moving average.

The analysis that follows assesses the appropriateness of the proposed formula in light of the objectives as expressed in the Organic Law. I analyse the mathematical, economic, and governance implications of the legislated withdrawal formula as depicted in equation (1) above.

In this note I show three key results: first, that the withdrawal formula given in equation (1) is opaque even to a numerically literate audience; second, that the withdrawal formula fails to achieve the stipulated aim of macro-economic stabilisation; and, third that the use of the proposed formula can lead to the exhaustion of the stabilisation

The rest of this short note is structured as follows. Section 2 provides the mathematical implications of the proposed formula for withdrawal of funds for stabilisation. Section 3 presents the economic implications, Section 4 presents the governance implications, followed by the Conclusions.

2. Mathematical implications

The quantum of withdrawals W at period t is set equal to the product of two terms: the value of non-mineral and non-petroleum receipts two years preceding and the moving average of the ratio of mineral and petroleum receipts (i.e. X) to non-mineral and non-petroleum receipts (Y) for the second to sixth preceding years.

The withdrawal formula can be expressed more succinctly by dropping the time subscripts and introducing the moving average as a separate function; that is,

$$W = Y\,M(X,Y,n) = M\left(\frac{X}{Y},n\right) \qquad (2)$$

The notations are as given for equation (1) with the addition of 'M' which denotes the moving average function, and 'n' being the number of periods taken into account whilst calculating the moving average. The effect on W from an exogenous (and permanent) increase in X holding Y and n constant can be derived by partially differentiating W with respect X, which gives the following result:

$$\frac{\partial W}{\partial X} = M_{X/Y} = 1 \qquad (3)$$

Equation (3) shows that a permanent increase/decrease in receipts of mineral and petroleum rents raises/reduces withdrawals proportionately. Simple substitution into equation (1) reveals that if X increases permanently by a factor α then W rises commensurately. Thus the level of withdrawals change one-for-one in tandem with any change in mineral and petroleum receipts. The detailed economic implications of (3) are explained in the next section.

The impact on W of a permanent change in Y in contrast is nil; that is,

$$\frac{\partial W}{\partial Y} = 0 \qquad (4)$$

Equation (4) shows that a permanent change in Y, all else constant, has nil impact on the value of withdrawal from the Stabilisation Fund. The results in equations (3) and (4) are for permanent changes in either X or Y. The effects of temporary changes in X or Y, which are more realistic given amongst other things the exhaustible nature of the resource, are derived using numerical simulations. The economic implications of temporary shocks to X and Y are explained in the next section.

3. Economic implications

The stipulated goal of the Stabilisation Fund is macroeconomic stabilisation, meaning the use of the drawn-down (or saved) funds for the conduct of countercyclical demand management through the national budget. The mathematical derivations shown in equations (3) and (4) are relatively straightforward, and demonstrate that levels of withdrawals from the Stabilisation Fund are independent of the changes in the non-mineral economy.

(i.e. nil effect of changes in Y on W) is the product of a change in Y that is completely offset by the opposite change in the moving average (i.e. M in equation (2)). Stabilisation requires withdrawals to be counter-cyclical to the movements in the non-mineral and non-petroleum economy in a case where mining is an enclave activity, but the withdrawal formula precludes this.

The permanent changes in either X leading to permanent change in the level of withdrawals or similar changes in the size of the non-mineral economy having nil impact on the levels of withdrawals from the SWF can be rationalised. But any temporary changes in either X or Y needs to translate into opposite changes in W for macroeconomic stabilisation.

Consequently I next investigate the impact of temporary shocks to X and Y individually on the levels of withdrawals from the SWF noting the fact that countercyclical demand management requires an increase in the fiscal stimulus when the non-mineral economy contracts and vice-versa. Important for the discussion that follows is the fact that distinguishing between a permanent and temporary shock ex-ante is difficult thus the results from the simulations of temporary shocks may be more relevant for policymaking than those for permanent shocks. I therefore simulate separately the impact on the levels of withdrawals from the SWF for a one off change in X and Y. The numerical simulations are undertaken in Microsoft Excel software but any other statistical package may be used for the above.

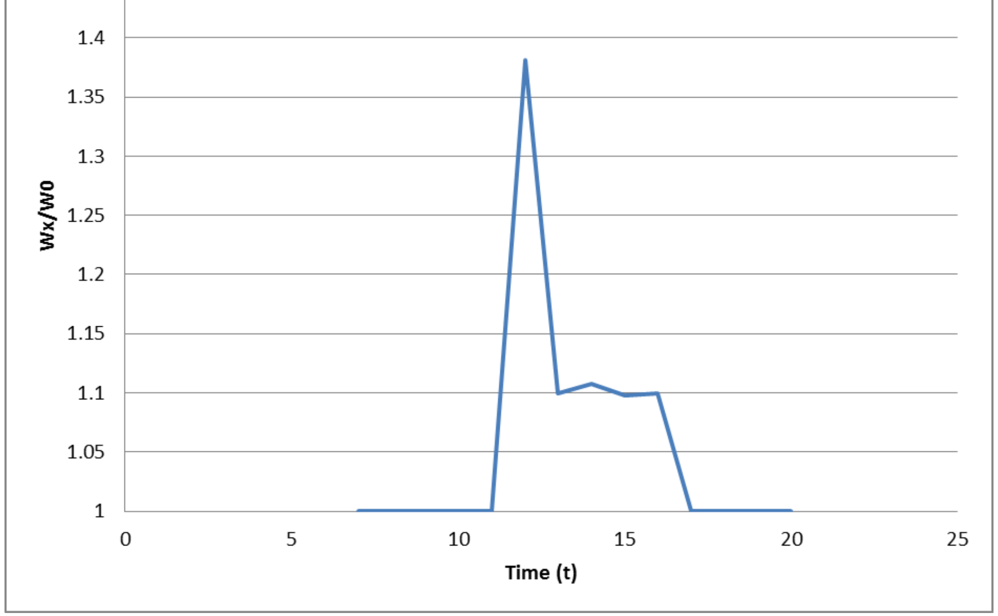
For the simulations, I first draw 20 random fractions with a uniform distribution for the initial values of X and Y. These values are then used to calculate the baseline value of withdrawals from the Stabilisation Fund as given by equation (1). Next I shock (i.e. change) the value of X or Y by a multiple and compare the resulting change in the value of the withdrawals. Given that the initial values for X and Y are chosen randomly, the quantitative effects of any given shock is different following each iteration but the qualitative conclusions are unaffected by the individual simulations.

The specific shock considered next is that of a doubling of X in the tenth year. A doubling of X in Year 10 while keeping the rest of the values for X and Y constant leaves the value of withdrawals (W) unaffected for Years 10 and 11, followed by a spike in Year 12 which subsequently subsides to the pre-shock norms by Year 17. This is shown in Figure 1. The intuition for these results is revealed by close inspection of equation (1). The first effect (i.e. no change in W for Years 10 and 11) is due to the lags introduced in the formula for the calculation of the moving average. The spike dies out after the fifth year as the moving average is calculated over a span of five years only.

Next I simulate the effects on withdrawals of a doubling of Y in the tenth year only. A temporary change to the value of non-mineral and non-petroleum receipts temporarily increases the value of withdrawals from the stabilisation fund. The value of the withdrawals is affected two years from the period in which the shock occurs. As an example, a doubling of Y in Year 10 raises withdrawals by approximately 60 percent in Year 12 following which it subsides returning to the pre-shock baseline in Year 17. This effect is shown in Figure 2.

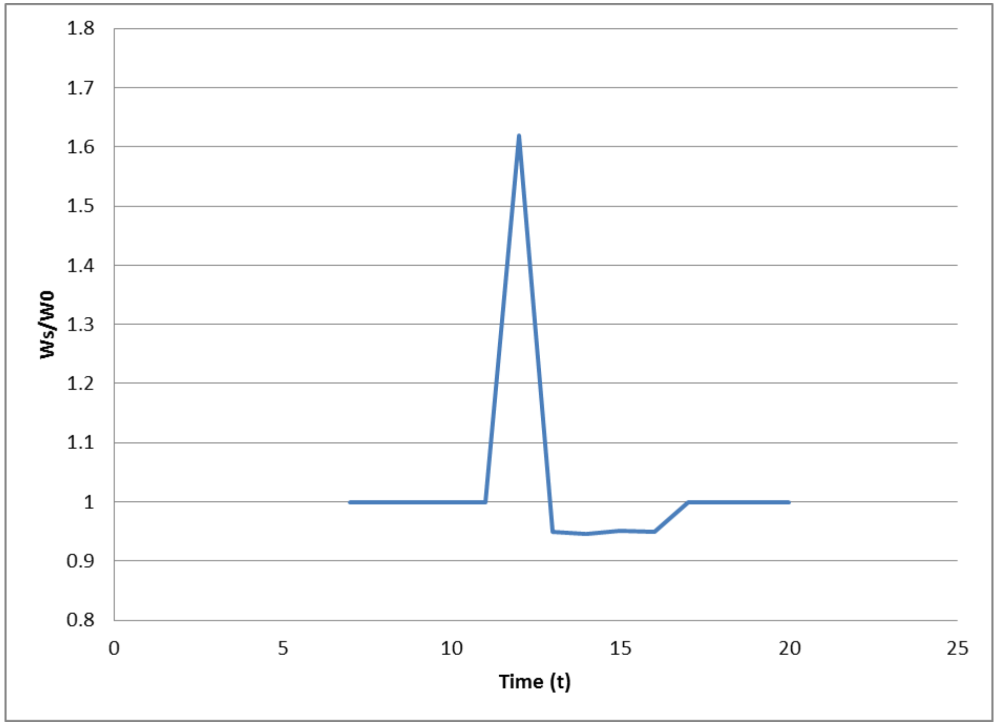
The intuition for this result is similar to that for a temporary shock to X as discussed above. The doubling of Y in the tenth year leads to an increase in withdrawals two years later given the lag of two years introduced in the first right-hand term of equation 2. The spike in withdrawals falls below the value for the baseline over the subsequent five years since the moving average is calculated over a span of five years but now with the value of Yt-2 within the moving average being larger than in the case of the baseline. In this case the withdrawal formula is destabilising!

These simulation results for temporary shocks reveal two serious economic problems with the formula for withdrawal from the stabilisation fund. First, the proposed formula for withdrawal as depicted in equation (1) does not assure stabilisation. Even more alarming is the fact that the formula for withdrawals from the Stabilisation Fund is destabi-



Source: Author calculations using numerical simulations of Equation (1) using Microsoft Excel.
Notes: (i) the quantitative estimates change with a new set of random numbers at each iteration for X and Y but the qualitative conclusions are unaffected; and, (ii) the vertical axis is a ratio of the value of withdrawals following the shock to that without the shock.

Figure 2: Impact of a doubling in Y in Year 10



formula given as equation (1) (see Paragraph 12(2a)).[4] Thus the Stabilisation Fund can be exhausted with the use of the legislated formula for withdrawals.

While it is beyond the purview of this paper to propose an alternative drawdown formula, I will propose the basic building blocks of such a formula next. Withdrawals from the Stabilisation Fund must release resources to the national budget for stabilisation whilst meeting the budget constraint. The above conditions are depicted in equations (5) and (6) below.

$$W_t = \gamma\,[\overline{GDP} - GDP_t] \qquad (5)$$

subject to the budget constraint that

$$W_t \leq S_t = \sum_0^t (D - W)_i \qquad (6).$$

where

$\overline{GDP}$ is the potential non-mining GDP that is delinked from the mineral economy, γ ($0 < \gamma < 1$) is the reciprocal of the fiscal multiplier, and D and W are the current values of deposits into and withdrawals from the fund. In addition to the above:

> "[t]he fiscal policy framework should be aimed at delinking government spending from volatile revenue originating from abroad in line with the economy's absorptive capacity and the government ability to spend well in the short term, and taking into account long-term exhaustibility of resources (IMF, 2010:13).

The withdrawal formula derived from (5) and (6) will lend funds for stabilisation when potential GDP, defined as the real output of the economy when all resources are fully employed, is known. In addition to the above, any credible withdrawal formula would need to take into account the absorptive capacity of the economy and the exhaustibility of the resource from which funds are raised (see Hartwick, 1977).

A weakness of (5) is that the level of potential GDP may not be readily understood by the bulk of the population. Furthermore, the term to exhaustion of the resource may be uncertain. Offsetting the former concern is the fact that the prevailing Medium Term Fiscal Strategy constrains non-mineral fiscal deficit to within 8 percent of GDP while mandating that mineral revenues in excess of 4 percent of GDP are used for one-off transactions including debt reduction (to account for 30 percent of the proceeds) and additional public investments (70 percent) (IMF, 2011:13).[5] With regards to uncertainties on the productive life of a natural resource project, conservatism may be appropriate but political pragmatism may lead to the very opposite. In the dynamic PNG context of competition between politically powerful groups, incentives for the incumbent administration is for more than a proportionate withdrawal from any windfall gains (see Aaron & Lane, 1999). Such a 'voracity effect' may be contained through design of transparent rules that can be publicly monitored and enforced so as to mitigate risks of abuse of the SWF. In short, governance matters!

governance matters? A useful reminder with regards to the above is the MRSF which was created with a similar objective to the SWF but had a premature death due to mismanagement. While no structure and legislation can guarantee the health and efficacy of the recently established SWF, institutional features could be designed to lessen the risks of mismanagement. I enumerate six of these features next.

1. The risks of mismanagement can be mitigated by a withdrawal formula that is transparent to the majority of the population. A simple formula imbedded within the national budget which is understood by the public can help with transparency. The distributions for specific purposes from the SWF could then be made public. The legislated formula in Paragraph 12 (pages 6–7) of the *Organic Law* is complicated and potentially opaque to the bulk of the population.
2. Timely monitoring and reporting of the performance of the SWF by independent agencies as per the Generally Accepted Principles and Practices (GAPP) number 4 (IWG, 2008) will increase accountability of fund managers. Imbedding the above in the SWF legislation would therefore be helpful.
3. Deposits into the SWF can be simplified by legislating that <u>all</u> receipts are in the first instance placed in the SWF as argued by the NRI in its original submission to the Parliamentary Committee (NRI, 2015). Norway and Timor-Leste have this feature in their wealth funds (IMF, 2010).
4. Withdrawals from the Stabilisation Fund can be integrated within the budget with the stipulated objective of macroeconomic stabilisation. As an example, GDP and potential GDP data as published by the National Statistics Office in collaboration with the IMF could be linked to the levels of withdrawals. Doing so will ensure that the activities of the SWF are consistent with the overall macroeconomic (i.e. monetary and fiscal) policies as per GAPP 3 (IWG, 2008).
5. The number of sub-funds (i.e. instruments) created from the SWF must match the number of objectives of the SWF. In its current form, the SWF has 3 objectives; namely, "(a) macroeconomic stabilisation, (b) inter-generational equity; and, (c) asset management in relation to assets accrued from mineral and petroleum receipts" (paragraph 5, page 3) of the *Organic Law*). A Stabilisation Fund is to deliver on the first objective, a Savings Fund is to deliver on the second, leaving the third objective without any resources or means to achieving it.
6. Public interest in the performance of the SWF can be nurtured through incentives such as public distributions tagged to the performance of the fund.

Conclusions

This paper has assessed the math, economics, and financial soundness of the withdrawal formula for the Stabilisation Fund that is a component of the newly established Sovereign Wealth Fund (SWF) for Papua New Guinea. A typical stabilisation fund aims to smooth out government expenditure in the face of volatile and unpredictable inflows of revenues from the sale of a non-renewable natural resource — Liquefied Natural Gas in the case discussed here. The conduct of fiscal policy is the responsibility of the Department of Treasury which uses the national annual budget for the above. The SWF however can be used as the reservoir that houses mineral receipts and provides this to the budget as mandated by the Organic Law on withdrawals from the SWF. The focus of this paper has been on the legislated formula for withdrawals from the Stabilisation Fund.

The analysis reveals that the proposed formula for withdrawals does not guarantee stabilisation in the face of volatile mineral receipts, and that it can lead to the very opposite. The two-year lag between the timing of the shock and the time when withdrawals are allowed can exacerbate short-run macroeconomic fluctuations. Numerical simulations show that a one-off change in non-mineral and non-petroleum receipts can create destabilising ripple effects for the subsequent five-year period. Thus the withdrawal formula for stabilisation can produce the very opposite from its original intent. Furthermore, the withdrawal formula is complex and thus could compromise the credibility of the SWF. The IMF (2007), IWG (2008) and the OECD (2002) provide practical advice on achieving fiscal transparency conflation of objectives to outlays from the fund. Complicating this further is the fact that the withdrawal formula ignores the balance in the Stabilisation Fund while pervasive political instability lends the incentives to exhaust the fund (Chand, 2002). The financial implication of the above is that the Stabilisation Fund runs the risk of being depleted. This is serious given the fate of the Mineral Resource Stabilisation Fund that was created in 1974 and was depleted and thus shut down in 2001.

Most important but beyond the purview of this exercise is the design of a withdrawal formula that is aligned to the goals of stabilisation whilst preserving the fund for continued use. The basic requirements of such a formula are that: (i) it is stabilising; and, (ii) the incentives are built into the design of the SWF so as to contain the risks of mismanagement. Transparency in terms of flows into and out of the SWF, and the release of real-time information are critical to containing the risks of mismanagement.

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ties torn by conflict. For the past three years, Satish has been researching the rebound in the economy of Bougainville and how this rebound is helping sustain peace following the decade-long conflict.

The views expressed in this paper are entirely the author's own and not those of the National Research Institute.

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