Egypt's Government Debt: Perpetual Deficits and Exchange Rate Depreciations

Sara B. Alnashar*

The World Bank

Table of Contents

JEL Classification: E60, E61, H60

Keywords: Egypt, government debt, debt dynamics, SVAR, primary balance, exchange rate

* This research paper does not necessarily reflect the views of the World Bank Group.
The author can be contacted at: salnashar@worldbank.org or sara.b.alnashar@gmail.com

ABSTRACT

Is public debt solely a fiscal phenomenon? This paper argues that, in Egypt, the exchange rate has been an equally important determinant of government debt accumulation, as much as the primary deficit has been. Using annual data for FY2001/02—FY2016/17, this paper undertakes a debt dynamics decomposition exercise that quantifies the cumulative impacts of the primary deficit to GDP ratio, the exchange rate, the real interest rate and real growth. This analysis shows that the primary deficit ratio, followed by the valuation effect caused by exchange rate depreciations, have been the leading causes of debt accumulation in Egypt. The analysis also provides evidence that the domestic debt is partially inflated away. An 'unidentified residual' that also contributes to debt accumulation emerges from this analysis, which points to fiscal transparency issues that show how unclear, 'below-the-line' items may lead to higher-than-anticipated debt accumulation.

This research also conducts a Structural VAR analysis, using quarterly data for FY2004/05—FY2016/17, including the following 4 variables: the exchange rate, primary deficit, real interest rate and the debt level. The impulse response functions show that the debt responds by the same magnitude to primary deficit as well as exchange rate shocks. The variance decomposition provides preliminary evidence that there might be a deficit-depreciation spiral, although more work is still needed to establish the mechanism by which deficits can ultimately lead to a depreciation. This is identified as an area for future research.

I. INTRODUCTION

Egypt's government debt is currently at a precarious level, recorded at 108 percent of GDP in end-June 2017. This elevated level reflects long-standing macro-fiscal imbalances, but also the recent surge in external indebtedness associated with the International Monetary Fund's Extended-Fund Facility. The exchange rate depreciation during 2016/17 alone was responsible for an 8 percentage-points increase in the debt to GDP ratio. At the same time, the loose fiscal policy – manifested in the large fiscal deficit and debt levels over the past two decades – has contributed to inflationary pressures, especially due to the liquidity expansion fueled by the accelerating credit extended to the government. This in turn led to real exchange rate appreciation, loss of competitiveness, a deterioration in the net exports balance, and finally an inevitable exchange rate depreciation. In fact, the two episodes of exchange rate depreciation, in the recent past (FY2002/03 and FY2016/17) have occurred following periods of deteriorated fiscal accounts and government debt to GDP ratios that surpassed 100 percent of GDP. Consequently, the exchange rate depreciation implies higher foreign currency interest payments in the government budget, and a higher government debt ratio.

So, what are the drivers of Egypt's government debt? And is there a deficit-depreciation spiral? This research paper thus has two objectives: ***(1) to analyze the determinants of the debt to GDP ratio, (2) to better understand that relationship between public finances and the exchange rate in Egypt.***

Using annual data for FY2001/02—FY2016/17, this paper undertakes a debt dynamics decomposition exercise that quantifies the cumulative impacts on the debt to GDP ratio of the following variables: the primary deficit to GDP ratio, the exchange rate, the real interest rate and real growth. This analysis shows that the primary deficit, followed by the valuation effect caused by exchange rate depreciations, have been the leading causes of debt accumulation in Egypt. The analysis also provides evidence that the domestic debt is partially inflated away. This might explain the authorities' difficulty in extending the maturities of its domestic debt, as potential holders of sovereign debt would refrain from purchasing debt that may lose its 'real' value in the future. An 'unidentified residual' that also contributes to debt accumulation emerges from this debt dynamics analysis, which points to fiscal transparency problems that show how unclear, below-the-line items may lead to higher than anticipated debt accumulation.

This research also conducts a Structural VAR analysis, using quarterly data for FY2004/05—FY2016/17, including the following 4 variables: the exchange rate, primary deficit, real interest rate and the debt level. The impulse response functions show that the debt responds by the same magnitude to primary deficit as well as exchange rate shocks. Furthermore, the variance decomposition shows that the primary deficit shock is a relatively important contributor to the variability of the exchange rate. This may provide evidence of a deficit-depreciation spiral, although more work is still needed to establish the mechanism by which deficits can ultimately lead to a depreciation. The deficit-depreciation spiral is thus identified as an area of future research, to further extend the analysis of this paper.

The policy implications that arise from this research paper shed light on the multi-dimensional aspects of the government debt situation in Egypt. It is not solely a fiscal phenomenon, but rather a problem that finds its roots in exchange rate management, institutional issues such as fiscal transparency, as well as macroeconomic policy coordination, at large.

The rest of this report is organized as follows: **Section II** provides the background and literature review on the "debt accumulation" and its drivers. **Section III** discusses the magnitude of Egypt's government

debt during FY2001/02—FY2017/18, along with its structure in terms of maturity, residency of holder, and currency-composition. **Section IV** is split into two parts: Section IV.a. displays the results of the debt dynamics decomposition, and Section IV.b. presents the Structural VAR identification and results. Finally, **Section V**. is dedicated to the conclusion and policy implications of this research.

II. THEORETICAL BACKGROUND AND LITERATURE REVIEW

What drives the government debt to GDP ratio? Government debt depends on the previous period's "stock" of debt and the current budget balance. Following the budget equation of Barro (1979), Cottarelli and Escolano (2014) express this concept, while breaking down the budget balance into interest payments and primary balance (non-interest revenues minus non-interest expenditures). Their basic identity for debt accumulation is written as:

$$\boldsymbol{D_t = (1 + i_t)D_{t-1} - P_t} \qquad \textbf{(1)}$$

Equation 1 says that the debt ***(D_{t-1})*** at the end of period t[1] is equal to the stock of debt at the end of period t-1 ***(D_{t-1})***, augmented by interest ***($1+i_t$)*** and reduced (augmented) by the primary surplus (deficit) ***(P_t)*** (Cottarelli and Escolano, 2014).

And as public debt can be denominated in both local and foreign currencies, then the debt accumulation equation above can also be written with notations for the foreign-currency debt component as well.

$$\boldsymbol{D_t = \left(1 + i_t^D\right)(1 - \alpha_{t-1})D_{t-1} + \left(1 + i_t^F\right)(1 + e_t)\alpha_{t-1}D_{t-1} - P_t} \quad \textbf{(2)}$$

Equation 2 is adopted by the IMF in its Debt Sustainability Analysis tool,[2] where ($\boldsymbol{i_t^D}$) is the interest rate on local currency public debt; ($\boldsymbol{\alpha}$) is the proportion of public debt that is denominated in foreign currency; ($\boldsymbol{i_t^F}$) is the interest on foreign currency-denominated debt; ($\boldsymbol{e_t}$) is the exchange rate depreciation (noting that the exchange rate is the local currency value of one unit of foreign currency). As such, a depreciation would imply a positive 'e' that would lead to an increase in D_t.

The first two arguments on the right hand side of Equation 2 say that the previous period's local currency debt is augmented by the interest rate, and the foreign currency debt is augmented by the relevant interest rate, in addition to the exchange rate depreciation.

Equation 3 below is the same as equation 1 above, but after diving through by nominal GDP, which through algebraic derivation, can be expressed in the form of real GDP growth and real interest rate (Cottarelli and Escolano, 2014 and Escolano, 2010).

$$\boldsymbol{d_t = \frac{1+r_t}{1+g_t} d_{t-1} - p_t} \qquad \textbf{(3)}$$

Equation 3 thus expresses the debt to GDP ratio ***(d_t)*** at the end of year t as a function of the previous year's debt to GDP ratio ***(d_{t-1})***, but in this case augmented by the "real interest/growth differential" ($\boldsymbol{\frac{1+r_t}{1+g_t}}$), which is also called the "automatic debt dynamics"; where ***(r_t)*** is the real interest rate, and ***(g_t)*** is the real GDP growth rate at year t.

[1] 't' can be any period (year or quarter, etc.)
[2] https://www.imf.org/external/pubs/ft/dsa/mac.htm

Abbas, Belhocine, El-Ganainy and Horton (2011) also add a 'residual' term to the above equation to account for what they call "stock-flow adjustment term", which represents other items that contribute to changes in the government debt to GDP ratio, including valuation effects of exchange rate changes, "below the line" fiscal expenditures/revenues such as bank recapitalization or privatization proceeds, as well as errors and omissions. Consequently, they further expand equation (2) as follows:

$$d_t = \frac{1+r_t}{1+g_t} d_{t-1} - p_t + SFA_t \qquad (4)$$

Where the newly introduced term **(SFA_t)** accounts for that unidentified residual that affects the debt to GDP ratio.

Several studies have previously attempted to put these above equations into application in order to determine the factors behind the evolution of the public debt to GDP ratio. Abbas, Belhocine, El-Ganainy and Horton have compiled data on public debt in what they called the "Historical Public Debt Database" (HPDD), covering 178 countries. They employ equation 4 to analyze the evolution of the debt to GDP ratio, during episodes that they had identified as "large" accumulations or reductions of debt, in 19 advanced economies between 1800 and 2007. They attributed these episodes to the three factors in their equation 4 (above), namely, the primary balance, the interest/growth differential and the stock-flow residual term. They find that the primary balance has been the relatively most important factor in reducing the debt to GDP ratio, whereas the favorable interest/growth differential was more important during the World War II period to contain the accumulation of public debt. The impact of the 'residual' term on debt dynamics seems to be relatively more prominent during the episodes of large debt "increases". This, in part was due to the fact that they have not included the exchange rate as a separate explicit determinant of changes in the debt to GDP ratio. Thus, exchange rate valuation effects, in part, explained these large contributions from the residuals in the Abbas, Belhocine, El-Ganainy and Horton study. The realization of contingent liabilities was one other factor that they believe explains the large contribution of the residual factor to the growth in the public debt to GDP ratio.

Jaimovich, Panizza and Campos (2006) regress the debt to GDP ratio on the deficit to GDP ratio, in a panel dataset, controlling for heterogeneity across the countries by using fixed effects. They find that this model is not well fitted, as it has a low R^2 (that ranged from 0.08 to 0.25, depending on the sample and variable calculation). They also ran separate regressions for a number of countries where data permitted. For the Egypt model, the R^2 was very small (0.007).

Jaimovich, Panizza and Campos then go on to identify for all countries what "other unexplained factors" (beyond the budget deficit) can be driving the debt. They arrive at a similar conclusion to that of Abbas, Belhocine, El-Ganainy and Horton; that the "unexplained part of debt" is also in part a 'balance sheet' or valuation effect due to exchange rate depreciations, as well as the contingent or implicit liabilities that turn into a direct burden on the government budget. Such factors seem to be larger drivers of debt dynamics.

Easterly (2001) argues that economic growth has been an important determinant of the increase in the debt to GDP ratios in industrial countries as well as the debt crises in the Highly Indebted Poor Countries during the 1980s and 1990s, as well as the debt crises in the middle-income countries during the 1980s. His regression analysis shows that these countries have not adjusted their budget deficits following the

economic slump post-1975, and so the debt accumulation that would have been sustainable at previous (higher) growth rates of the past, became "explosive"/unsustainable.

Budina and Fiess (2005) use the same debt dynamics equations stated above, in order to decompose the changes in the debt to GDP ratio into contributions from primary surpluses, real interest rates, real growth rates, exchange rate depreciations as well as that residual which they call "other factors". For the period 1991—2002, they present an aggregate public debt decomposition for 21 Market-Access Countries (MACs). They find that primary surpluses and real GDP growth have had favorable impacts on the debt to GDP ratio throughout the whole period under study. The real exchange rate and real interest rates had a positive impact on containing the debt to GDP ratio during the first half of the 1990s, but became a cause of debt accumulation in the second half of the 1990s. The residual "other factors" were found to be a strong contributor to debt accumulation as well. Budina and Fiess then zoom in on 15 MACs that experienced episodes of large increases or decreases in the debt to GDP ratio. During the episodes of very big debt accumulation, the exchange rate and/or the real interest rate were important contributors thereof. They also find that in half of these cases, the debt to GDP ratio continued to rise despite the fact that these countries were running primary surpluses at the time.

Regarding Egypt-specific studies on the drivers of public debt, we cover two main research pieces: Abdel-Khalek (2000) provides a comprehensive description of the trends, structure and drivers of domestic public debt in Egypt between 1980 and 1997. On the underlying causes of its accumulation, Abdel-Khalek first employs the "debt dynamics" equation; assessing the developments in the primary balance to GDP ratio, as well as the interest/growth differential in Egypt. He shows that Egypt was caught in a debt/interest spiral during the late 1980s and throughout the 1990s. In addition, he analyzes the domestic debt accumulation in light of the broader macroeconomic context, focusing on the combined impact of the pegged exchange rate, free cross-border capital mobility, and the tightened monetary stance. This policy mix has led to an influx of large capital inflows during the early 1990s, and a large accumulation of reserves, which induced the central bank to conduct "sterilized intervention" to neutralize the impact of these capital inflows, through the issuance of domestic debt, to mop up the excess liquidity and to defend the peg. Indeed, he shows that Egypt has been issuing domestic debt in volumes that exceeded its fiscal needs during the early 1990s. This excessive sterilization of capital flows has had a flipside: Domestic debt accumulation.

Alba, Al-Shawarby and Iqbal (2004) analyze Egypt's fiscal and public debt sustainability, but they also touch upon the "fiscal trends underlying debt developments in the 1990s". They attribute Egypt's precarious debt position at the time to the "large and persistently growing budget deficits", as deficits create the need to borrow, and as the debt level increases over time, interest payments continue to put upward pressures on the budget, which creates the possibility of a debt-deficit spiral. They also discuss the interest/growth differential and its impact on the debt level and its sustainability, but without quantifying their respective impact on debt accumulation.[3] They conclude that Egypt's debt to GDP ratio is above what may be considered as the "safe" range, and that the deterioration in public finances in the

[3] While they do not quantify the impact of these factors precisely on the debt accumulation, they highlight crucial issues for deficit-reporting at the time: In order to arrive at the true domestic financing requirements, they augmented the budget deficit with "investment arrears"[3], as well as the "errors" line that the government used to report, reflecting inconsistencies between financing flows and debt accumulation. This way of calculating the overall financing needs resulted in a value that is double the budget deficit at the time.

late 1990s and the early 2000s was driven by "structural" factors affecting the revenues and expenditures, rather than transitory cyclical factors.

Beyond the preceding literature review, the author is not aware of a separate 'Egypt' case study that utilizes the debt dynamics equations above in a quantitative fashion that would disentangle the specific impacts on debt accumulation of the primary balances, real growth, real interest rates as well as the exchange rate valuation effects. Thus, in an attempt to understand Egypt's public debt; its recent trends and driving forces, this research paper puts into application the debt dynamics equation. This is done first through a mechanical/accounting exercise using the IMF's Debt-Sustainability tool, and later through an empirical estimation. But first, we dedicate the next section to the analysis of the overall government debt structure and trends, with a focus on the debt dynamics variables.

While the focus of the next section is to identify the drivers of the public debt accumulation at large, specific focus is given to the exchange rate: The exchange rate is a main driver of public debt in Egypt, yet it has been generally overlooked, as the primary deficit and the interest payments seem to have received more attention as drivers of debt accumulation. We therefore pay special attention to the relationship between debt and exchange rate depreciation, due to the possibility of an ensuing depreciation-debt accumulation spiral. Nazier and Essam (2012) conduct a Structural Vector Autoregression model using annual data for 1992-2010 in order to test whether the Twin Deficit Hypothesis holds for Egypt for not. They find "twin convergence" however where a fiscal shock would result in an improvement in the current account balance. Interestingly, they also show that the real exchange rate depreciates in response to a primary deficit shock. Nazier and Essam hence provide evidence that fiscal policy bears consequences for the conduct of the exchange rate.

III. Egypt's Government Debt: Definition, Magnitude, and Structure

Definition of government debt

The public debt definition that is used in this research is that of the "central government". It is the sum of "gross domestic budget sector debt" [4, 5] published by Egypt's Ministry of Finance, and "external government debt"[6] published by the Central Bank of Egypt (CBE). This is considered the narrowest definition of the public sector.[7] The central government definition of debt remains however the largest in terms of magnitude, because it does not "net out" the large intra-debts that the central government has with other entities. See annex 1 for the classification of the various definitions of the public sector. The main reason for choosing the "central government" debt in this research paper is because the fiscal accounts (budget data) are more comprehensively available under this definition. Also, the budget sector domestic debt coverage is the most comparable to the scope of external government debt

[4] The budget sector includes three entities: The central administration, local governments and public service authorities (Ministry of Finance, Financial Monthly, Various Issues).

[5] Cottarelli and Escolano (2014) say that debt dynamics and sustainability analyses are done usually using gross debt, rather than net debt.

[6] This is defined by the CBE as external debt of the central and local governments.

[7] The central government (or the budget sector) is the narrowest definition of the public sector, as it does not include the National Investment Bank (NIB), the Social Insurance Funds (SIF) and the public economic authorities.

published by the CBE, and so they make the most sense to add up together, to obtain the "total government debt" that is henceforth used in this paper.

Government debt in this paper thus includes both, debt held by residents (domestic government debt), as well as debt held by non-residents (external government debt). The former is predominantly in local currency, but also has a foreign currency component. External government debt however is entirely denominated in foreign currency, in the Egyptian case.

The Magnitude of Government Debt in Egypt

Egypt's total government debt has historically been elevated, averaging 97 percent of GDP between FY2001/02[8] and FY2017/18. It had previously reached a high of 120 percent of GDP in end-FY2004/05, but the fiscal reforms that started thereafter (including a one-off fuel price hike as well as tax reforms) led to a significant decline in the government debt to GDP ratio, albeit remaining relatively high at about 80 percent, during FY2005/06—FY2010/11. However, with the economic downturn, and the deteriorating fiscal accounts post-2011, government debt spiked once again, till it reached a 12-year high of 108 percent of GDP in end-FY2016/17, thus undoing almost all of the gains of the previous fiscal consolidation period (Figure 1).[9]

The recently adopted reform program (supported by the IMF's Extended Fund Facility) has helped achieve a (small) primary surplus, and the debt to GDP ratio declined to around 98 percent in end-FY2017/18.[10]

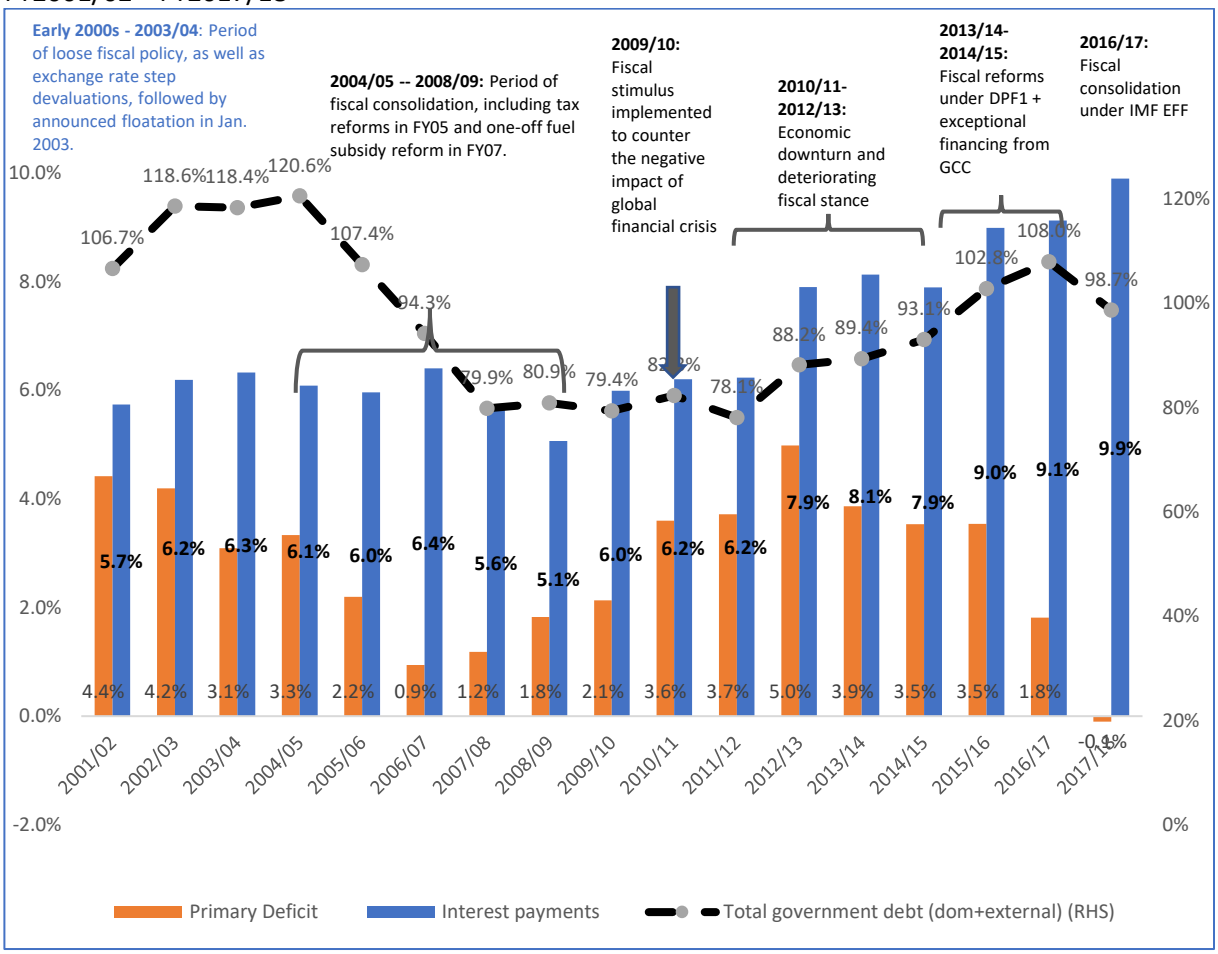
Egypt's chronic primary deficits have been financed by the perpetual issuance of government debt. This in turn led to further borrowing in order to "service" the existing debt. The interest payments have thus remained very high, increasing from an average below 6 percent of GDP in the mid-2000s (following the fiscal consolidation and the rapid decline in the debt ratio) to almost 10 percent of GDP in FY2017/18. The contributions of these factors (the primary balance and interest rate, along with real growth and exchange rate) are later explored in the section on Egypt's debt dynamics.

[8] The Ministry of Finance does not publish data prior to 2001/02 using the GFSM2001 classification. That is why the analysis start in 2001/02.

[9] Section III draws on (and updates) analysis presented in Alnashar, Chowdhury, Jessen, Boitreaud and Youssef (2017).

[10] This statement is based on reported statements attributed to Egypt's Finance Minister: http://english.ahram.org.eg/NewsContent/3/12/316403/Business/Economy/Egypts-economy-A-cautious-road-ahead.aspx. Data on domestic government debt for end-FY2017/18 has not been officially published yet. That is why the analytical and empirical work in this research paper stop in 2016/17.

Figure 1: Egypt's Fiscal Stance: Government Debt, Primary Deficit and Interest Payments (% of GDP) FY2001/02—FY2017/18

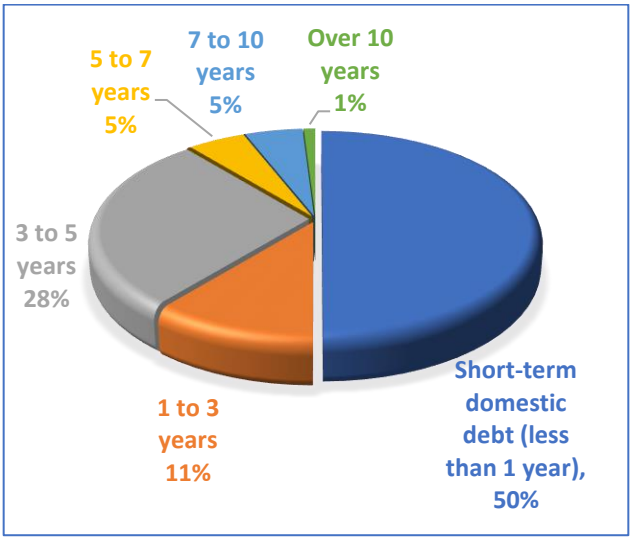


Source: Ministry of Finance and Central Bank of Egypt.

The Structure of Government Debt in Egypt

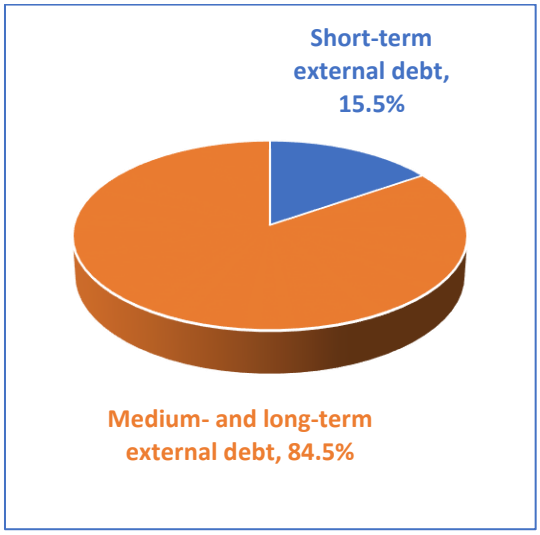
Egypt's government debt is characterized by a dismal structure, especially the domestic portion thereof. The domestic government debt (which has formed, on average, 85 percent of total government debt during FY2001/02—FY2017/18) is mostly issued on a short-term (of up to one year) basis (Figure 2). In fact, 50 percent of domestic government debt is "rolled-over" annually, thus increasing Egypt's financing requirements significantly, and raising its exposure to refinancing risks, such as sudden increases in domestic interest rates, in case of a contractionary monetary policy or tighter liquidity conditions. This is a manifestation of what Eichengreen, Hausmann and Panizza (2007) called "the original sin" where most countries would not be able to issue long term domestic debt. While their study did not arrive at any robust reason behind this phenomenon, other than the "size of the country", the short term maturity of Egypt's domestic debt may be related to the chronic high inflation rates that threaten to erode even seemingly high interest rates in the long term. The external debt on the other hand is mostly long-term and on a concessional basis (Figure 3).

Figure 2. Domestic Budget Sector Debt (end-June 2017)



Source: Ministry of Finance.

Figure 3: Total External Debt (end-June 2017)



Source: Central Bank of Egypt.

Egypt's debt exposure to foreign exchange shocks has been limited over the past two decades, but has increased in recent years, due to the rise in external debt as well as the foreign-currency portion of domestic debt. The external government debt (that is, debt held by non-residents, and in the Egyptian case, entirely denominated in foreign exchange[11]) has been generally low averaging 15.2 percent of GDP (15.4 percent of total government debt) during FY2001/02—FY2017/18. It has also been on an overall declining trend; coming down from a high of 27.3 percent of GDP in end-2002/03, reaching a low of 8 percent of GDP in end-FY2015/16. However, external government debt jumped suddenly by 10 percentage-points to reach 18.1 percent of GDP in end-FY2016/17, and continued to rise to 19.1 percent of GDP in end-FY2017/18, thus approaching its elevated levels of the early 2000s once again (Figure 4). The recent uptick in external government debt (in FY2016/17) was, in part, driven by the "valuation" effect of the exchange rate depreciation (similar to what happened back in FY2002/03), in addition to the increased external borrowing, in light of the International Monetary Fund's Extended Fund Facility, along with the associated financing package from the World Bank, African Development Bank as well as other bilateral partners (such as the GCC) and the international Eurobond issuances. Similarly, the foreign currency component of domestic debt (held by residents) has almost doubled to 13.5 percent of GDP in end-FY2016/17 (Figure 5), thus bringing total foreign currency-denominated debt (both domestic and external) to 31.6 percent of GDP, from 15.1 percent in end-FY2014/15. The recent uptick in foreign currency-denominated domestic debt was fueled by the need to ramp up foreign reserves during the severe shortages in hard currency prior to the liberalization of the exchange rate in November 2016.

[11] The CBE provides the currency breakdown of total external debt (not external government debt separately). As of March 2018 (latest data available), the US dollar is the most important currency (forming about two-thirds of total external debt), followed by the Euro (13.9 percent), and then by the Special Drawing Rights (10.2 percent), the Chinese Yuan (3.2 percent), the Kuwaiti dinar (2.8 percent), and the Japanese yen (2.7 percent). The remainder is grouped together by the CBE under "other currencies" (CBE, Egypt External Position, Vol. 61).

Figure 4: Total Government Debt (% of GDP): Domestic VS. Foreign (by residency) FY2001/02—2017/18

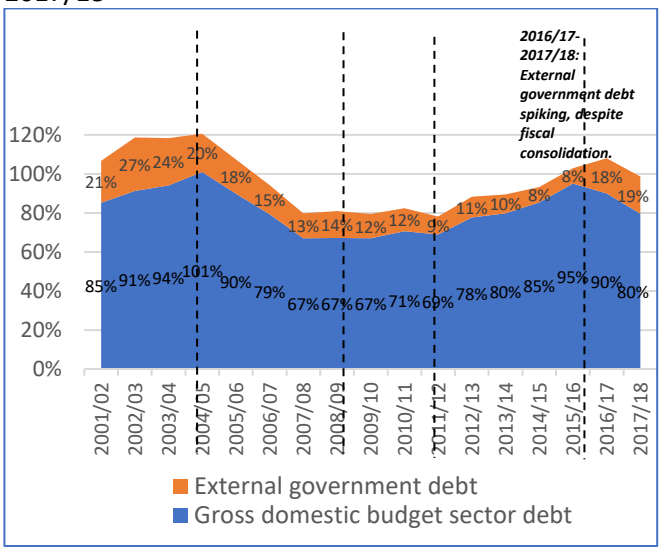
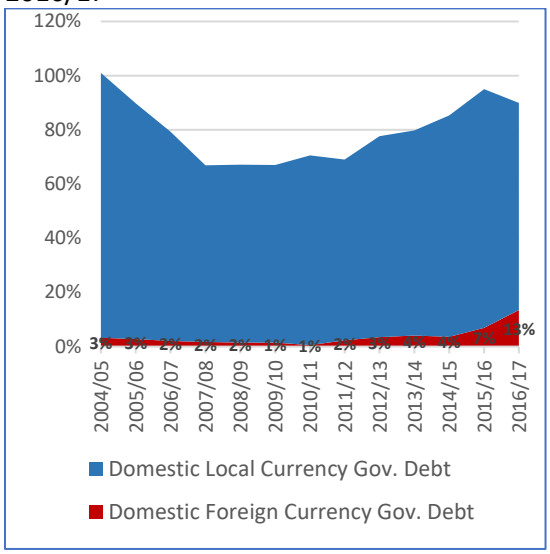


Figure 5: Domestic Debt (% of GDP): Local Vs. Foreign Currency-denomination FY2004/05-2016/17



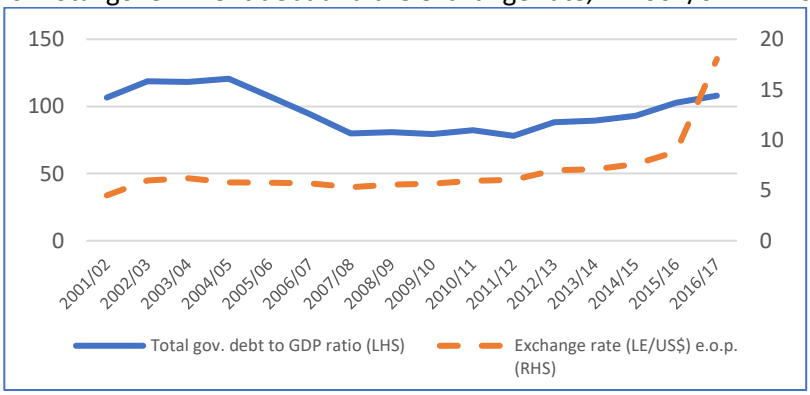
Source: Ministry of Finance and Central Bank of Egypt.

Note: Figures 4 and 5 are not combined together, because the breakdown of domestic government debt by currency denomination is only available for the period FY2004/05—FY2016/17, whereas the domestic/external classification (i.e., debt by residency) is available for FY2001/02—FY2017/18.

The Relationship between Egypt's Public Finances and the Exchange Rate

Given Egypt's increasing foreign currency debt, the exchange rate is thus becoming a more important determinant of the overall government debt ratio to GDP. As shown in figure 6 below, the government debt to GDP ratio has drifted upwards with each episode of exchange rate depreciation.

Figure 6: Total government debt and the exchange rate, FY2001/02—FY2016/17



Source: Ministry of Finance and International Financial Statistics Online.

At the same time, we note that the latest two episodes of large exchange rate depreciation in Egypt (FY2002/03 and FY2016/17) took place following a period of deteriorated fiscal accounts and debt to GDP ratios above 100 percent.

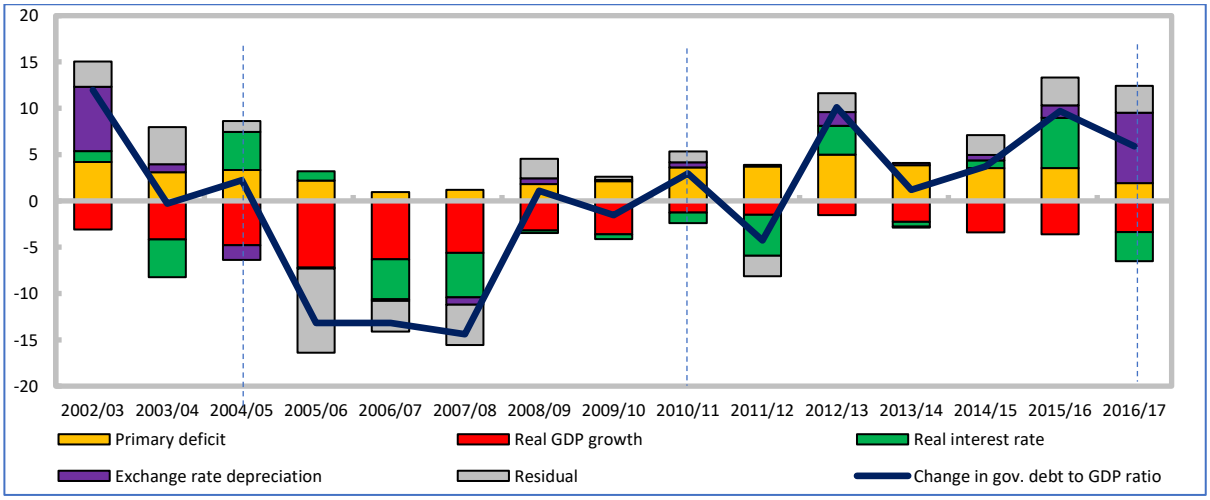
The preceding description of the government debt to GDP ratio shows that there are broadly three sub-periods of interest: **The beginning of the 2000s and up until FY2004/05** when the debt to GDP ratio was generally on the rise. The following period from the **mid-2000s to 2010/11** when the government debt to GDP ratio dropped rapidly, and finally the **post-2011 period** when the economic activity in Egypt slumped, and fiscal accounts deteriorated, and government debt spiraled up again. What are the reasons behind these trends? This is the question that we seek to answer in the next section, using the debt dynamics equation in order to distill contributions of the various factors that affect the debt to GDP ratio.

IV. What Are the Drivers of Egypt's Government Debt?

IV.a. The Dynamics of Egypt's Government Debt Accumulation

In this part, the IMF's Debt-Sustainability Analysis tool[12] is employed in order to disentangle and quantify the impact of the various drivers of the total government debt to GDP, namely, the primary deficit to GDP ratio, the exchange rate, the real interest rate as well as the real GDP growth rate. Using annual data for the period FY2001/02—FY2016/17, this DSA tool shows that perpetual primary deficits and bouts of exchange rate depreciations have been driving the increases in the government debt to GDP ratio, whereas real GDP growth and the (mostly) negative real interest rates have partially contained this increase (Figure 7). The quantification of the impact of these factors on the debt to GDP ratio is done for the three sub-periods of interest below.

Figure 7. Contribution to changes in total government debt-to-GDP ratio (FY2001/02—FY2016/17)



Source: Authors' calculations performed on the Market-Acess Debt Sustainability Analysis platform.

The first sub-period FY2001/02—FY2004/05, the government debt to GDP ratio increased by 13 percentage-points, to reach a high of above 120 percent of GDP in end-FY2004/05. This sub-period coincided with the depreciation (FY2002/03), which had an adverse valuation effect on the debt level, in addition to the elevated primary deficit and the interest payments that averaged around 4 percent and

[12] The Market Access Debt Sustainability Analysis tool is available at: https://www.imf.org/external/pubs/ft/dsa/mac.htm

6 percent of GDP, respectively. This sub-period also suffered from underperforming growth that had averaged 3.9 percent.

We use the DSA tool in order to better understand by how much each of the above-mentioned factors have led to this 13 percentage-points cumulative increase in the debt to GDP ratio: The primary deficit to GDP ratio contributed by 11.5 percentage-points cumulatively, while the exchange rate depreciation contributed by 7.5 percentage-points, and the (positive) real interest rates were responsible for 2 percentage-points. On the other hand, the real growth helped contain the debt to GDP ratio by 12 percentage-points cumulatively over the same period. That is to say that the DSA model was able to exactly explain 9 percentage-points of the 13 percentage-point increase in the government debt to GDP ratio during FY2001/02—FY2004/05.[13] The 4 percentage-points of 'remaining balance' is accounted for by a 'residual' that includes changes in assets and other unidentified items affecting the debt-to-GDP ratio. This is the stock-flow adjustment (SFA) that was previously presented in equation 4 earlier. By inspecting the "sources of financing" published by the Ministry of Finance, we find that below-the-line "payment of outstanding arrears" during this first sub-period have contributed to increasing the borrowing needs, and thus to debt-to-GDP accumulation by around 3 percentage-points. Apart from the arrears, the rest of the residual remains unexplained.

During the second sub-period FY2005/06—FY2010/11, the government debt to GDP ratio *decreased* by 36 percentage-points cumulatively, and stabilized at about 80 percent of GDP, as the government implemented a fiscal consolidation program including a one-off fuel price adjustment (in FY2006/07), as well as tax reforms, altogether bringing down the primary deficit to an average of 2 percent of GDP (half its ratio in the previous period). This period also coincided with a growth spurt of 5.5 percent on average annually, and the exchange rate appreciated[14], thus containing the domestic value of the foreign currency debt due to the favorable (re)valuation effect. Interest payments remained rather high, but the inflation spike of 2008 (due to the international food crisis, as well as the global oil prices) has led to an overall negative real interest rate during this period.

Using the DSA tool, this 36 percentage-points cumulative decrease in the government debt to GDP ratio is explained by the uptick in economic growth, negative real interest rates and the exchange rate appreciation, which brought down the debt to GDP ratio by 32, 6, and 2 percentage-points, respectively. These favorable debt dynamics have over-compensated for the accumulation of the primary deficit to GDP ratio (15 percentage-points, cumulatively) during the same period. The balance (residual or stock-flow adjustment) during the second sub-period was estimated at -11 percentage-points. This may be partially attributed to the one-off privatization proceeds which were used to finance the budget deficit (in lieu of issuing debt), in addition to the domestic currency appreciation (revaluation) against other currencies.

The third sub-period FY20011/12—FY2016/17 saw an increase in the government debt to GDP ratio by 30 percentage-points, reaching a 12-year high of 108 percent of GDP in end-FY2016/17. This was driven by step devaluations in the exchange rate, which culminated with a large depreciation in November

[13] That is to say that the 9 percentage points are basically 11.5ppt from the primary balance + 7.5ppt from the depreciation + 2ppt from the real interest rate – 12ppt from real growth.

[14] The exchange rate appreciated by 14.5 percent, to LE5.3/US$ in end-FY2007/08, compared to LE6.2/US4 in end-FY2003/04.

2016.[15] The fiscal accounts also had deteriorated at the beginning of this time-period, with populist measures (such as increasing the civil servants' wage bill and converting temporary staff into permanent government employees, in addition to the sharp increases to the energy subsidy bill). This has led to a ballooning in the primary deficit, until it reached a peak of 5 percent of GDP in FY2012/13. However, starting FY2013/14, the government adopted measures to contain the wage bill as well as the energy subsidy bill and shifted the General Sales Tax into a modern Value Added Tax that expanded the tax base and raised the tax rate. The fiscal accounts have since started improving.

Using the DSA tool, this 30 percentage-point rise in the debt to GDP ratio can be explained as follows: The primary deficits during this period were responsible for a cumulative increase of 25 percentage-points. The episodes of exchange rate depreciation accounted for a 12 percentage-point increase in the debt-to-GDP ratio. On the other hand, real growth helped to partially ameliorate the debt-to-GDP trajectory by bringing the ratio down by around 17 percent cumulatively. The real interest rate had an overall neutral cumulative effect on the debt-to-GDP ratio between 2011/12 and 2016/17, as the bouts of positive real interest rates were counterbalanced with negative real interest rate episodes.

Similar to the previous two sub-periods, the balance (residual/stock-flow adjustment) is estimated at 10 percentage-points. The Ministry of Finance's data indicate that the "difference between the face value and present value of T-bills" has been responsible for around 1.5 percentage points increase in the debt-to-GDP, as it implied additional borrowing needs. The rest of the residual remains unexplained.

In 2016/17 alone, the government debt-to-GDP ratio is estimated to have increased by 5.9 percentage-points. The exchange rate depreciation alone was responsible for an 8 percentage-points increase in the debt-to-GDP ratio, followed by the primary deficit which was responsible for a 1.8 percentage-points increase. That is to say that the magnitude of increase in the government debt to GDP ratio because of the exchange rate depreciation of FY2016/17, was almost equivalent to the impact of the cumulative primary deficit to GDP ratio of three years (FY2014/15—FY2016/17). On the other hand, the real growth and the negative real interest rate (due to the spike in inflation) have helped contain the debt-to-GDP ratio by bringing it down by 3.4 percent and 3.2 percent, respectively.

In summary, the primary deficit stands out as the largest contributor to the increase in the government debt to GDP ratio, but only in the absence of the episodes of exchange rate depreciation. In fact, in the year of a depreciation (like FY2002/03 and FY2016/17), the exchange rate depreciation has been a much larger contributor to government debt accumulation.

On the other hand, the real GDP growth and the largely negative real interest rates have ameliorated the debt to GDP trajectory throughout the whole period under study (FY2001/02—FY2016/17).

While this is a useful exercise to quantify the impact of the debt dynamics variables on the debt to GDP ratio, it is rather mechanical. We attempt now to undertake a more rigorous approach towards understanding the drivers of government debt accumulation in Egypt, using a higher frequency dataset of quarterly observations.

[15] On November 3, 2016, Egypt's exchange rate depreciated from EGP8.88/US$ to EGP14/US$, and over-shot to EGP21/US$ in end-December 2016, and then appreciated slightly and remained stable at just below EGP18/US$ throughout calendar years 2017 and 2018.

IV.b. An Empirical Investigation into the Main Drivers of Debt Accumulation: A Structural Vector-Autoregression Model

The structural vector autoregression (SVAR) is conducted to model the joint behavior of the exchange rate, the real interest rate on the three-months treasury bill, the primary deficit, as well as the total debt level. The time series properties of the variables of interest are first investigated, using the Augmented Dickey-Fuller (ADF) test, and they are found to be I(1), with the exception of the primary deficit which is I(0). The results of the ADF test are deferred to Annex 2.

The exchange rate, real interest rate as well as the debt variables (i.e., the non-stationary series) enter the SVAR in their first differences, whereas the primary deficit enters in its 'level' (as it is already stationary). The exchange rate and debt are transformed to their natural logs, whereas the primary deficit and real interest rates are left without the log-transformation as they have negative values in some quarters.

In matrix notation, the SVAR is expressed as follows:

$$\mathbf{X_t = A(L)\ \varepsilon_t} \qquad \mathbf{(5)}$$

where X_t is the vector of endogenous variables included in the SVAR system = (ΔLog_Exchange_Rate, Primary_Def, ΔInterest, ΔLog_Debt)'.

A(L) is the matrix of structural vector-moving average coefficients. "L" is the polynomial lag operator. A(0) gives the contemporaneous effect of ε on X. And A(1) gives the long-run impact of ε on X.

And ε_t is the vector of uncorrelated structural shocks that have unit variances and zero covariances (i.e., $E(\varepsilon_t\varepsilon_t') = I$).[16] The exogenous structural shocks are defined as follows: An exchange rate shock, a primary deficit shock, an interest rate shock and a government debt shock.

This vector of structural shocks is a transformation of the reduced form errors, using identifying restrictions (details below) as well as an estimated structural matrix.

As the SVAR system includes 4 endogenous variables, it thus generates 16 impulse responses (that is, the response of each of the four variables to each of the four structural shocks). The full identification of the SVAR therefore requires information on these 16 impulse responses. Of these, 10 parameters are estimated from the reduced form VAR, while the remaining 6 impulse responses are identified through the imposition of long run (exclusion) restrictions. The details of the identification procedures are presented below.

[16] "I" here means *identity matrix*, where diagonal elements of the matrix are 1, and all other elements are zero.

The reduced form VAR is first estimated using quarterly data for the differenced log exchange rate, primary deficit, differenced real interest rate, and log differenced total government debt (see footnote for data sources and comments).[17] The VAR is run with one lag. See Annex 3 for the VAR lag selection.

The variance-covariance matrix of the error terms (denoted as Ω) is obtained from the reduced form VAR. Blanchard and Quah (1989) show that the matrix of contemporaneous structural responses A(0) could be obtained from Ω. Towards this end, they assumed that there is a matrix (that they denote "S") that is a "unique lower triangular Cholesky factor of Ω". A(0) would thus be an orthonormal transformation of "S", such that A(0)A(0)' = Ω.

In light of the assumption that the structural shocks (ε) are orthogonal and are normalized, Blanchard and Quah also show that A(0) is the restriction matrix that is used for two important procedures that are later used to calculate the fully-identified matrix of long run structural impulse responses. **In the first procedure**: A(0) is used for the linear transformation of the error term to obtain the structural shocks, as shown in equation 6 below. **In the second procedure**, A(0) is used to obtain the lag effects of the structural shocks on the four variables of the SVAR system, as shown in equation 7.

$$\boldsymbol{\varepsilon_t = A(0)^{-1} v_t} \qquad \textbf{(6)}$$

Where $\boldsymbol{v}$ is the vector of error terms obtained from the reduced form VAR, and $\boldsymbol{\varepsilon}$ is the structural shock.

$$\boldsymbol{A(j) = C(j)A(0)}, for\ all\ j \geq 1 \qquad \textbf{(7)}$$

Where $\boldsymbol{A(j)}$ represents subsequent lag effects of the structural shocks on the 4 variables, and $\boldsymbol{C(j)}$ is obtained from the reduced form VAR, and represents the coefficients on each of the 4 endogenous variables, due to shocks to themselves as well as shocks to the other 3 variables in the model.

Identification of the SVAR

The 4X4 matrix of long run structural impulses is identified as follows: 10 coefficients are obtained from the transformations done using equation 6 above. That is because these coefficients are estimated based on the 'S' matrix which is lower diagonal and thus provides 10 [=k(k+1)/2] unique parameters. These are the non-zero parameters shown in the matrix below (Equation 8).

There are thus 6 additional restrictions that are still needed to render the matrix of long run structural impulses fully-identified ['6' =k(k-1)/2]. The additional 6 identifying restrictions are "exclusion" restrictions that render A(1) a lower triangular fully-identified matrix *(i.e., by assuming zero long run impulse responses for the 6 remaining parameters of the matrix)*. It thus looks as follows:

[17] The exchange rate is the period average exchange rate, obtained from the International Financial Statistics (IFS). The period average is used in the SVAR model (instead of the end-of-period), because the latter was found to be I(2) which would have been more complicated to include (and interpret) in the SVAR. The real interest rate is calculated by the author as the nominal three-month treasury bill rate (obtained from the CBE) minus the inflation rate (obtained from the IFS). Total debt is the budget sector domestic debt plus the external government debt. The external government debt is multiplied by the end-of-period exchange rate in order to obtain its local currency value at the end of each quarter. As mentioned earlier in section III, the domestic debt is obtained from the Finance Ministry, while the external government debt is obtained from the CBE. The end-of-period exchange rate is from IFS.

$$A(1) = \begin{bmatrix} A(1)_{11} A(1)_{12} A(1)_{13} A(1)_{14} \\ A(1)_{21} A(1)_{22} A(1)_{23} A(1)_{24} \\ A(1)_{31} A(1)_{32} A(1)_{33} A(1)_{34} \\ A(1)_{41} A(1)_{42} A(1)_{43} A(1)_{44} \end{bmatrix} = \begin{bmatrix} A(1)_{11} & 0 & 0 & 0 \\ A(1)_{21} & A(1)_{22} & 0 & 0 \\ A(1)_{31} & A(1)_{32} & A(1)_{33} & 0 \\ A(1)_{41} & A(1)_{42} & A(1)_{43} & A(1)_{44} \end{bmatrix} \quad \textbf{(8)}$$

The elements of A(1) are explained as follows: $A(1)_{11}$ denotes the accumulated long-run impulse response of the differenced natural log of the exchange rate (which is equivalent to the exchange rate depreciation) to the exchange rate shock (ε_1). $A(1)_{12}$, $A(1)_{13}$ and $A(1)_{14}$ are the long-run impulse responses of the exchange rate depreciation to the primary deficit(ε_2), interest rate (ε_3) and debt shocks (ε_4), respectively. These are assumed to be zero. That is because the exchange rate has been largely "managed" (almost predetermined) throughout the period of study FY2005-FY2017 (with the exception of the November 2016 depreciation). Similarly, $A(1)_{21}$ and $A(1)_{22}$ are the long run impulse response of the primary deficit shock to the exchange rate shock, and the primary deficit shock, respectively. They are both non-zero as the primary deficit is believed to be affected permanently by its own shocks (ε_2) and by the exchange rate shock (ε_1)[18]. $A(1)_{23}$ and $A(1)_{24}$ are assumed to be zero, as the primary deficit is not expected to sustain a permanent impact due to interest rate shock[19] and debt shock, respectively. Also, $A(1)_{31}$, $A(1)_{32}$ and $A(1)_{33}$ are the long run impulse response of the real interest rate to the exchange rate shock, and the primary deficit shock, as well as the interest rate shock, respectively. They are non-zero, as the real interest rate is expected to be persistently impacted by an exchange rate shock,[20] and also through the exchange rate impact on inflation (which is part of the real interest rate calculation). $A(1)_{34}$ is zero, as the real interest rate is assumed to be impacted by the debt shock (ε_4) only temporarily, but not permanently (thus the zero long-run impulse response). That is because the interest payments in Egypt are predominantly on short term maturities, which means that a debt shock will impact interest rates on debt that mature in less than a year. Finally, $A(1)_{41}$, $A(1)_{42}$, $A(1)_{43}$, $A(1)_{44}$ are the long run impulse responses of the debt to all four shocks. They are assumed to be non-zero, as the exchange rate, primary deficit, real interest rate and the debt shocks are all expected to have a permanent impact on debt.

Structural Vector-Autoregression Impulse Responses

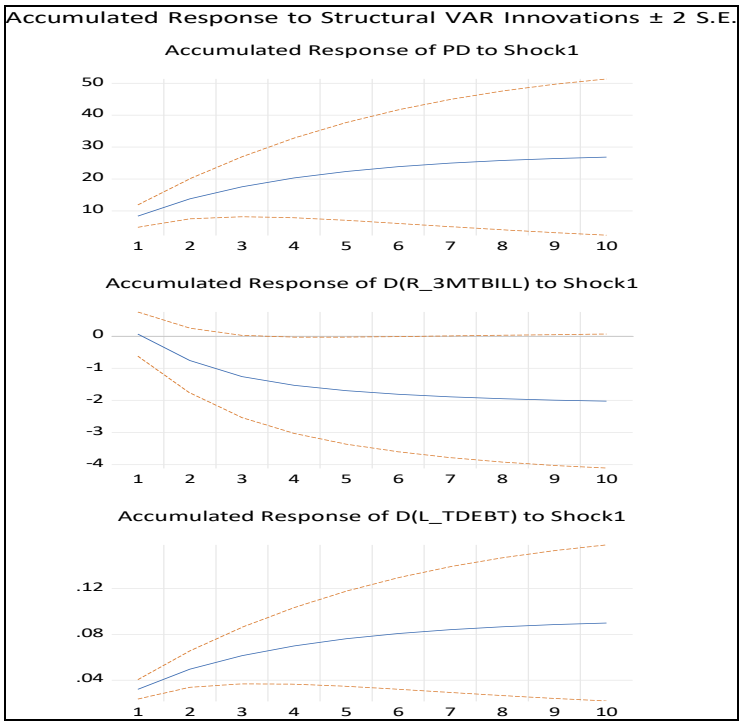
The SVAR estimation results and the full set of structural impulse responses are deferred to Annex 4. We single-out below the impulse responses that are most relevant to our analysis. Figure 8 shows that the exchange rate shock has a strong and statistically significant impact on all the other variables included in the model.

[18] The primary deficit is expected to be permanently affected by the exchange rate shock, due to the presence of foreign currency obligations in the budget (e.g. government imports on the expenditure side and customs revenues on the revenues side).

[19] The primary deficit excludes interest payments by definition (Primary balance = overall balance - interest payments), therefore, a higher interest rate is not expected to have a permanent effect on the primary deficit.

[20] Selim (2012) shows that interest rates "systematically react to changes in the exchange rate".

Figure 8: Structural Impulse Responses to a one standard deviation exchange rate shock



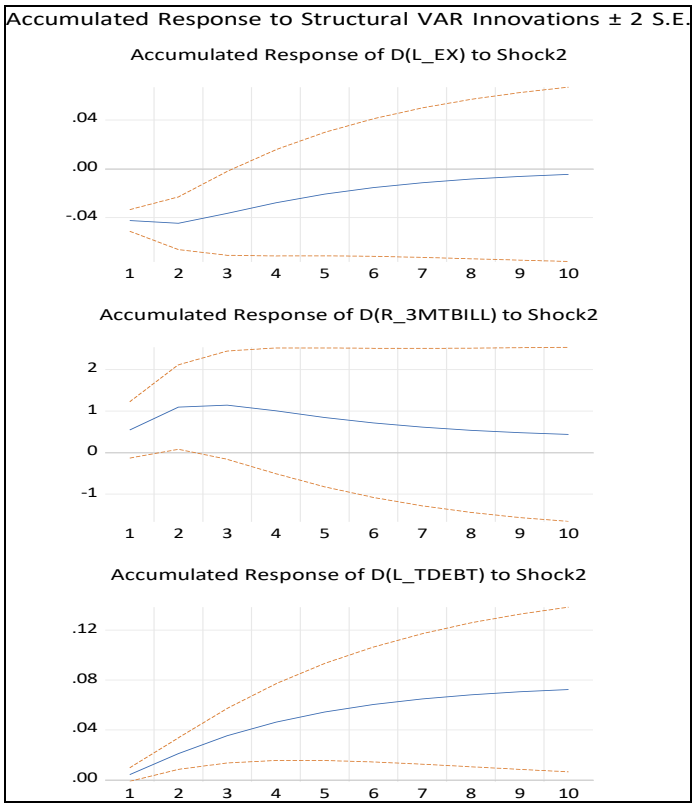
A one standard deviation shock to the exchange rate would lead to a rise in the level of the primary deficit (upper panel in figure 8), as well as in the pace of growth in total government debt (lower panel in figure 8). This, in fact, indicates that the exchange rate has a double impact on the government debt level, one through its effect on the primary deficit (and thus on the gross financing needs), and second on the growth in the debt level itself (due to the valuation effect). The exchange rate shock has a negative impact on the change in the real interest rate (middle panel in figure 8), possibly due to the inflationary impact associated with an exchange rate depreciation which may dilute any increases in the nominal interest rate.

The primary deficit also leads to an increase in the government debt growth. The impulse response function is increasing and is statistically significant throughout the 10 plotted quarters (lower panel in figure 9). The primary deficit shock also has a short-lived effect on the exchange rate depreciation, before that impact dies out towards the end of the 10 quarters (upper panel of figure 9). The impulse response is statistically significant only for the first three quarters. This indicates that a deterioration in the fiscal stance may lead to a transitory exchange rate depreciation. Finally, a primary deficit shock leads to an increase in the real interest rate (middle panel in figure 9). The impulse response is statistically significant only in the second quarter. The higher real interest rate associated with a primary deficit shock may be due to the increase in the budget financing needs, which thus leads to higher government debt issuance, and thus a higher implicit interest rate.[21]

[21] The implicit interest rate is defined as the interest payments in period 't' divided by the debt stock in period 't-1'.

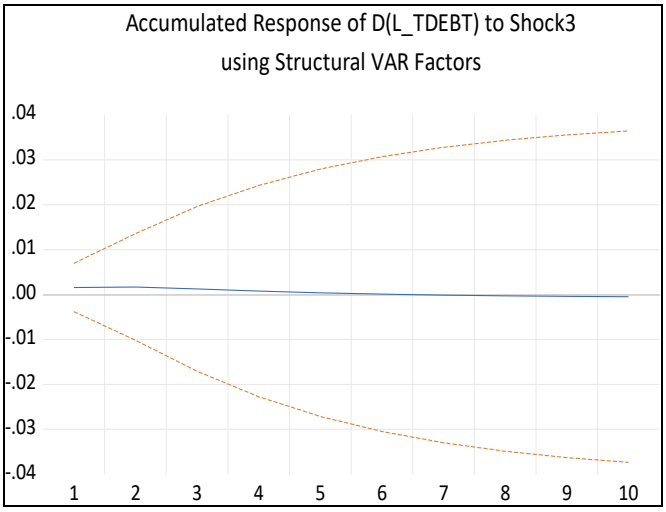
One important observation here is that the impulse response of debt to the exchange rate (lowest panel in figure 8) is almost equal in magnitude to the debt response to a primary deficit shock (lowest panel in figure 9).

Figure 9: Structural Impulse Responses to One Standard Deviation Primary Deficit Shock



On the contrary, the real interest rate shock does not seem to have a statistically significant impact on the government debt growth (Figure 10). This may be attributed to the fact that real interest rates in Egypt are often negative, and thus do not consistently contribute to the increase in government debt.

Figure 10: Structural Impulse Response of Debt to One Standard Deviation Interest Rate Shock



In summary, the structural impulse responses show that primary deficit as well as the nominal exchange rate are important determinants of total government debt in Egypt. They also show that the magnitude of response of government debt to an exchange rate shock is at par with that of a primary deficit shock.

SVAR Variance Decomposition: Evidence of a Depreciation-Deficit Spiral?

We complement the SVAR impulse response analysis with the forecast error variance decomposition. This helps us quantify the average contribution of each structural shock to the observed variability of the data (Kilian, 2011). In other words, the variance decomposition gives the relative importance of each structural shock as a contributor to the variability of each one of the SVAR model variables.

Table 1 below displays the variance decomposition of the exchange rate, due to the four structural shocks. The exchange rate variations are mostly explained by its own shock, but the primary balance also stands out as an important contributor to the variability of the exchange rate, accounting for just below a third of the observed variation in the exchange rate, on average, throughout the 10 quarters.

Table 1: Exchange rate Variance Decomposition

PERIOD	S.E.	**EX. RATE SHOCK**	**PRIMARY BALANCE SHOCK**	**INTEREST SHOCK**	**DEBT SHOCK**
1	0.07	65.14	33.24	0.02	1.60
2	0.08	69.30	29.23	0.07	1.41
3	0.08	69.48	29.04	0.07	1.40
4	0.08	68.99	29.52	0.07	1.42
5	0.08	68.61	29.90	0.07	1.43
6	0.08	68.38	30.11	0.07	1.43
7	0.08	68.26	30.24	0.07	1.44
8	0.08	68.19	30.30	0.07	1.44
9	0.08	68.15	30.34	0.07	1.44
10	0.08	68.13	30.36	0.07	1.44

We had seen earlier that the exchange rate shock sustains a permanent and statistically significant impact on the primary deficit (as shown in the impulse responses of figure 8 above). However, this analysis of the variance decomposition provides evidence that the primary deficit shock may be responsible for some of the variability of the exchange rate.

This analysis in this paper regarding the presence of a deficit-depreciation spiral is limited. The paper does not delve into the full process that generates this spiral: While the impact of the exchange rate depreciation on the fiscal accounts is clear (through the valuation effect), further analysis is needed to empirically test how the mechanism works in the other direction; that is, from the deficit to the depreciation. The author views this issue in the context of "fiscal dominance", where fiscal outcomes drive the decisions of the central bank. This manifests itself in the form of monetary financing of the deficit, which in turn, drives inflation, leading to a real exchange rate appreciation, which undermines competitiveness and ultimately leads to a depreciation, as the reserves are gradually depleted. This kind of analysis is beyond the scope of this research paper, and is thus an area for future research.

V. Conclusion, Key Findings and Policy Implications

Egypt's government debt has historically been very high. This paper applied a debt dynamics decomposition, using annual data for FY2001/02—FY2016/17, in order to disentangle the effect of the various drivers of the government debt to GDP ratio. Based on this analysis, the primary deficit stands out as the main contributor to the increases in the government debt to GDP ratio, followed by the adverse valuation effect stemming from the episodes of exchange rate depreciation. The real growth has had a favorable impact, as it helped to partially contain the rise in the debt to GDP ratio. The real interest rate has also had a favorable impact on debt accumulation, as real interest rates have been largely 'negative' during the period of study. This provides evidence that the government is, in part, "inflating the debt away". And it might also explain the predominance of short term maturities in Egypt's domestic debt, as customers would refrain from holding debt that they know might lose its 'real' value in the medium- to long-run. Importantly, the debt dynamics decomposition also discovered a 'stock-flow adjustment' residual; accounting for as much as a third of the increase in the debt to GDP ratio, in some periods. This residual may be just valuation effects that were not captured by the single bilateral exchange rate that was included in the debt dynamics model, but can also be 'below-the-line' items that contribute to debt accumulation and that are not identified.

This research paper also runs a Structural Vector Autoregression using quarterly data between FY2004/05—FY2016/17 for the following four variables: The exchange rate, primary deficit, real interest rate as well as the total government debt level. The structural impulse responses show that in the long run, the exchange rate depreciation has a similar impact on government debt accumulation, as that of the primary deficit. The recent uptick in foreign currency denominated debt thus creates further vulnerabilities for Egypt.

The variance decompositions estimated from the SVAR point to the possibility of a deficit-depreciation spiral, as the deficit shock is found to be a relatively important contributor to the variability of the exchange rate. The presence of a spiral can be viewed in the context of "fiscal dominance" which is beyond the scope of this paper, and thus can be an area for future research.

The policy implications that follow from this paper touch upon various crucial issues: First, the usual (unsurprising) recommendation of fiscal consolidation and boosting economic activity, in order to bring the debt to GDP downwards. Second, the foreign currency denominated debt needs to decrease and remain low. Third, bringing down the inflation rate, and gradually extending the maturity structure of domestic debt. Forth, institutional reforms that enhance fiscal transparency are critical to eliminate this unexplained "residual" that drives debt. Fourth, (related to the previous point): the proper accounting of government expenditures to enhance predictability; that is through minimizing the off-budget items that may cause a sudden and unexpected jump in financing needs. Fifth, the management of exchange rate policy in such a way that avoids the large and abrupt depreciations that result in large adverse valuation effects on total government debt.

References

Abbas, S, Nazim Belhocine, Asmaa El-Ganainy, and Mark Horton. 2011. "Historical Patterns and Dynamics of Public Debt—Evidence from a New Database". *IMF Economic Review*. Vol 59, No. 4

Abdel-Khalek, Gouda. 2000. "Domestic Public Debt Accumulation in Egypt: Magnitude, Structure and Consequences". In Abdel-Khalek, Gouda and Karima Korayem (eds.) *Fiscal Policy Measures in Egypt: Public Debt and Food Subsidy.* Cairo Papers in Social Science, Volume 23, Number 1, Cairo: AUC Press

Alba, Pedro, Sherine Al-Shawarby and Farrukh Iqbal. 2004. "Fiscal and Public Debt Sustainability In Egypt" *World Bank Working Paper Series* no. 38. Washington, DC: The World Bank.

Alnashar, Sara, Ibrahim Chowdhury, Lars Jessen, Sebastien Boitreaud and Hoda Youssef. 2017. Egypt's Government Debt: Structure, Recent Developments and Risks. World Bank Report. Mimeo.

Barro, R. 1979. "On the Determination of Public Debt". *Journal of Political Economy* 87(5): 940-971.

Budina, N. and N. Fiess. 2005. "Public Debt and its Determinants in Market Access Countries." Washington, D.C.: The World Bank.

Blanchard, Olivier Jean and Danny Quah. 1989. "The Dynamic Effects of Aggregate Demand and Supply Disturbances," *American Economic Review*, American Economic Association, vol. 79(4), pp. 655-673, September.

Central Bank of Egypt. *Monthly Statistical Bulletin.* Various Issues.

----------. *External Position of Egyptian Economy*. Various Issues.

----------. CBE online time series, available at: http://www.cbe.org.eg/en/EconomicResearch/Statistics/Pages/TimeSeries.aspx

Cottarelli and Escolano 2014. "Debt Dynamics and Fiscal Sustainability", in Cottarelli, Gerson and Senhadji (eds.) Post-crisis Fiscal Policy. Cambridge: MIT Press.

Easterly, Willian R. 2001. "Growth Implosions and Debt Explosions: Do Growth Slowdowns Cause Public Debt Crises," *Contributions to Macroeconomics*, Vol. 1, No. 1, Article 1, pp. 1–24.

Eichengreen, B.; Hausmann, R.; Panizza, U. 2007. "Currency Mismatches, Debt Intolerance and Original Sin: Why They Are Not the Same and Why it Matters". *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*. University of Chicago Press. pp. 121–170.

Escolano, J., 2010, "A Practical Guide to Public Debt Dynamics, Fiscal Sustainability, and Cyclical Adjustment of Budgetary Aggregates," *Technical Notes and Manuals*, Fiscal Affairs Department. Washington: International Monetary Fund.

International Monetary Fund. International Financial Statistics Online Database. Available at: http://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B

----------. Market Access Debt Sustainability Analysis. Available at: https://www.imf.org/external/pubs/ft/dsa/mac.htm

Jaimovich, Dany; Panizza, Ugo; Campos, Camil F.S. 2006. "The Unexplained Part of Public Debt", *Inter-American Development Bank Working Paper,* No. 554, Washington, DC: Inter-American Development Bank, Research Department.

Kilian, Lutz. 2011. "Structural Vector Autoregressions", *CEPR Discussion Paper* No. DP8515.

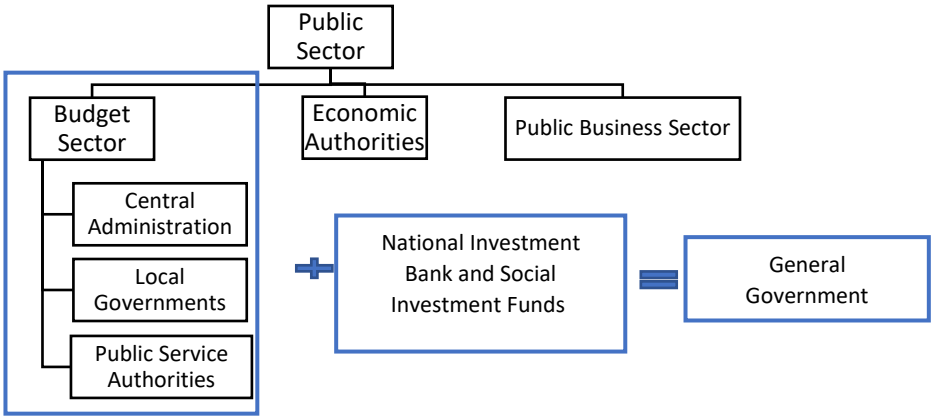
Ministry of Finance. *Financial Monthly.* Various Issues.

Nazier, Hanan and Mona Essam. 2012. "Empirical Investigation of Twin Deficits Hypothesis in Egypt (1992–2010)." *Middle Eastern Finance and Economics*, 17, 45–58.

ANNEX 1: DEFINITIONS OF THE BUDGET SECTOR, GENERAL GOVERNMENT AND PUBLIC SECTOR

The scope or definition of the government/public sector in Egypt could be grouped into three categories.[22] In ascending order of coverage/comprehensiveness, these are: The 'budget sector', the 'general government' and the 'public sector' (Figure A-1).

Figure A-1: The various levels of the public sector/government



The budget sector includes three entities: the central administration, the local governments and the public service authorities. The general government is a relatively wider definition of the government, and encompasses three entities under the budget sector in addition to the National Investment Bank (NIB) and the Social Insurance Funds (SIFs). Finally, the public sector includes the general government in addition to the economic authorities as well as the public business sector (State-Owned Enterprises).

According to the Ministry of Finance data on government debt, the gross domestic budget sector debt is that of the budget sector as described above. Similarly, the gross consolidated general government domestic debt represents the debt of general government as described above. However, gross consolidated public domestic debt is the debt of general government and economic authorities, but does not include the public business sector debt where state-owned enterprises (SOEs) fall. There are no data on the outstanding debt of SOEs.

In terms of magnitude, budget sector debt is by and large the highest, because general government debt accounts for (subtracts) the inter-debt that exists between the Budget Sector and the National Investment Bank and the Social Investment Funds. This debt includes Ministry of Finance securities held by both the NIB and SIF as well as SIF bonds.[23] Economic Authorities debt has on average made up 7.6 percent of gross consolidated public domestic debt over the period from FY12 to FY16 and averaged 5.9 percent of GDP over the same period. The National Investment Bank debt on the other hand has averaged 12.9 percent of gross consolidated public domestic debt and 10 percent of GDP from FY12 to FY16.

[22] This annex draws on Alnashar, Chowdhury, Jessen, Boitreaud and Youssef (2017), with thanks to Rana Fayez (World Bank Consultant, at the time) for preparing Figure A-1 and contributing to this annex.

[23] For example, in FY12, gross domestic budget sector debt was recorded at EGP1,155 billion (69 percent of GDP) while gross consolidated general government domestic debt was at EGP1,081 billion (64.6 percent of GDP) and gross consolidated public domestic debt was at EGP1,122 billion (67 percent of GDP), in FY16 the figures recorded were EGP2,573 billion (95 percent of GDP), EGP2,411 (89 percent of GDP) and EGP 2,481 billion (91.6 percent of GDP) respectively.

ANNEX 2: AUGMENTED DICKEY-FULLER TEST RESULTS

The times series properties of the four variables that are included in the SVAR estimation are investigated using the Augmented Dickey-Fuller test. The results are presented in table A-1 below. The null hypothesis is "variable has a unit root". The variable is deemed stationary when the null hypothesis is rejected.

Table A-1: Augmented Dickey-Fuller Test Results.

Series tested for stationarity	Time period	ADF test details	ADF test statistic	MacKinnon one-sided p-value associated with t-statistic of the ADF test	ADF test details	ADF test statistic	MacKinnon one-sided p-values associated with t-statistic of the ADF test
		Variable in Levels			Variable in First Difference		
Log Exchange Rate (period average)	2005Q1 – 2017Q4	Constant, 0 lags	3.33	1.00	Constant, 0 lags	-4.96	0.00***
Log Total Government Debt	2005Q1 – 2017Q4	Constant, 0 lags	2.61	1.00	Constant, 0 lags	-6.94	0.00***
Primary Deficit	2005Q1 – 2017Q4	Constant, 0 lags	-5.27	0.0001***			
Real 3-month T-Bill Rate	2005Q1 – 2017Q4	Constant, 1 lag	-2.44	0.14	Constant, 0 lags	-5.54	0.00***

*** Significant at the 1% level.

Note: Lag selection in ADF test is generated in EViews automatically, based on the Schwartz Information Criterion (SIC).

The results of the above ADF test show that the exchange rate, the total debt and the real interest rate are stationary after taking their first differences, and the primary deficit is stationary in its level.

ANNEX 3: SVAR ORDER SELECTION AND IMPULSE RESPONSES

This annex is divided into three parts: First, we present the lag selection criteria, and second, the Impulse Responses generated from the SVAR.

First: VAR lag selection

Table A-2: VAR Lag Order Selection Criteria

Endogenous variables: L_EX PD R_3MTBILL L_TDEBT
Exogenous variables:
Date: 12/01/18 Time: 12:35
Sample: 2005Q1 2017Q4
Included observations: 48

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-117.2204	NA	0.003030*	5.550850*	6.174584*	5.786560*
2	-106.1802	18.40035	0.003767	5.757508	7.004976	6.228928
3	-95.28761	16.33888	0.004806	5.970317	7.841518	6.677447
4	-84.85192	13.91425	0.006452	6.202164	8.697098	7.145003

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Based on the FPE, AIC, SC and HQ criteria, one lag is selected for the VAR estimation.

Second: The SVAR Impulse Responses