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Abstract

This paper examines the effectiveness of fiscal policy in Egypt under different debt regimes. In so doing, we evaluate the relationship between expansionary fiscal policy and real economic growth. Two elements of particular interest are the (non)linearity and the impact of domestic debt on macroeconomic variables. Specifically, we search for a threshold effect by applying the Hansen (2000) sample-splitting threshold regression model. We establish with statistical significance that fiscal expenditure leads to greater real GDP in a low-debt regime (81.5% domestic debt-to-GDP threshold) and lower real GDP in a high domestic debt above the threshold. We further explore and test possible theoretical explanation for the findings. The paper concludes with a discussion of policy implications of this research.

Keywords: Fiscal Sustainability; Debt; Fiscal Policy; Economic Growth.
JEL Classifications: E62; F34; H63.

ملخص

تتناول هذه الدراسة فعالية السياسة المالية في مصر في ظل أنظمة الدين المختلفة. ومن ثم فإنها تقوم بتقييم العلاقة بين السياسة المالية التوسعية والنمو الاقتصادي الحقيقي. وهناك عنصران لهما أهمية خاصة وهما اللاخطية وتأثير الدين المحلي على متغيرات الاقتصاد الكلي. وعلى وجه التحديد تتناول الدراسة تأثير الحد الأدنى من خلال تطبيق نموذج انحدار الحد الأدنى بتقسيم العينات (Hansen, 2000). وأثبتت الدراسة بدلالة إحصائية أن الإنفاق المالي يؤدي إلى زيادة الناتج المحلي الإجمالي الحقيقي في نظام الدين المنخفض (81.5٪ نسبة الدين المحلي إلى الحد الأدنى للناتج المحلي الإجمالي) وانخفاض الناتج المحلي الإجمالي الحقيقي في الديون المحلية المرتفعة فوق الحد الأدنى. وتستكشف الدراسة كذلك وتختبر التفسير النظري المحتمل للنتائج، وتختتم بمناقشة الآثار السياسية لهذه الدراسة.

1. Introduction

Egypt has been undergoing a major IMF-supported reform program to solve its fiscal structural problems and move towards fiscal consolidation over the past five years. Those efforts led to notable fiscal development and overall improvement of the economic climate in Egypt. However, the COVID-19 pandemic put tremendous pressure on many sectors of the Egyptian economy (e.g., tourism and manufacturing), decreasing Egypt's economic growth rate by two percentage points compared to the pre-pandemic forecast.

This pandemic led policymakers to adopt an expansionary policy and enact a COVID-19 emergency budget increase of 100 billion Egyptian pounds. In addition, the government passed tax relief such as halving the dividends tax and the exchange tax relief. The rise in fiscal spending coupled with reduced revenue constitutes a threat to the Egyptian government's fiscal consolidation efforts.

We empirically investigate the impact of fiscal stimulus on real economic growth and shed light on the relationship between these variables. We particularly explore whether fiscal stimulus has a different effect on real economic activity when a country has low domestic debt versus when it has high domestic debt as a percentage of GDP. We then empirically quantify a particular threshold (i.e., a tipping point) at which the effectiveness of fiscal policy changes.

First, we establish the existence of a threshold that splits the data into a low domestic debt regime and a high domestic debt regime at 81.5% domestic debt-to-GDP ratio. We also test for the existence of more than one threshold in the data, but we do not find any other threshold. Second, we establish with statistical significance that fiscal expansion increases real economic growth in the low-debt regime ($\leq$ 81.5%) and a decrease in real economic growth in the high-debt regime (>81.5%).

Third, we explore some of the possible theoretical explanations for the existence of the threshold effect. The first is the "Ricardian equivalence argument" – private investors internalize the government's budget constraint and reduce investment spending when debt levels are high, which leads to lower real economic growth. The second one is that higher fiscal spending increases interest rates, leading to a crowding out effect on investment. The last potential explanation is the "precautionary saving hypothesis" (Barro, 1974) – current excessive spending coupled with existing high levels of accumulated debt causes households to consume less and save more in the present because of anticipated tax hikes in the future (which has contractionary effects on real GDP). In the fourth section of this paper, we test empirically whether any of these arguments could explain why government spending has an adverse effect on growth in the high-debt regime.

To the best of our knowledge, no other empirical papers quantify debt-to-GDP thresholds for Egypt

or provide policy implications of debt accumulation under different debt regimes. The paper is divided into five sections. The first section is an introduction that presents the research statement and the objective of this paper. The second section is a literature review. The third section describes the data used in the analysis and shows the sources, followed by the empirical methodology used to test our hypothesis. The fourth section shows the results of the empirical analysis and explores the theoretical arguments. The fifth section discusses the policy implications of the result. The last section concludes.

2. Literature Review

Optimal fiscal policy has been extensively studied in the economic literature. For example, authors have examined fiscal consolidation (Alesina and Ardagna, 2010; von Hagen and Strauch, 2001), fiscal reaction functions (Bohn, 1995 and 2007), and the optimal level of government expenditures (Forte and Maggazino, 2016). Several studies have also investigated these topics in developing economies (Baldacci et al., 2006; Gupta et al., 2005). Others evaluated government expenditures numerically and tax multipliers (Blanchard and Perotti, 2002; Coenen et al., 2012; Ilzetzki et al., 2013; Ramey, 2019; Romer and Romer, 2010; Woodford, 2011), including in MENA countries (Al Moneef and Hasanov, 2020; Alnashar, 2017; Cerisola et al., 2015; Espinoza and Senhadji, 2011).

Following the COVID-19 pandemic, fiscal stimulus, and other macroeconomic measures in the OECD and the US received extensive attention. Yet, as Alon et al. (2020) observes, it quickly became clear that developing countries could not replicate policies implemented in the advanced economies. Similarly, the analysis and the policy recommendations in the emerging markets should naturally follow the patterns intrinsic to developing economies and be based on the local data. Therefore, in our research, we reference recent work on the pandemic impact in emerging markets[2] and we pay particularly close attention to the papers that examined the fiscal measures under different debt regimes in developing countries (Burger and Calitz, 2020; Benmelech and Tzur-Ilan, 2020).

Several aspects of the optimal fiscal policy in Egypt (in particular, the effect of government spending and tax relief on GDP growth over different time horizons) have not been examined sufficiently in the recent economic literature. However, two notable works that are exceptions to this premise exist; both studies provide valuable insights but have some limitations. Alnashar (2017) evaluates the determinants of the government spending multiplier but does not analyze the tax change multiplier, and the research covers the pre-pandemic time frame. On the other hand, El-Khishin (2020) focuses on the economic measures taken by Egypt's government to alleviate the impact of the pandemic. However, as a brief policy report, this study provides only the

[2] (Addison et al., 2020; Arellano et al., 2020; Loayza and Pennings, 2020)

descriptive summary of the policy response and lacks the depth of the economic analysis.

The strand of literature that relates closely to our paper examines the empirical relationship between the level of debt and economic growth. For example, Reinhart and Rogoff (2010) employs a data set covering 44 countries over 200 years to show that a government debt-to-GDP ratio exceeding 90% is associated with lower GDP growth. Cecchetti et al. (2011) uses data on government, corporate, and household debt from 18 OECD countries and find that high debt levels (>80-90% for government, >90% for corporate, and >85% for household debt) are associated with lower economic growth while a moderate level of debt can improve welfare. Checherita-Westphal and Rother (2012) utilizes data from 12 EU countries to show a negative effect of debt-to-GDP at the high levels of 90-100%. Several papers use threshold regression to study the impact of government spending on GDP under different debt regimes. Nickel and Vansteenkiste (2008) employs a panel of 21 developed countries and quantifies a threshold of 85% as the point after which spending and debt have adverse effects on growth, while Baharumshah et al. (2017) uses time series data on Malaysia and finds a threshold of 54.71% for domestic debt.

3. Data and Methodology

We use the publicly available quarterly data for Egypt ranging from March 2001 to March 2021. The data source for all the variables except economic policy uncertainty is the Central Bank of Egypt (CBE); we use monthly statistical bulletins, quarterly economic reviews, annual reports, and quarterly time-series data – all retrieved from the official CBE webpage. Data for economic policy uncertainty (EPU) index has been retrieved from Federal Reserve Bank of St. Louis Economic Data (FRED), World Economic Uncertainty Index for Egypt. The summary of the variables used in the research is given in the Table 1 below.

Table 1. Descriptive statistics of the variables

	Available Data	*Qtrs.*	*Mean*	*Median*	*Min.*	*Max.*	*S.D.*
Δ Real GDP	2003:Q3-2021:Q1	71	1.272	1.210	-7.580	9.330	3.751
Domestic Debt	2001:Q2-2020:Q2	77	78.813	79.800	66.300	96.700	6.808
Total Debt	2001:Q2-2020:Q2	77	103.840	105.100	81.400	131.200	13.260
Fiscal Balance	2003:Q3-2020:Q3	69	-2.194	-2.200	-4.900	0.4000	0.964
Δ Money Supply	2003:Q3-2021:Q1	71	4.169	4.030	-1.790	13.330	2.900
Consumption	2001:Q3-2021:Q1	79	78.529	78.080	62.870	91.080	6.848
Investment	2001:Q3-2021:Q1	79	16.874	16.420	8.200	27.780	3.941
Export	2001:Q3-2021:Q1	79	20.401	19.680	9.440	35.760	7.094
Inflation Rate	2003:Q3-2021:Q1	71	11.134	10.470	3.200	32.150	5.993
Unemployment Rate	2003:Q1-2021:Q1	73	10.656	10.600	7.200	13.400	1.853
EPU	2001:Q1-2021:Q1	81	0.1446	0.100	0.000	1.010	0.180

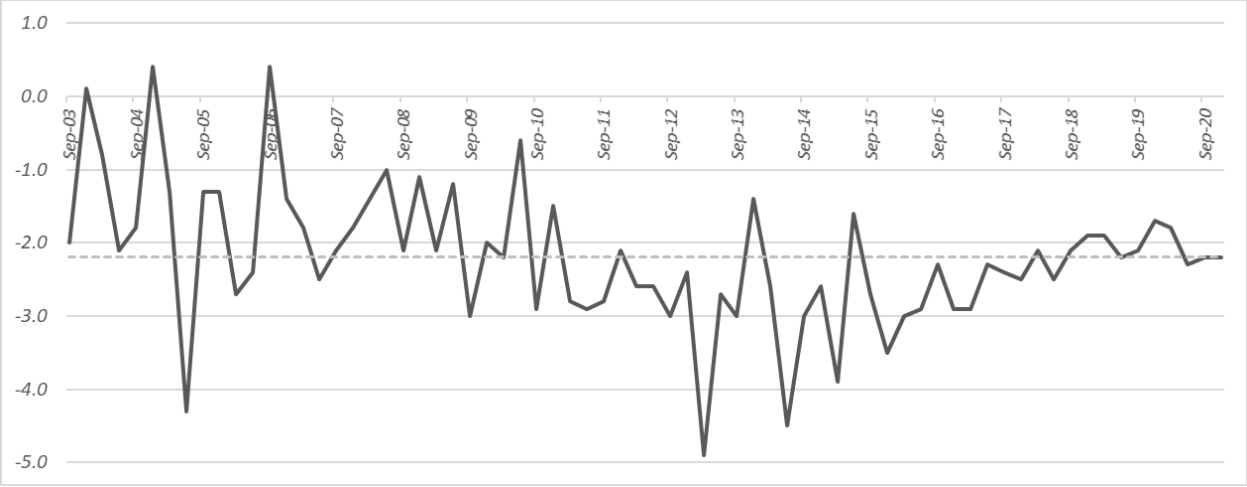
As can be seen from the Table 1, the overlapping period for all the variables is September 2003 – July 2020, 68 quarters in total. Since Egypt uses a fiscal year (FY) that starts in July and ends in June, the time frame of our research matches FY 2003/04:Q1 – FY 2019/20:Q4.

The raw quarterly data for real GDP exhibits a clear pattern of seasonality: there is a significant increase in real GDP between the last quarter of a previous fiscal year and the first quarter of a current fiscal year; we observe this pattern for the entire span of the data series. We apply a simple deseasonalizing method based on the centered moving average and used the deseasonalized data to calculate the change in real GDP between quarterly periods.

We consider two debt variables as a potential threshold variable in our paper: domestic debt and total debt, the latter refers to the sum of domestic debt and external debt. Both variables are normalized to a GDP level (expressed as debt-to-GDP ratios) and are measured in percentage points of Egypt's nominal GDP. It should be noted that the public debt reported by CBE includes the government's debt as well as the debt by public economic authorities and the debt accrued to National Investment Bank of Egypt; however, the share of the government's debt in public debt is estimated to fluctuate around 80-90% for the period analyzed in the current research.

The fiscal balance is calculated as the difference between total government revenues and total government expenditures over nominal GDP, the positive (negative) value for the fiscal balance implies that the government is running a fiscal surplus (deficit) in the current period. As it can be seen in the Figure 1 below, the government of Egypt was running a fiscal deficit in all but three time periods during the time span analyzed in the paper, and the median value for the fiscal balance to nominal GDP is negative 2.2 percentage points.

Figure 1. Egypt's Fiscal Balance in 2003 September - 2020 September



We chose the standard control variables used in the economic literature: change in money supply (M1), consumption, investment, export, inflation rate, unemployment rate, and EP uncertainty. The inflation rate has been calculated as the change in consumer price index (CPI) relative to corresponding month of previous year, the weights from January 2010 CPI were used for the entire data span to preserve the consistency for the calculation exercise. Consumption, investment, and export are normalized to a GDP level and are measured in GDP percentage points.

We resort to Hansen (2000) sample splitting threshold regression model as a methodological base of our exercise. Consider a following simple regression equation:

$$y_t = (\beta_{10} + \beta_{11}x_t + \beta_{12}x_{t-1} + \ +\beta_{13}x_{t-2}\ )\, I[q_t \le \gamma] \\ +\ \ (\beta_{20} + \beta_{21}x_t + \beta_{22}x_{t-1} + \ +\beta_{23}x_{t-2})\, I[q_t > \gamma] + \ \varepsilon_t \quad (1)$$

where y_t is the dependent variable;

x_{t-j} is a vector of predictor variables, lagged j period(s);

q_t is a threshold variable;

γ is a threshold value;

$I[q_t \le \gamma]]$ is an indicator function that is equal to 1 when $q_t \le \gamma$ and equals 0 otherwise;

$I[q_t > \gamma]]$ is an indicator function that is equal to 1 when $q_t > \gamma$ and equals 0 otherwise.

We are testing the null hypothesis $H_0 : = \beta_{1i} = \ \beta_{2i}\ for\ i = 0, 1, 2, 3$. If the null hypothesis has been rejected, then the threshold effect has been established. The threshold value γ can be found by estimating equation (1) though finding the minimum one of the sums of squared errors in a threshold variable. Under the null hypothesis, the distribution of the *p*-value statistic is uniform, and this transformation can be calculated through bootstrap.

4. Results of the Empirical Models

As we mentioned previously, we consider two potential candidates for a threshold variable: domestic debt and total debt. Running different versions of empirical models, we find that regressions with domestic debt as a threshold variable yield robust result, but we are not able to reach significant results for models with total debt as a threshold variable. One of the drawbacks to using total debt as a threshold is that the total debt incorporates the external debt component, which was subject to major exchange rate shocks in the past two decades, as the external debt being issued in world trade currencies, mainly in U.S. dollars. Being unable to collect the quarterly data on exchange rate for Egyptian pound, we cannot add the control variable for the exchange rate in the vector of regressors. Therefore, we resort to domestic debt as a threshold variable in the regression equations.

We consider contemporaneous variables as well as their first and second lags for fiscal balance and change in money supply to examine potential delayed responses to fiscal and monetary policy changes. We include only contemporaneous variables for the remaining explanatory (control) variables. The primary setup of an empirical model we estimate is as follows:

$$\begin{aligned}\Delta Y_t = \big(&\alpha_{10} + \beta_{11}FB_t + \beta_{12}FB_{t-1} + \ +\beta_{13}FB_{t-2} \ + \lambda_{11}\Delta M_t + \lambda_{12}\Delta M_{t-1} + \lambda_{13}\Delta M_{t-2} \\ &+ \sigma_{1k}x_{k,t}\big)\, I[DD_t \le \gamma] \\ &+ (\alpha_{20} + \beta_{21}FB_t + \beta_{22}FB_{t-1} \ + \beta_{23}FB_{t-2} \ + \lambda_{21}\Delta M_t + \lambda_{22}\Delta M_{t-1} + \lambda_{23}\Delta M_{t-2} \\ &+ \sigma_{2k}x_k\,)\, I[DD_t > \gamma] + \ \varepsilon_t \ (2)\end{aligned}$$

where ΔY_t is the change in Real GDP, relative to the previous time period;

FB_{t-j} is the fiscal balance at time period *t-j*;

ΔM_{t-j} is the change in money supply (M1), relative to the previous time period;

$x_{k,t}$ is the vector of control variables at time period t;

DD_t is the domestic debt (threshold variable) at time period t.

The summary of the estimated regressions is provided in Table 2 below. We include a wide list of potential explanatory variables, namely investment, inflation rate, export, unemployment rate, and EPU in a vector of control variables in Model 1. The model exhibits the threshold effect: we establish the existence of the first threshold with the estimated value 81.5% at a 10% level of significance (bootstrap *p*-value of the threshold estimate is 0.09). We go a step further after that and test for the existence of a second threshold (either above or below the estimated value of the first threshold). However, we cannot establish a statistically significant second threshold effect as the bootstrap *p*-value of the second threshold exceeds 0.10. Note also that while most of fiscal balance and change in money supply variables are significant (at different level of significance), only investment, and EPU for the low-debt regime are significant.

We include only investment as a control variable in Model 2 and obtain stronger results. Firstly, the model still exhibits the threshold effect, and the value of a threshold remains at 81.5% being estimated at a much higher significance (at 1% level of significance, since bootstrap *p*-value of the threshold estimate is 0.004); like in the previous model, the existence of the second threshold has not been detected. Secondly, while the signs of the regressors slope coefficients tend to remain the same, we observe the major improvement in their significance.

We observe that coefficients of both lagged fiscal balance variables are significant and have a negative sign under the low-debt regime, and a coefficient of the first lagged fiscal balance variable

has a positive sign and is significant under the high-debt regime We can interpret these signs as follows: expansionary fiscal policy is associated with positive (negative) real GDP growth under the low-debt (high-debt) regime.

We have previously mentioned three potential reasons for the fiscal policy inefficiency under the high-debt regime: the precautionary savings motive for consumers, and the Ricardian equivalence and crowding out effect for private investors. To test the empirical validity of these theoretical claims we use modified empirical models with consumption or investment as a dependent variable and include only fiscal balance and change in money supply variables as regressors. Different from the first two models, we do not check for the existence of threshold(s) for the case of consumption and investment regressions. Instead, taking the estimated threshold value of domestic debt (81.5%) as given, we run three separate regressions for both consumption and investment models: for the full sample, for the low-debt regime subsample, and for the high-debt regime subsample.

The obtained results do not support the Ricardian equivalence and precautionary saving hypotheses because the slope coefficients of fiscal balance variables albeit being highly significant, do not exhibit different signs under different debt regimes indicating no threshold effect. For these two hypotheses to hold we would have needed to see a negative sign for fiscal balance coefficients under the low-debt regime and positive coefficients under the high-debt regime.

Table 2. Empirical Models Estimation

Regressand	**Change in Real GDP (Model 1)**			**Change in Real GDP (Model 2)**			**Private Consumption**			**Investment**		
Regressors	*Full sample*	*Low debt regime*	*High debt regime*	*Full sample*	*Low debt regime*	*High debt regime*	*Full sample*	*Low debt regime*	*High debt regime*	*Full sample*	*Low debt regime*	*High debt regime*
Fiscal Balance	0.158	-0.430	0.428	-0.389	-0.593	-0.001	-1.154	-1.471	-1.147	0.466	1.409	-0.157
	(0.641)	(0.865)	(0.854)	(0.489)	(0.820)	(0.522)	(0.746)	(1.236)	(1.094)	(0.469)	(0.838)	(0.617)
Fiscal Balance, lagged 1 period	0.525	-1.249	1.660**	0.184	-1.577**	1.513**	-1.478**	-1.313	-1.827	0.757	1.314*	0.425
	(0.565)	(0.783)	(0.732)	(0.488)	(0.669)	(0.575)	(0.734)	(0.996)	(1.194)	(0.462)	(0.675)	(0.674)
Fiscal Balance, lagged 2 periods	-0.190	-1.749*	0.089	-0.533	-2.432***	-0.160	-3.230***	-2.874**	-3.807***	1.583***	1.879**	1.351**
	(0.616)	(1.028)	(0.823)	(0.524)	(0.832)	(0.602)	(0.736)	(1.217)	(1.131)	(0.463)	(0.825)	(0.638)
Δ Money Supply	-0.248	-0.548*	0.314	-0.286*	-0.600**	0.213	-0.402	-0.474	-0.198	0.062	0.062	-0.163
	(0.198)	(0.283)	(0.297)	(0.169)	(0.243)	(0.229)	(0.259)	(0.381)	(0.476)	(0.163)	(0.259)	(0.269)
Δ Money Supply, lagged 1 period	0.291*	0.591***	0.421	0.228	0.446**	0.395	0.001	0.254	-0.354	-0.225	-0.294	-0.203
	(0.173)	(0.211)	(0.315)	(0.157)	(0.185)	(0.232)	(0.236)	(0.280)	(0.480)	(0.149)	(0.190)	(0.271)
Δ Money Supply, lagged 2 periods	0.014	-0.497**	0.567*	0.001	-0.468**	0.536*	-0.056	-0.336	0.715	0.172	0.359*	-0.254
	(0.179)	(0.217)	(0.295)	(0.168)	(0.203)	(0.271)	(0.256)	(0.305)	(0.558)	(0.161)	(0.207)	(0.315)
Investment	0.437**	0.856***	0.421	0.319**	0.580***	0.394*						
	(0.168)	(0.218)	(0.267)	(0.135)	(0.161)	(0.199)						
Inflation Rate	-0.091	-0.104	-0.128									
	(0.079)	(0.109)	(0.112)									
Export	-0.066	-0.218	-0.126									
	(0.114)	(0.151)	(0.187)									
Unemployment Rate	0.625*	0.727	-0.047									
	(0.370)	(0.503)	(0.938)									
Economic Policy Uncertainty	-1.135	-6.238*	-1.655									
	(2.935)	(3.175)	(8.922)									
# of observations	66	41	25	66	41	25	66	41	25	66	41	25
R^2	0.2287	0.5169	0.5967	0.1709	0.4220	0.5445	0.3701	0.3316	0.5206	0.3090	0.4272	0.3463

Standard errors are given in parentheses.
Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1

However, the crowding out hypothesis (that higher government spending increases interest rates leading to reduced investment) might be valid in this case as we see a statistically significant positive association between fiscal balance and investment (which indicates that running larger fiscal deficits leads to lower private investment) under both low and high-debt regimes.

In general, we could not establish in this paper with confidence what is causing the contractionary effects of higher government spending under the high-debt regime. This is a topic we are planning to explore in future iterations of this research.

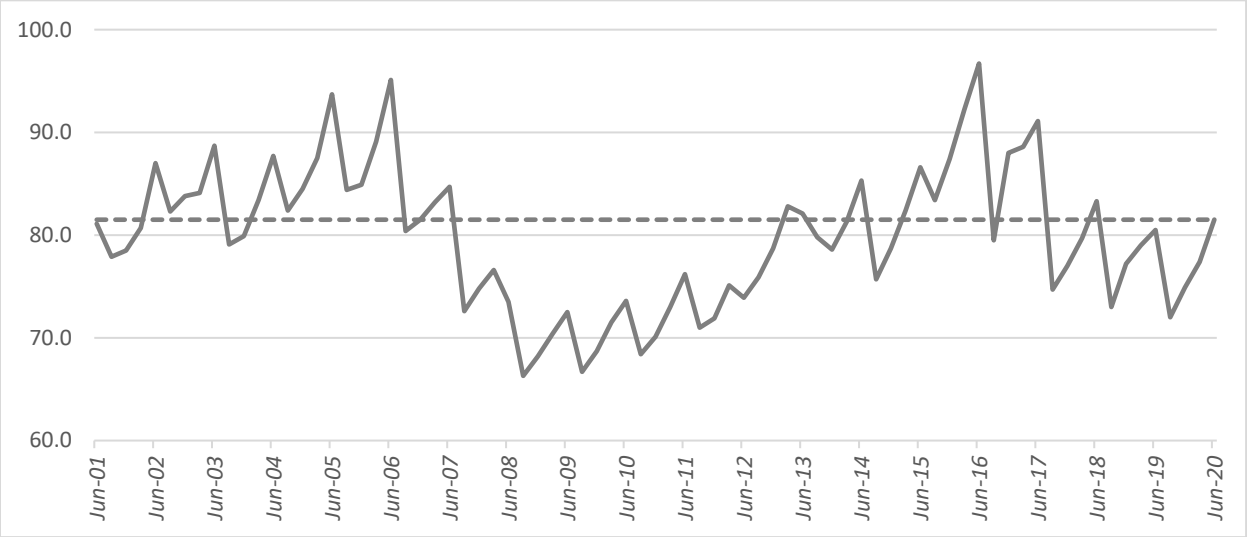
5. Policy Implications

1) The Egyptian government should increase prudence at high domestic debt-to-GDP ratios. In other words, it should constantly monitor debt levels before considering fiscal stimuli. When debt is high relative to GDP, any expansionary effects of additional spending disappear (or even become contractionary at worst). Thus, while the economy may expand in the short run, it is likely to contract in the medium to long run. This reversal means that the government should get its debt situation under control if its fiscal policy is to be effective.

2) Our empirical results suggest that the Egyptian policy makers should target a domestic debt level below or at the threshold value (81.5% domestic debt-to-GDP ratio). Historically, 47 out of 77 quarters of available data for Egypt's domestic debt fall in the low-debt regime while only 30 quarters fall in the high-debt regime as seen in Figure 2.

3) The Egyptian government should coordinate with the Central Bank of Egypt. Fiscal-Monetary Coordination in times of high debt could help stimulate growth despite the contractionary effects of fiscal spending that we found. As shown in Table 2, we can see that lagged growth in money supply (M1) is positively associated with real GDP growth in the high domestic debt regime for the second lag (with statistical significance) and in the first lag (weakly). Thus, expansionary monetary policy can lead to positive real GDP growth under high domestic debt regime without the need for more debt accumulation through fiscal expansion.

Figure 2. Egypt's Domestic Debt in 2001 June - 2020 June



4) Our data shows a negative effect of economic policy uncertainty (EPU) on real GDP growth (with statistical significance in low debt regime and weakly in high debt regime). This indicates that risk management practices and innovative efforts to mitigate the negative consequences of EPU could be of great benefit for the Egyptian economy in the time of crisis.

6. Conclusion

In this paper, we explore the relationship between expansionary fiscal policy and real economic growth under different debt regimes. First, we test if the relationship between fiscal expansion and economic growth is nonlinear and depends on the amount of domestic debt accumulated. To do this, we search for a threshold effect employing Hansen's (2000) sample-splitting threshold regression model. As a result, we establish that lagged fiscal expenditure leads to an increase in real GDP in the low-debt regime (below 81.5% domestic debt-to-GDP ratio threshold) and that fiscal expansion leads to adverse effects on real GDP under the high-debt regime (above 81.5%). We further explore and test possible theoretical explanation for the findings such as Ricardian equivalence hypothesis, the precautionary saving hypothesis, and the crowding out of investment hypothesis. We conclude by discussing the policy implications of our results.

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