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Meeting the Imperative for Growth within Fiscal Constraints: How Sustainability Transitions and Innovation Policy Can Deliver the Public Goods

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Abstract

The COVID-19 pandemic, taking place in conjunction with an economy that has been resistant to growth, has driven national debt to extreme levels. Within a 5-year period, the debt to gross domestic product (GDP) ratio has risen from 51% to 83% and is projected to reach 100% unless revenue grows and expenditure is curtailed. Our study started with a simple projection of GDP, revenue and expenditure, revealing that a nominal GDP growth rate of 8.8% will be required to maintain government expenditure and service the national debt. Given the persistent structural issues and the economy's historical performance, it seems unreasonable to expect that such rates will be attained. The dilemma for the public sector is to decide which programmes to curtail and which to maintain. This article notes that research and development (R&D) is a counter-cyclical activity. Moreover, the development of technological capability is a long-term endeavour. I argue that public-funded R&D expenditure should be increased from its 2020 levels in real terms, and this funding should be supported with stronger innovation policy that seeks to amplify the achievements of the R&D programmes with appropriate demand and supply side instruments. In particular, the country could benefit from a global economy that is divesting of fossil fuels and moving towards a hydrogen/electron paradigm. 2021 would be the wrong moment in which to abandon this opportunity.

Keywords

Modern Monetary Theory; research and development; public funding; fiscal constraint; deficit myth

1. Introduction

Over the last 5 years, government debt in South Africa has risen from 51% to 83% of GDP and is projected to reach 120% within the next five years even if there is some growth in tax revenues and a degree of curtailment in government expenditure. In terms of conventional fiscal policy, excessive government debt has severe implications for the country's finances. Debt repayments as a proportion of the total expenditure rise to unaffordable levels, over-spending puts inflationary pressure on the economy and fiscal constraints limit the ability of government to finance programmes in social welfare, health and education.

These perspectives of public spending and deficit are, however, challenged by the claims of modern monetary theory (MMT). According to Kelton (2020), it is incorrect to claim that governments need to "balance the books". Revenue through taxation and expenditure are substantially unrelated and a deficit should be considered as a stimulation of the economy, rather than a threat or a long-term burden. Government spending is not consequent to raising revenue from taxes; instead, it is a mechanism of generating economic activity, which can then be taxed, a means of redistributing income to address inequality and a mechanism to control inflation. Based on MMT, the main function of taxation is to create demand for the national currency and build the capacity within a national

economy to supply the goods that government needs in order to meet its obligations as a provider of public goods. Furthermore, interest rates are a policy intervention, and hence the size of debt repayments is at least partly within the control of governments.

Critics of MMT argue that this is simply a revival of Keynesian economics. It ignores the diversity of capital markets, and that the private sector has access to multiple sources of finance. It also fails to understand the influence of risk perception on the value of a national currency, and, in a lack of awareness about conditions in developing countries, it neglects the aspect that inflation can be caused by several effects, including the weakening of global supply chains which restricts supply and results in higher prices even if demand is constant.

Nevertheless, the insights of MMT are important and topical at a time when the COVID pandemic has disrupted the global economies and caused a ballooning of national deficits. A conventional response would be the introduction of austerity measures and the imposition of severe fiscal discipline. Expenditure would be scrutinised and reduced in all spheres in order to allow public finances to reach lower levels of debt (say 50% of GDP) and government to maintain a surplus in its current account.

It is widely agreed that fiscal discipline must remain a cornerstone of government expenditure. Reckless consumption and allocation of public funds to unproductive activities, which do not support the realisation of public sector targets or the attainment of high levels of public service, would be completely inappropriate and would result in the longer-term devaluation of a national currency. Expenditure without productivity is precisely the vice which raises the ire of liberal economists who question the role of the state and the value that it creates.

However, a contraction of public funding in all spheres of government would be an incorrect response. In this article, which covers how governments can operate in a post-pandemic environment (if we ever get there!), I make two essential arguments as follows:

- At a time of fiscal pressure, when government expenditure is under pressure to contract in real terms, reducing the budgets of certain public activities, and in this case, particularly the budgets for public-funded research and development (R&D), is short-sighted and *deleterious* action.
- Public-funded R&D is both counter-cyclical and more productive in a post-pandemic context, suggesting that *increasing* budgets for the science and innovation portfolio is a logical and evidence-based decision.

In the next section, I discuss the link between MMT and R&D, and how R&D is precisely the function for which governments cannot and should not “run out of money”.

2. Modern Monetary Theory and Public-Funded Research

At this point, it is worth repeating two of the several insights from MMT. Firstly, deficits are not indicative of overspending; it is inflation, where spending lowers productivity, that governments need to monitor and avoid. Secondly, in the same way that banks give loans to generate deposits, governments issue and spend money to generate economic activity which can be taxed. The latter is a reversal of the conventional understanding within public finance, and is described by Kelton (2020) as S(TAB) or “spending before taxing and borrowing”.

S(TAB) or TAB(S) (taxing and borrowing precede spending) may seem an unimportant distinction. Whether you “pay now, fly later” or “fly now, pay later” may seem just an issue of cashflow

management. However, MMT claims there is an essential difference, which is the purpose of the spending. Without spending, the economy cannot grow, and hence taxes cannot be raised. S(TAB) is not just a preferred strategy; it is a fundamental acknowledgement of the role that public funding provides in stimulating the economy. Unlike the claims of liberal economists, who argue that deficits are by definition symptomatic of undisciplined and wasteful expenditure, MMT asserts that deficits can be a policy decision indicative of money flowing into a productive economy. In this sense, the deficit is simply a re-allocation of capital from the public to the private sectors.

This insight does not condone all types of overexpenditure. Indeed, expenditure which is not matched by production would simply cause inflation and devalue the national currency. Within the context of significant deficit, such as South Africa's current situation, public expenditure on several productive activities, however, is logical and appropriate. The questions then emerge "how can such activities be identified?" and "what should governments do to ensure injection without inflation?".

Both questions are addressed in the following sections. In Section 3, I present a simple model of public finance which predicts revenues and debt over the next 30 years. This model is then used to develop the identifiers for productive expenditure during periods of economic distress and contraction. In the final section, I describe how increases in counter-cyclical public-funded R&D can lead to longer-term economic growth.

3. Cashflow Model for Public Funds

The discourse on public debt and economic growth is ubiquitous. In an article on "3% is South Africa's magic number on the economic growth front", Wood (2021) quotes Nishan Maharaj from Coronation as stating:

> *"There are only two ways to escape a debt trap in South Africa. Increasing growth so that tax revenues rise sufficiently to compensate for increased spending or decreasing spending to balance the equation. The latter poses the greatest political and social risk, whereas the first could lift us out of our current economic quagmire. But what would it take to raise tax revenues sufficiently through growth? We estimate that it will take 3% to 4% real growth, with inflation contained to around 4.5% over the next two to three years, to generate nominal growth of about 8%, which is needed to stabilise the nation's debt profile".*

Wood (2021) further argues that until this growth is achieved:

> *"Expenditure will have to be reallocated and contained … our economic health will largely depend on freezing public sector wages and ensuring no further financial support is required from the state-owned entities."*

The numbers can be relatively easily confirmed through a simple spreadsheet model, based on the assumptions as listed in the Appendix. Profiles of national debt as a percentage of gross domestic product (GDP) over the period 2020 to 2040, and final debt to GDP ratios at the end of 20 years (2040 with 2020 as the base year), both as a function of levels of real GDP growth are shown in Figure 1 and Figure 2 respectively. The influence of varying levels of nominal interest rates on the 2040 debt to GDP ratio is also shown in Figure 2.

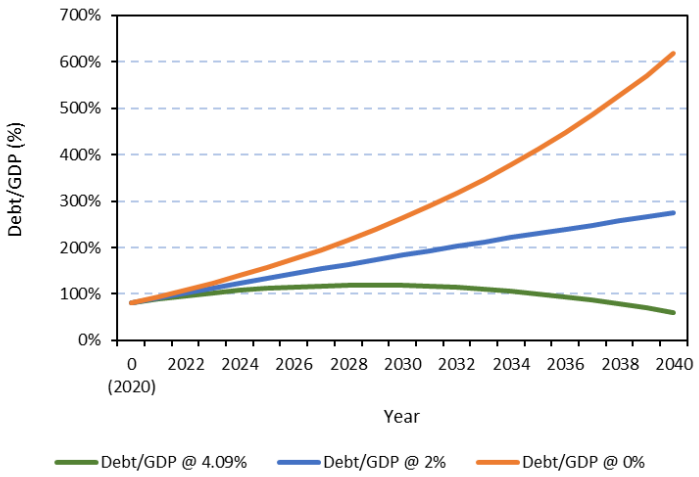


Figure 1. National debt per year at different GDP growth rates

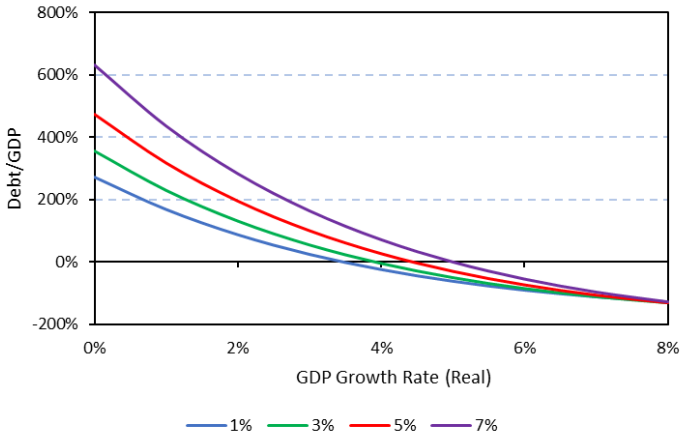


Figure 2. National debt in 2040 vs GDP growth rates for different nominal interest rates

The modelling results agree with the earlier quoted figure of 3% to 4% real growth. On the basis that nominal interest and inflation rates remain at present levels (6.83% and 4.5% respectively), GDP growth needs to reach at least 4% per annum in real terms in order to stabilise the level of national debt at about 60% of the GDP by 2040. Thereafter, there will be further opportunity to increase government expenditure or reduce taxation, as may be dictated by the principles of fiscal policy.

4. Identifiers of Counter-Cyclical Expenditure

The model as outlined in the previous section makes the simplifying assumption that government expenditure will remain at 2020 levels in real terms (in other words, the annual increases will be limited to the inflation rate). One of the propositions, however, in this article is that public-funded R&D is counter-cyclical and should be increased within a period of fiscal constraint. Taken together, these two factors imply that there needs to be a re-allocation of government expenditure such that additional funds can be released for R&D.

Re-allocation of government budgets is a difficult process. In a previous publication (Walwyn, 2020), I have argued that pathway dependence dominates the process, with separate functions in government being almost guaranteed of their historical allocations. If budget cuts are to be made, these tend to be mandated equally across all functions, with limited concern for the expenditure priorities under times of deficit or crisis. The conditions for significant changes tend to occur randomly

and fleetingly, characterised by the conjuncture of an evident and growing problem, a suitable policy framework, some indication of value-for-money, and powerful political support (Walwyn, 2020).

A time of crisis is precisely one of these antecedents. Given the conditions of low economic growth, as was recorded in the second half of 2020, additional flexibility over budget allocations is critical. In particular, activities which build economically productive functions during a downturn, in preparation for or as a means of moving towards an economic upturn should be prioritised.

As noted earlier, the questions are "how can such activities be identified and what are they"? A defining characteristic of an economic downturn is a lack of investor confidence, particularly over the medium to long term. Private investors feel uncertain and pessimistic about the future and delay investment decisions as a precautionary measure against unpredictable events resulting in financial loss. This perception of high long-term risk is often reflected in the interest rates, with the appearance of a so-called inverted yield curve.

A yield curve depicts interest rates as a function of the duration of the investment contract or deposit period. Typically, such curves, which are also known as the term structure of interest rates, have an upward sloping profile, with longer periods corresponding to higher interest rates. Such a relationship makes perfect sense. The longer the investor is required to forego access to her deposit and its liquidity, the greater the uncertainty and hence the higher the risk premium.

However, at times of financial crisis, the uncertainty in the market collapses the demand for longer period borrowings, with the result that long-term interest rates fall below short-term rates. This phenomenon is known as an inverted yield curve, and is considered to be an unhealthy state in capital markets. Such events took place in the 1970, 1974, 1980, 2001, 2008 and 2020 recessions. In all cases, normalisation of the yield curve required central bank intervention and a renewal of economic growth. The former can take two forms, firstly the lowering of central bank interest rates, and secondly, the use of quantitative easing.

Public-funded R&D can be likened to quantitative easing, with the nature of the benefit being new knowledge rather than new finance. Furthermore, private-funded R&D behaves in an analogous fashion to yield curves. In periods of financial crisis and economic uncertainty, private firms tend to reduce R&D expenditure and focus on short-term projects, leading to the well-known market failure in terms of knowledge generation. This observation leads to an answer for the question posed at the beginning of this section. The key identifier of a necessary counter-cyclical expenditure is an inversion of the expected returns from long-term investments, driven by a loss of confidence in the future. In other words, government need to increase the size of budgets for public-funded R&D when the business confidence index falls below a threshold level.

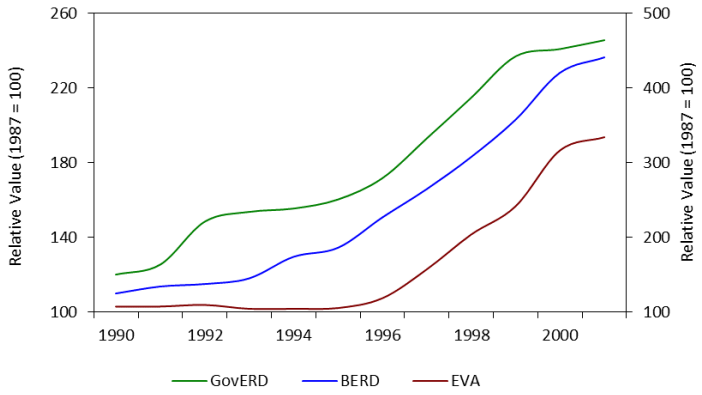
In the next section, the final part of the argument for boosting public-funded R&D during economic crises is presented. The section starts with the example of the development of Nokia in Finland during the 1990s, and the important role of an earlier public investment in the core technology (Walwyn, 2007). Using a model based on R&D investment and product revenue waves, I argue that public investment is an important antecedent for the subsequent gains in GDP. Assuming that this inference is correct, the section concludes with a number of recommendations for R&D programmes, including the development of technologies to support decarbonisation and the transition to the hydrogen/electron economy.

5. The Link between Public-Funded Research and Economic Growth

Finland in the 1990s was in a severe economic crisis. With a legacy of government "overspending, uncontrolled deregulation of the financial sector, the collapse of lucrative trade deals with the Soviet Union, and a heavy reliance on forestry and forestry-related industries", the country was struggling to emerge from a period of recession. Government Expenditure on R&D (GovERD)[1] was significantly increased from 1990 and by the end of the decade had more than doubled, growing from 0.6% to 0.9% of GDP (GovERD/GDP).

There are three distinguishing features of this investment. Firstly, the increase in GovERD took place at a time when the GDP and government revenues were declining i.e., the increases were counter-cyclical relative to the economy, as shown in Figure 3. Secondly, the bulk of the new GovERD investment *preceded* a similar growth in private sector R&D, which similarly preceded the growth in the sectoral value add (referred to as electrical goods value-added or EVA) and the country's GDP. Thirdly, it was a directed investment; the Finnish government specifically identified the opportunity in the cell phone market, understood the country's competitive advantage and invested heavily in the technology and infrastructure which led to Nokia becoming a major player in the industry (Walwyn, 2007). Wider support for the overall strategy of focussed or mission-oriented innovation policy has since emerged, particularly through the work of Mazzucato (2018).

Figure 3. Profiles for GovERD, BERD and EVA in Finland (1990 to 2002)[2]



There have been many studies attempting to correlate GovERD with economic growth (Hall, Mairesse and Mohnen, 2010). Most of these studies are confounded by the occurrence of multiple effects within the national economies which are simultaneous to any specific intervention. In the case of Finland, the emergence of Nokia as a consequence of a directed R&D investment by the Finnish government overwhelmed any other changes in the economy and enabled this comparison to made with unusual clarity.

The illustration of the Nokia study supports one of the initial propositions in this article, namely that public-funded R&D is a counter-cyclical expenditure and should be increased in moments of economic crisis, rather than curtailed. Assuming that similar conditions apply to South Africa in 2021, and that additional public money can be raised to support R&D, the final question to answer is how this funding should be spent. I have already intimated that the global economy is on the point of a deep transition to a more sustainable set of socio-technical systems (Schot and Kanger, 2018). In particular, many

[1] It is acknowledged that GovERD differs from the extent of public-funded R&D. The former refers to performance and the latter to expenditure (funding), regardless of which sector undertakes the R&D work. In the case of Finland, and indeed many countries, the two figures are quite similar.

[2] Note to the Figure: GovERD is on the left-hand axis, BERD and EVA on the right-hand axis

countries are directing their energy, mobility and manufacturing systems away from a dependence on fossil fuels to a decarbonised future.

South Africa is in a highly advantageous position to become a major player in the green economy (Walwyn and Crompton, 2020). It has the natural resources and, in some cases, already has the technology to be part of the electron/hydrogen future (IHS Market, 2021). It is estimated that the adoption of an integrated hydrogen strategy, using existing technologies such as renewable energy combined with water electrolysis, would result in a net increase of 370,000 jobs and a 75% reduction in carbon emissions (IHS Market, 2021). Similar results have been obtained in other studies (Bischof-Niemz, 2019; Bischof-Niemz and Creamer, 2019), indicating that with the appropriate policy and financial support, South Africa could use the opportunity of the energy transition to develop the economy, create jobs and improve its trade balance. In addition to the markets for hydrogen (Walwyn, 2021; Milani, Kiani and McNaughton, 2020) and photovoltaic modules (Semelane, Nwulu, Kambule and Tazvinga, 2021), there are also opportunities for new energy storage products (Siddique and Thakur, 2020), and processes for recycling and the equipping the circular economy, including separation equipment for precious metals and plastics from waste products in the energy sector (Stahel, 2019).

Further details on each of these opportunities for public-funded R&D programmes to support the development of new technological innovation systems in hydrogen and renewable energy can be obtained from the references as indicated. At this point, the intention has been only to highlight the importance of public R&D expenditure during economic downturns.

6. Conclusion

Public-funded R&D is a key instrument to build absorption capability, public knowledge and the detailed know-how for new economic areas, and to support the emergence of new technological innovation systems (Hekkert and Negro, 2009). It can be highly instrumental in leading a national economy from recession to growth once other economic factors improve. It can counteract the negative effects of business confidence on private-funded R&D and rebuild sentiments about the importance of long-term investments in the economy.

In this article, I have shown how this claim is supported by evidence from Finland/Nokia in the 1990s, which showed the important role of GovERD in stimulating the subsequent development of the country's mobile phone sector. Unfortunately, the results of a simple cashflow model for South Africa's public debt indicate that there is little choice for National Treasury other than to impose fiscal constraints on government spending. Despite these constraints, in which it is seemingly impossible to raise additional public funds, I argue that public-funded is a counter-cyclical expenditure which should be grown in real terms, especially under recessionary conditions. Such expenditure is broadly supported by the principles of MMT, which argues that deficit spending is fully justified as long as the funds are non-inflationary and productive.

Finally, I recommend that the directionality of public-funded R&D should be sharpened. In particular, more funds should be allocated towards the realisation of the hydrogen/electron economy and the development of the new technological innovation systems that will be required to achieve net zero carbon for South Africa by 2050.

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Appendix: Assumptions for the Economic Model

The model is constructed using Excel and based on the following assumptions:

- The level of national debt at the end of 2020 was R3,950 billion (ZAR3.95 trillion)
- Government's expenditure (EXCLUDING interest payments) for 2020 was R1,750 billion
- Government's interest payment for 2020 was R250 billion; the applicable interest rate was 6.83%
- The 2020 Gross Domestic Product (GDP) was estimated to be R4,920 billion
- Government's income (revenue) for 2020 was R1,363 billion, which is 27.7% of GDP.
- National debt can be treated in the same way as a bank loan, albeit at a lower interest rate
- The debt repayment period is 20 years and each year the repayment amount is recalculated on the same terms but based on the revised deficit
- If government expenditure exceeds revenue in any particular year, the difference is simply added to the deficit
- Government expenditure excluding the interest payment will remain stable at R1,750 billion in constant 2020 Rands (you must ignore inflation in this question unless requested otherwise)
- Government revenue will always be 27.7% of GDP.

The following steps were applied in the construction of the model:

A. Calculate government revenue based on GDP (start with 0% growth rate) and then enter the government expenditure without debt repayments for all years.

B. Calculate total government expenditure for 2020 (with debt repayments) and hence the deficit between revenue and total expenditure (including interest payments) for 2020.

C. Now calculate the real interest payment for 2021 based on the level of debt from 2020, assuming simple interest (no repayment of the principal) and that the same interest rate (6.83%) applies over all the years.

D. Now calculate the deficit for 2021 real expenditure for 2021 including debt repayments.

E. Repeat the steps C, D and E for all the 20 years, making sure that you calculate the deficit for each year and the total amount of debt for each year.

F. Hence calculate the total level of government debt and the Debt to GDP ratio for all the 20 years (express the ratio as a percentage).

G. Now use Goal Seek to calculate the magic number. You must do this exercise by finding the GDP growth rate for which the debt to GDP ratio falls back to 60% by the end of the 20 years. (HINT: this ratio is presently 80% and will be 618% at the end of 20 years if there is no growth in the GDP).

H. Finally, calculate the nominal equivalent of your magic number assuming the inflation rate of 4.5% using the formula to convert from real to nominal interest rates.