

Essay on the Assessment of Madagascar's Fiscal Multiplier

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Abstract – This paper investigates the role played by the fiscal authority on economic activity. In this respect, we try to assess the value of the fiscal multiplier associated to different type of expenditure such as functioning, wage and capital. In order to capture both the short and long run impact, we perform an ARDL Model on Malagasy budgetary data spanning from the period 1960 to 2019. The results displayed that the error correction term is negative but not significant. In other words, only the short run matter, inferring the absence of a long run relationship.

Keywords – ARDL Model, Fiscal Multiplier, Bounds test.

I. INTRODUCTION

The General Budget of the State is one of the main instruments the Government has, in case of conducting fiscal policy-based taxes and expenditures. In this respect, it seems necessary to assess the magnitude of actions undertaken by authorities when they fix expenditure's level along with their type of allocations. In this paper, our concern is about to make the link between economic growth and government expenditure (functioning, salary, investment), whether there is crowding-in or crowding-out effect. If theory claims particularly the positive role played by the public investment on the real side of the economy, reality seems, instead, to be on the contrary. The paper also attempts to estimate the fiscal multiplier related respectively to these varieties of spending but give particular attention to the one associated to the investment in case of Madagascar. Several surveys have been made on this issue, but these remain ambiguous and inconclusive. Actually, the lack of data as well as its relevance has always been considered the major bottleneck which slow down research in developing countries. Apart from that, country is always facing a cyclical political crisis which happens almost every seven years that counteract to reach the steady state. This makes the analysis trickier and more interesting on many aspects of the modelling process. During the last thirty years, the country was enduring four major crisis (1972, 1991, 2002, 2009) which were brought about by political turmoil. So, consequences were felt on every sector because no policy resilience has been set up in order to offset taxation resources loss. Thus, government spending has to be reduced at its sustainable level to attain a low fiscal deficit consistency to the Development of National Plan known as PND. If that is the case, it really matters that decision makers need to understand what precisely is the impact of these different types of expenditures both on the technical prospect and, obviously, on political point of view.

From that, a Medium term fiscal framework together with a medium term expenditure framework maybe shaped by ensuring consistency with macroeconomic framework.

To shed some light, there are a couple of questions that need to be addressed: *To which extent Government expenditure have an impact on economic activity? What is the magnitude of this impact? How can the authority react to change in government expenditure?*

In order to bring a clear response, the remainder of the paper is organized as follows. In section 2, we will make a brief review of the literature, followed by the Section 3 which describes the methodology. Then, we will introduce the econometric modelling together with its interpretation. Section 4 displays simulation under public investment impulse and the last section give a conclusion and a policy recommendation.

II. LITERATURE REVIEW

The debate around the effect of public investment on economic activity remain a core of most policy makers discussion. In this sense, the time has not made it outdated as fiscal policy become more and more influential on economic issue. Actually, the effect is still ambiguous particularly in Subsaharian country while in most developed one, the pass-through is already evident. Nowadays, since the advanced use of technology, many researches experienced by developed and developing countries make the link between these two variables (Dar and AmirKhalkhali 2002). Since the acquisition of its independence, Madagascar has severely experienced a recurrent political crisis followed each time by a dramatic economic downturn. Hence, this makes the country extremely vulnerable to any shock and the cumulative effect cause a persistent wave effect. Wagner in the “law of increasing state activity” established the bidirectional link between government expenditure and National Revenue that served as a point of departure for other researchers and decisionmakers. It has been validated later by several empirical survey.

On the one hand, Peacock and Scott (2000)) investigate the effects of economic growth over public investment by using diverse procedure and different measure at the government level as well. In the same way as Akitoby, Clements, Gupta and Inchauste (2006) support Wagner's viewpoint by the use of the cointegration method with a sample of 51 developing countries. However, on the other hand, few empirical analysis argue the inverse effect as initiated by Bird (1971), Ram (1986), Abizadeh and Gray(1985). Sharing the same idea as these latter, Courakis, Moura- Roque, and Tridimas (1993) and Bohl (1996) even found out a contradictory relationship and Henrekson (1993) too.

On the “*Keynesian*”perspective, It is only assumed a unidirectional causality which claims the role of government expenditure on economic growth but not the opposite at all [Keynes ,1936]. This theory, based on the “*demand efficiency*”, emphasizes the positive impact of an autonomous public expenditure on economic growth. Barro (1990) corroborate this hypothesis while arguing the effect of productive expenditure.

III. METHODOLOGY

This section presents all achieved steps to derive to the principal results. But at first glance, we assume a strong constraint that is the unidirectional relationship running from government spending to real GDP¹. The data spread between 1960 and 2015 and is collected on official government database (known as OGT which means Treasury Global Operation), National Statistics Institute (INSTAT) and Ministry of Economy and planification.

The model variables are: Real Gross Domestic Product, functioning expenditure, Wage expenditure and capital expenditure (or public investment). After their log transformation, i) stationarity test will be performed following the “Augmented Dickey Fuller”(ADF) and “Phillips Perron”(PP) procedure.

Yet whatever the results of the previous test (whether variables are I(1) or I(0)), we choose to conduct ii) an Autoregressive Distributed Lag Model (ARDL Model) in order to take into account a dynamic features and a likely long run relationship. It is noteworthy that such model has the ability to mix I(1) and I(0) variables and to implement at the same time a “bounds test approach” (Pesaran, Shin, and Smith) to assess the existence of an equilibrium relationship. Associated to that, short and long run equation will come up together with the estimation of the error correction term. Once

¹ The properly procedure is to test the causality by using Granger or Toda-Yamamoto approach. For more details the readers may visit the David Gile's blog

we get the best model 2, we check its relevance by carrying out a iii) stability, Heteroskedasticity, autocorrelation LM test on the residual. These have to be a sort of guarantee for the performance of our forecast exercise.

To end up with, a iv) simulation will be performed under some economic assumptions (for instance the increase of public investment, the decrease of rate of inflation, . . .).

IV. ECONOMETRIC MODELLING AND INTERPRETATION

4.1. Stationarity test

This section deals with the presence or not of a unit root in the series by carrying out an ADF and PP test as stated in the previous section. In a strict sense, we try to check whether the mean and/or the variance of these series do not vary over time. The test exhibits not only the critical value and the t-statistic but also the p-value of the probability of acceptance of the null hypothesis ³. Besides, three different steps have been realized when running such test. The first one is performing the test with constant and trend, then, only with constant but without trend and the last one, without constant and trend. The rule is that a P-value close to zero (precisely a P- value < 0.05) would reject the null hypothesis, otherwise accept it at 5 percent significance level. Variables are expressed in logarithm in order to interpret coefficient as an elasticity.

Table 1: p -value / Unit Root test

| Variables | Level | first difference |
|-------------|-------|------------------|
| $\log GDP$ | 0.97 | 0.00 |
| $\log func$ | 0.99 | 0.00 |
| $\log inv$ | 0.61 | 0.00 |
| $\log wage$ | 0.99 | 0.00 |

Source: authors's calculations

GDP: Gross Domestic Product, func: Functioning expenditure, inv: Investment expenditure, wage: personnel expenditure

All variables are integrated of order 1 (- i.e - I(1)) (see 1) since all of their P-value are roughly equal to zero when their are first differenced. Thus, one can proceed by testing a cointegration relationship following a bounds test approach. Bound test

Similarly to the Johansen cointegration technique, bounds test can readily run a cointegration test but at one condition that is when the order of integration of all variables does not exceed 1. Indeed, this is exactly the case here. Such approach was initiated by Pesaran, Shin, and Smith under the following equation:

Terms in parenthesis () represent standard error

² Model that minimize AIC and BSC criteria

³ EViews 9.0 shows these results in the same window

$$\begin{aligned} \Delta \log(GDP_t) = & \underbrace{0.06 \Delta \log(inv_t)}_{(0.02)} - \underbrace{0.09 \Delta \log(wage_t)}_{(0.06)} + \underbrace{0.09 \Delta \log(func_t)}_{(0.02)} + \underbrace{0.01 \log(inv_{t-1})}_{(0.01)} + (1) \\ & \underbrace{0.01 \log(func_{t-1})}_{(0.02)} + \underbrace{0.04 \log(wage_{t-1})}_{(0.04)} - \underbrace{0.02 \Delta \log(gdp_{t-1})}_{(0.07)} - \underbrace{0.009t}_{(0.00)} + \underbrace{0.35}_{(0.39)} \quad (2) \end{aligned}$$

$$R^2 = 0.55, DW = 2.4$$

The following table (2) provides the bounds value showing the F-statistic associated to the test. These have to be compared with the bounds value at 10, 5, 2.5 and 1%.

Table 2: Bounds test

| Test Statistic | value | k |
|----------------|----------|----------|
| F-statistic | 2.16 | 3 |
| bounds | | |
| Significance | I0 bound | I1 bound |
| 10% | 3.47 | 4.45 |
| 5% | 4.01 | 5.07 |
| 2.5% | 4.52 | 5.62 |
| 1% | 5.17 | 6.36 |

Source: Authors's calculations

The null hypothesis is the absence of a long run relationship ⁴. The value of the F-statistic (2.16) (from 2, second line) is below the value of the critical bounds at 10 percent significance level (3.47 > 2.16) ⁵(from 2, 4th line). This means that the assumption there exist a long run relationship is automatically rejected. Hence, only the short run dynamic matters leading to the conclusion that the error correction term is **not significant**.

4.2. Short run dynamic

Short run equation is characterized by the effect of a variation of exogenous variables on the variation of real GDP. This is represented by the following equation:

Terms in parenthesis () represent standard error

$$\begin{aligned} \Delta \log(GDP_t) = & \underbrace{0.06 \Delta \log(inv_t)}_{(0.02)} + \underbrace{0.09 \Delta \log(func_t)}_{(0.03)} - \underbrace{0.08 \Delta \log(wage_t)}_{(0.06)} - \underbrace{0.01 \Delta t}_{(0.00)} - \underbrace{0.03 ect_{t-1}}_{(0.07)} \quad (3) \end{aligned}$$

$$R^2 = 0.55, DW = 2.3$$

Now we can interpret the change of the variables as a growth rate since they are expressed in log. Hence, a 1 % rise of public investment corresponds to 0.06 % increase of real GDP if the remaining variables are supposed to be unchanged

⁴ the rule is that when the F-stat is under the I0 bound at x percent level, we can reject the Null Hypothesis. If this stat is between I0 and I1, the result is inconclusive and if it is above I1, Null hypothesis should not be rejected

⁵ even for 5 percent, 2.5 percent and 1 percent the value of the F statistic is always below the critical bounds of these significance level

and a 1 percent increase of functioning expenditure cause a rise of GDP growth up to 0.09 percent. However, 1 percent increase of the wage expenditure lower GDP growth approximately to 0.08 % which could be interpreted as a crowding out effect. As we have expected the error correction term is negative but not significant even if its standard error is low enough (0.07). Thus, no long run cointegrating relationship is detected.

4.3. ARDL Model

The formulation of the ARDL Model equation is as follows, given that the long run effect is considered as insignificant:

Terms in parenthesis () represent standard error

$$\begin{aligned} \log(GDP_t) = & \frac{0.97}{(0.07)} \log(GDP_{t-1}) + \frac{0.09}{(0.02)} \log(func_t) - \frac{0.08}{(0.02)} \log(func_{t-1}) + \\ & \frac{0.06}{(0.02)} \log(inv_t) - \frac{0.05}{(0.02)} \log(inv_{t-1}) - \frac{0.09}{(0.06)} \log(wage_t) + \frac{0.14}{(0.07)} \log(wage_{t-1}) - \\ & \frac{0.01}{(0.00)} t + \frac{0.18}{(0.39)} \end{aligned} \quad (4)$$

$R^2 = 0.98, DW = 2.3$

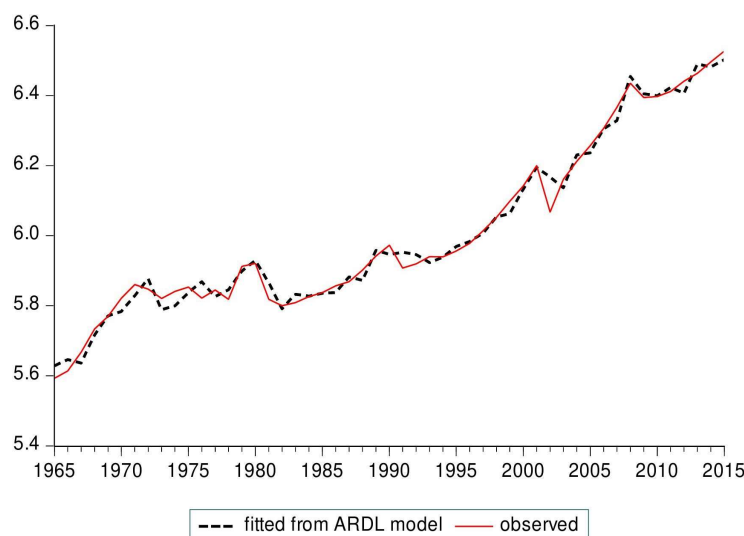


Figure 1: log of Real GDP

Seemingly, the model is well adjusted to the actual data since the R square is high enough. 98 percent of the variance of the real GDP react to the change of its past own value and the remaining exogenous variables. Moreover, the present and the lagged explanatory variables have different effect (value and sign) on the current log of real GDP; and the previous log of real GDP also have a positive effect on its own current value. The effects of all previous variables tend to be negative expect for wage. However, the trend is significant but not the constant. If we observe carefully, this equation is nearly similar to the short run one where the variables maybe interpreted as growth level. Thus, 1 percent increase on the current investment cause a rise of 0.06 percent of real GDP. The coefficient is highly significant but at a lower rate. However, government spending on wage has no impact on economic activity neither in short nor long run.

V. SIMULATION

Only the effect of the variation of public investment is going to be documented. Thus, each period (year), we add either minus or plus “x” percent to get the shock. In such a way, given the baseline scenario, three scenarios will be analyzed such that a consecutive positive shock of 10 percent (S1) and 50 percent (S2) and the last one, a negative shock of 10 percent (S3) knowing that the other variables remain unchanged. The choice of these scenarios is guided by the fact that we want to understand the behavior of the economic activity in case of different momentum.

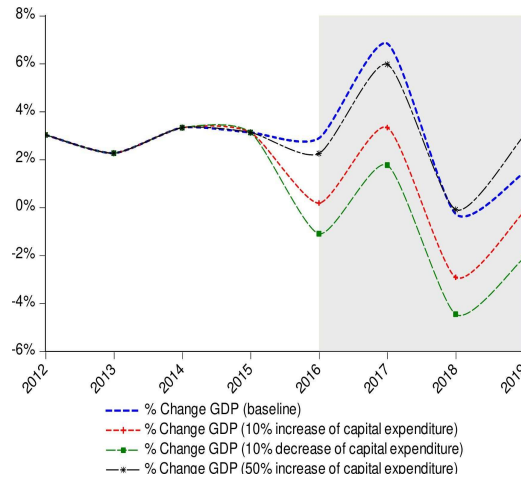


Figure 2: GDP response

The first two scenarios may be interpreted as if the government is enacting a budgetary expansion in order to draw the economy from a downturn; however, the last one is similar to a policy which tries to fight against an overheating economy characterized by, let's say, a rise of demand. The figure 2 displays an apparently crowding out effect hitting the economy activity for all scenarios but at a different level as the magnitude of the shock matters. Indeed, the GDP growth rate reacts negatively to the public investment impulse. This immediate response is then followed by a sinusoidal movement until 2019 (like a business cycle). The lowest level (-4.44 percent) (see table 3 column S2, line 4) is observed in 2018 when we decrease the public investment up to 10 percent. A 10 percent rise of this latter will trigger the same effect but at a slightly higher level than the previous one (see the red curve in the figure 2). However, rising up to 50 percent will get close the GDP growth rate to the baseline level. Hence, to go beyond this latter necessitates much more level of capital expenditure, which may attain 60 percent or higher than the previous level. This mechanism may be corroborated by the impulse generated through the short run dynamic (equation 3) where the value of the fiscal multiplier (0.06) is not high enough to offset the negative effect of the wage expenditure interpreted under the coefficient related to this latter (0.08). To corroborate this mechanism, given the fiscal multiplier value (0.06) found in equation 3 and the negative sign of the wage expenditure coefficient, increasing public investment above 50 percent seems to be relevant.

Table 3: Growth rate of GDP in percent

| | baseline | S1 | S2 | S3 |
|------|----------|-------|-------|-------|
| 2016 | 2.89 | 0.18 | -1.11 | 2.22 |
| 2017 | 6.83 | 3.33 | 1.76 | 5.97 |
| 2018 | -0.27 | -2.92 | -4.44 | -0.10 |
| 2019 | 1.44 | -0.19 | -2.11 | 3.00 |

source: Authors's calculation

S1: 10 percent increase of public investment, S2: 10 percent decrease of public investment, S3: 50 percent increase of public investment

This table that corresponds to the figure 2, displays a drop but a positive economic growth rate in 2016 expect for S2 (10 percent decrease). However, in 2018, no matter what the magnitude of the shock, we observe an overall depression toward a negative value. Values presented here seem to exhibit the absence of convergence toward a long run equilibrium, since the GPD path does not get back to its steady state (the sinusoidal motion).

VI. CONCLUSION AND POLICY RECOMMENDATION

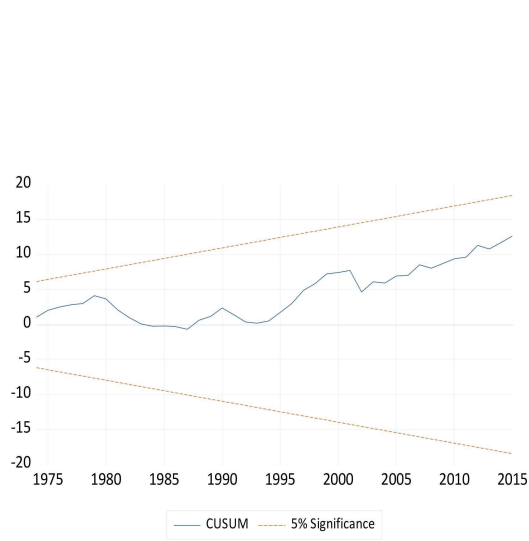
Bounds test approach makes the point of the absence of a long run relationship between Real GDP and the explanatory variables since the F-statistic is below the lower bounds at 10 percent. Thus, only the short run Dar and AmirKhalkhali (2002) coefficient is responsible for the movement of economic activity. The model estimate a value of 0.06 as a fiscal multiplier associated to the capital expenditure. Besides, the simulation shows that if we increase the public investment by 50 percent, from 2016 to 2019, we can reach 5.97 percent of economic growth in 2017 which would be better for Madagascar. However, the effect is not stable during the period.

Given these results, some policy need to be underpinned to maintain economic stability and to sustain development goal. As investment play the major role in development process, authority should strengthen the way how investment is selected according to some criteria and, after that, how it will be properly managed in order to enhance growth. This point has to be stressed because in developing country the transmission mechanism of investment is extremely affected by political turmoil. If we observe carefully the simulation graph, economic growth rate take no long time to fall. This means that the actual contemporaneous public expenditure has no longer efficiency effect starting at the second year of the impact of the shock. Thus, the level of public investment should be maintained at some point every year until to attain the steady state level (the level at which the economic growth rate reach a point consistency with a long run inflation and a natural level of unemployment). If so, this government spending should be injected in development programs and at a stable growth rate of wage.

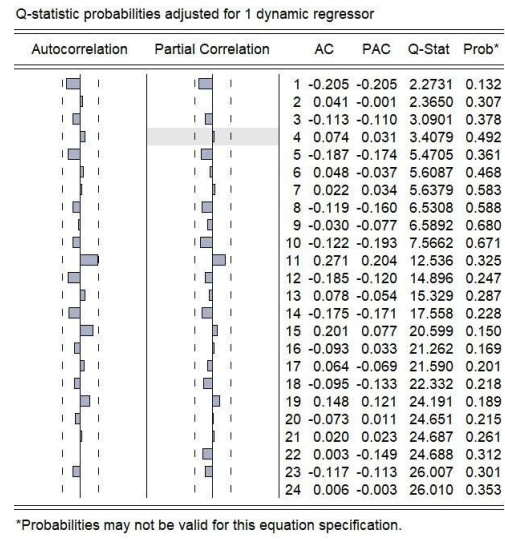
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APPENDIX



(a) Stability of model coefficient



(b) Correlogram of model residuals