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Is Egypt on a Sustainable Path of Debt Repayment: Evidence from IMF Framework and Fiscal Reaction Function

Maha Rashied
maharashied96@aucegypt.edu

The American University in Cairo
School of Business

Is Egypt on a Sustainable Path of Debt Repayment: Evidence from IMF Framework and Fiscal Reaction Function

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ABSTRACT

Fiscal policy is the starting point for an economy to achieve solid economic and social objectives through macroeconomic stability. Risks associated with excessive borrowing and the required fiscal adjustments are threatening especially to developing countries whose debt to GDP ratios are on the rise. Those countries' fiscal policies' sustainability is questioned; hence this research aims at testing for Egypt public debt sustainability and assessing the method capitalized on by the Egyptian authorities; the IMF Approach. By comparing the IMF Debt Sustainability Analysis Approach to the fiscal reaction function with ARDL and VAR as estimation methods, the results of both methods indicate weak sustainability of the public debt. However, the basis on which the conclusion is built differ tremendously. Areas where the IMF Framework exercises several limitations are also highlighted and critiqued. This thesis uses quarterly time-series data set from Q3-2005 to Q2-2020 in evaluating the government's reaction to public debt accumulation. The policy implications of the thesis point out to the importance of the necessary departure from the IMF Approach as the only tool that judges Egypt public debt sustainability and the need to integrate other measures as it juxtaposes the concerns needed to be taken care of. Calls for fiscal transparency and governance, as well as public expenditure reforms are also required.

Keywords: Sustainability, General Government Budget, Political Economy, Fiscal Policy

JEL Classification Codes: E62, H62, H63, F34

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION 1

CHAPTER 2 LITERATURE REVIEW 3

2.1 RECENT TRENDS IN GLOBAL PUBLIC DEBT 3
2.1.1 A 'FRESH START' TO THE HIPCS & EMDCS 5
2.1.2 WHERE DEBT HAS GONE? 6
2.1.3 COVID-19 DRIVES DEBT SURGE 7
2.2 LIMITATIONS TO ASSESSING DEBT SUSTAINABILITY 9
2.3 IMF DEBT SUSTAINABILITY ANALYSIS FRAMEWORK FOR MARKET-ACCESS COUNTRIES (MAC) 10
2.3.1 A STANDARDIZED APPROACH 10
2.3.2 BENCHMARKS IN MAC DSA 11
2.3.3 STEPS TOWARDS DSA ASSESSMENT 12
2.3.4 SHORTCOMINGS OF THE IMF DSA FRAMEWORK 13
2.4 OTHER APPROACHES TO MEASURING DEBT SUSTAINABILITY 15
2.4.1 VALUE AT RISK AND STRESS TESTS 15
2.4.2 DEBT-STABILIZING PRIMARY BALANCE 16
2.4.3 REACTION FUNCTIONS 18
2.5 EMPIRICAL EVIDENCE AND CLASSICAL METHODS OF INVESTIGATION 19
2.5.1 STATIONARITY 19
2.5.2 COINTEGRATION 21
2.5.3 FISCAL REACTION FUNCTION 23
2.6 PUBLIC DEBT AND MACROECONOMIC VARIABLES DYNAMICS 25
2.6.1 ECONOMIC GROWTH 25
2.6.2 INFLATION 28
2.6.3 INTEREST RATES 30
2.6.4 EXCHANGE RATE 33
2.6.5 PRIMARY BALANCE 34
2.7 EXTERNAL & DOMESTIC DEBT: SUBSTITUTES OR COMPLEMENTS? 36
2.8 GLOBAL PARTISAN POLITICS AND PUBLIC DEBT-TRAP DIPLOMACY 37
2.8.1 POLITICAL ECONOMY & DEBT RELIEF 37
2.8.2 FINANCING THAT DRIVES DEBT DISTRESS 38

CHAPTER 3 STYLIZED FACTS ABOUT THE EGYPTIAN ECONOMY 39

3.1 EGYPT'S RELATION WITH THE INTERNATIONAL FINANCIAL INSTITUTIONS 40
3.1.1 THE BREAD RIOTS AND THE PUBLIC RESISTANCE 40
3.1.2 PARIS CLUB I 41
3.1.3 PARIS CLUB II AND THE ERSAP 42
3.2 THE POLITICAL ECONOMY OF THE EGYPTIAN PUBLIC DEBT (2011 – 2017) 43
3.2.1 TRANSPARENCY VS DISCRETIONARY FISCAL POLICIES 44
3.2.2 EGYPT'S 2016 IMF-SUPPORTED REFORM PROGRAM 46
3.3 RECENT GENERAL OVERVIEW 48
3.3.1 STRUCTURAL FISCAL POSITION 52
3.4 EMPIRICAL STUDIES ON EGYPT 54

CHAPTER 4 DIFFERENT METHODOLOGIES FOR MEASURING SUSTAINABILITY 55

4.1 IMF APPROACH TO MEASURING PUBLIC DEBT SUSTAINABILITY 55
4.2 ECONOMETRICS METHODOLOGY DATA 58
4.2.1 DEFINITION OF THE GENERAL GOVERNMENT AND THE PUBLIC SECTOR 58
4.2.2 DEPENDENT AND EXPLANATORY VARIABLES 59
4.3 STATIONARITY TESTS 61
4.4 AUTOREGRESSIVE DISTRIBUTED LAG MODEL 61
4.5 VECTOR AUTOREGRESSION MODEL 63

CHAPTER 5 EMPLOYING THE IMF APPROACH TO MEASURE EGYPT PUBLIC DEBT SUSTAINABILITY 64

5.1 DATA SUPPLIED TO THE MAC TEMPLATE 64
5.2 RESULTS OF THE IMF APPROACH 66
5.2.1 CONSTRUCTING THE BASELINE SCENARIO 66
5.2.2 FORECASTED COMPOSITION OF THE PUBLIC DEBT 68
5.2.3 DEALING WITH UNCERTAINTY: ALTERNATIVE SCENARIOS 68
5.2.4 REALISM OF THE BASELINE ASSUMPTIONS 69
5.2.5 THE BOOM-BUST TOOL 71
5.2.6 STANDARDIZED AND CUSTOMIZED MACROECONOMIC SHOCKS 72
5.2.7 RISK ASSESSMENT 75

CHAPTER 6 EMPIRICAL RESULTS OF THE FISCAL REACTION FUNCTION 80

6.1 UNIT ROOT TESTS 80
6.2 ARDL MODEL ESTIMATION RESULTS 81
6.3 VAR MODEL ESTIMATION RESULTS 86
6.3.1 CORRELATION MATRIX AND GRANGER CAUSALITY TESTS 90
6.3.2 VARIANCE DECOMPOSITION AND IMPULSE RESPONSE 92

CHAPTER 7 CONCLUSION AND POLICY IMPLICATIONS 94

7.1 COMPARISON OF APPROACHES 94
7.2 LIMITATIONS AND FUTURE RESEARCH 96
7.3 POLICY IMPLICATIONS 96

REFERENCES 118

LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
ARDL	Autoregressive Distributed Lag
CAPB	Cyclically-Adjusted Primary Balance
CAPMAS	Central Agency for Public Mobilization and Statistics
CBE	Central Bank of Egypt
CPI	Consumer Price Index
CPIA	Country Policy and Institutional Assessment
cVaR/VaR	(Conditional) Value at Risk
DSA	Debt Sustainability Analysis
DSGE	Dynamic Stochastic General Equilibrium
ECM	Error Correction Model
EFF	Extended Fund Facility
EGP	Egyptian Pound
EMBIG	Emerging Market Bond Index Global
EMDCs	Emerging Markets and Developing Countries
ERSAP	Economic Reform and Structural Adjustment Program
EU	European Union
FM	Fiscal Monitor
FY	Fiscal Year
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
HIPCs	Heavily Indebted Poor Countries
HP	Hodrick-Prescott
IGBC	Intertemporal Government Budget Constraint
ILO	International Labour Organization
IMF	International Monetary Fund
IRGD	Interest Rate-Growth Differential
LC	Local Currency
LICs	Low Income Countries
LM	Lagrange Multiplier
MAC	Market Access Countries
MBS	Model-Based Sustainability
MENA	Middle East and North Africa
NIB	National Investment Bank
OECD	Organisation for Economic Cooperation and Development
PP	Phillips-Perron
PVC	Present Value Constraint
SAR	Special Administrative Region
SC/SIC	Schwarz (Information) Criterion
SIFs	Social Insurance Funds
SSA	Sub-Saharan African
UK	United Kingdom
US/USD	United States (Dollar)
VAR	Vector Autoregression
VAT	Value Added Tax
VECM	Vector Error Correction Model
WEO	World Economic Outlook

LIST OF FIGURES

FIGURE 1: HISTORICAL TREND OF PUBLIC DEBT IN ADVANCED AND EMERGING ECONOMIES: 1880-2021 4
FIGURE 2: FISCAL MEASURES IN RESPONSE TO THE COVID-19 PANDEMIC 7
FIGURE 3: FORECASTS FOR GENERAL GOVERNMENT GROSS DEBT AND FISCAL BALANCES, 2020 (PERCENT OF GDP) 8
FIGURE 4: NUMBER OF COUNTRIES IN RECESSION: IMF FORECAST COMPARED TO ACTUAL 13
FIGURE 5: DEMAND AND SUPPLY FRAMEWORK AVERAGE MATURITY AND LONG INTEREST RATE 32
FIGURE 6: STOCK OF TOTAL PUBLIC DEBT IN BILLIONS OF EGP: 2009-2020 44
FIGURE 7: EGYPT'S OPEN BUDGET INDEX SCORE 44
FIGURE 8: EGYPT HAS THE HIGHEST REAL INTEREST RATE IN THE WORLD: MARCH 2021 48
FIGURE 9: EGYPT YIELD CURVE: 19 APRIL 2021 49
FIGURE 10: HISTORICAL VALUES OF EGYPT'S PUBLIC DEBT TO GDP AND 5-YEAR FORECAST 50
FIGURE 11: EGYPT'S INTEREST PAYMENTS AS % OF GOVERNMENT REVENUES 51
FIGURE 12: TAX REVENUES AS A PERCENT OF PUBLIC DEBT AND NOMINAL GDP 53
FIGURE 13: GOVERNMENT'S SHARE OF GDP ON THE DECLINE: GOVERNMENT SPENDING AND REVENUE 54
FIGURE 14: DEBT-CREATING FLOWS (IN PERCENT OF GDP) 66
FIGURE 15: DEBT-CREATING FLOWS: CUMULATIVE 67
FIGURE 16: COMPOSITION OF PUBLIC DEBT BY MATURITY (LEFT) AND BY CURRENCY (RIGHT) 68
FIGURE 17: ALTERNATIVE SCENARIOS: GROSS NOMINAL PUBLIC DEBT (IN PERCENT OF GDP) (LEFT) AND PUBLIC GROSS FINANCING NEEDS (IN PERCENT OF GDP) (RIGHT) 69
FIGURE 18: ASSESSING THE REALISM OF PROJECTED FISCAL ADJUSTMENT 70
FIGURE 19: BOOM-BUST ANALYSIS 71
FIGURE 20: MACRO-FISCAL STRESS TESTS 73
FIGURE 21: ADDITIONAL STRESS TESTS 74
FIGURE 22: HEAT MAP 76
FIGURE 23: EVOLUTION OF PREDICTIVE DENSITIES OF GROSS NOMINAL PUBLIC DEBT (A) SYMMETRIC DISTRIBUTION AND (B) RESTRICTED ASYMMETRIC DISTRIBUTION 77
FIGURE 24: DEBT PROFILE VULNERABILITIES 78
FIGURE 25: RESIDUALS 83
FIGURE 26: COINTEGRATION GRAPH 86
FIGURE 27: INVERSE ROOTS OF AR CHARACTERISTIC POLYNOMIAL 87
FIGURE 28: VAR RESIDUALS 88
FIGURE 29: HISTORICAL DECOMPOSITION USING CHOLESKY (D.F. ADJUSTED) WEIGHTS: DECOMPOSITION OF PRIM_BAL 92

LIST OF TABLES

TABLE 1: PREREQUISITES OF THE IMF PROGRAM IN 2016 47

TABLE 2: AUGMENTED DICKEY FULLER (ADF) UNIT ROOT TEST 81

TABLE 3: PHILLIPS PERRON (PP) UNIT ROOT TEST 81

TABLE 4: ARDL MODEL ESTIMATION RESULTS 82

TABLE 5: PARAMETER ESTIMATES OF THE LONG RUN COINTEGRATING RELATIONSHIP 83

TABLE 6: ERROR CORRECTION MODEL (ECM) REGRESSION 84

TABLE 7: VAR COINTEGRATION JOHANSEN TEST 89

TABLE 8: COINTEGRATING EQUATION 89

TABLE 9: CORRELATION MATRIX 91

TABLE 10: GRANGER CAUSALITY: DEPENDENT VARIABLE PRIM_BAL 91

TABLE 11: VARIANCE DECOMPOSITION OF PRIMARY BALANCE 93

TABLE 12: VARIANCE DECOMPOSITION OF PUBLIC DEBT 93

Chapter 1 Introduction

Public debts are high and rising; leaving the entire world worrying of the unpremeditated consequences of accumulation of debt that may provoke a sovereign debt crisis. Since 1923, when the concept of sound finance was brought into discussion for the first time, by John Keynes, many economists have tried to investigate the issue of public debt sustainability. The concept of public debt sustainability has been scrupulously studied in the recent decades, in the fear of the grievous consequences that might arise from the misuse of the public borrowing. This has been further invigorated in the wake of the recent global recession that was sparked from the collapse of Lehman Brothers in 2008. There has been a perceptible increase in the size of governments and hence in the government expenditure, leaving many developing countries at high risk with regard to their fiscal sustainability.

During recessions, private spending is discouraged given the high uncertainty, and thus demand is weakened. Governments resort to expansionary fiscal policies in order to manage the inadequate demand. However, the massive public debt may very well restrain the government's ability to run expansionary policies. It has been evident that the high public debt prompts deleveraging by the private sector in the aftermath of a crisis; aggravating and extending the periods of recession (Guzman, Ocampo, & Stiglitz, 2016). The International Monetary Fund and other similar programs providing temporary assistance do not resolve the issue, in fact the problem may aggravate had the assistance been, and it will most likely be, accompanied by imposed austerity measures; worsening the debtor's economic situation. Consequently, interest has been revived in studying governments' response to the debt accumulation dynamic. Attention has been specifically dedicated to: (1) attempting to assist in theoretically and empirically proving the existence, sign, and size of response, and (2) studying the nature of governments' reaction to debt accumulation in terms of sustainability.

Repeatedly, public debt sustainability has been defined as a situation in which a borrower is expected to be able to continue serving its debts without an unrealistically large fiscal correction to the balance of income and expenditure. However, the modern literature lacks a coherent definition for public debt sustainability. The academic

perspective implies that debt is sustainable when the intertemporal solvency condition is satisfied, that is when the expected present value of future primary balances covers the prevailing stock of debt. Countries with high debt and deficits are solvent under this condition, as long as primary surpluses are expected anytime in the future. Despite the fact that this academic perspective furnishes a formula for debt sustainability, this condition hinges on assumptions about unobservable information and forecasting the future. In practice, what matters is the ratio of debt relative to a measure of capacity to repay instead of the level of debt per se (Debrun, Ostry, Willems, & Wyplosz, 2019).

According to the IMF, and in order to cope with the aforementioned constraints, the pragmatically accepted definition of debt sustainability relies on stable or declining projected debt ratios, provided also being sufficiently low. Therefore, it requires both; the government's ability and willingness to repay its debt. Sufficiently low implies that a declining debt ratio that remains high would still be considered unsustainable had it been associated with a high risk of default. Economies are also always subject to shocks; making a borderline debt ratio considered unsustainable. Furthermore, it is necessary to stress that there is neither a universally accepted definition nor a quantitative limit that sets the sustainability of debt. There are several adverse long-term economic consequences to high levels of public debt, including an increase in interest rates, expected distortionary taxation, and the impracticability of maintaining monetary policy independence. Evaluating the size of public debt that a particular economy may reach relies on whether it is probable to accept a higher debt-to-GDP ratio when an economy is growing rapidly and thus is expecting that future receipts will be able to repay the debt faster, or a higher ratio will in fact hamper the economy.

This research aims to answer one main question and contemplate the following sub-questions:

Assess the sustainability of the public debt of Egypt by employing different approaches and compare their results

- Evaluate thoroughly the accuracy of the IMF Approach to measuring debt sustainability

- Examine extensively the shortcomings of the IMF Approach and their inapplicability to Egypt
- Employ other approaches rather than the IMF's in order to judge Egypt public debt sustainability
- Compare results of different approaches and the variation in their results (if any)
- Furnish appropriate policy recommendations to ensure the downward trajectory of debt ratios

In light of the above, the presence of an accurate framework enabling an economy to judge its debt sustainability objectively and precisely is paramount. This research challenges the conventional widely-used IMF Debt Sustainability Analysis (DSA) Framework on several profound aspects. Through focusing on Egypt's debt sustainability, the IMF DSA Framework will be compared to employing an autoregressive distributed lag (ARDL) and vector autoregression (VAR) attempting to judge sustainability through the fiscal reaction function.

The rest of the research will be organized as follows: Chapter 2 focuses on the trends in global public debt and reports the conceptual and empirical literature on debt sustainability and debt dynamics, particularly focusing on the IMF DSA Framework critique. Chapter 3 presents stylized facts about the Egyptian economy and the history of debt and debt relief in the past few decades. Chapter 4 outlines the data used and the econometric methodology adopted. Chapter 5 sets forth the IMF approach to measuring public debt sustainability. Chapter 6 indicates the empirical results of the ARDL and VAR models, including unit root tests and estimation results. Lastly, Chapter 7 concludes with the discussion and recommendations for policymakers.

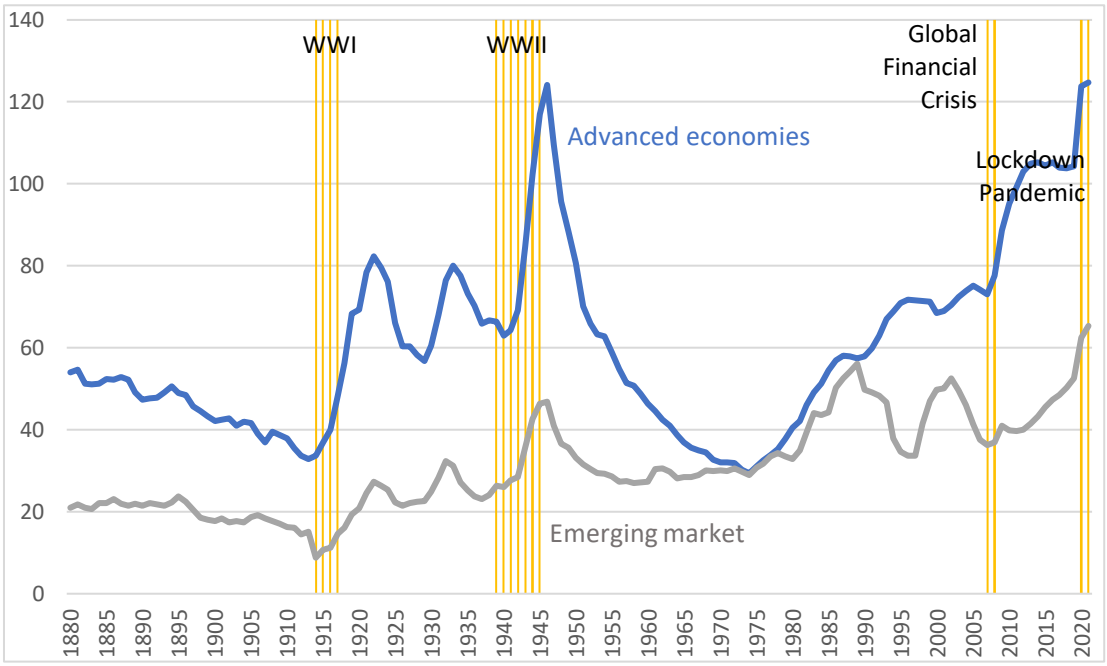
Chapter 2 Literature Review

2.1 Recent Trends in Global Public Debt

It is apparent that debt ratios escalate in response to shocks. Figure 1 shows the trend of global public debt since the 1880s. During the Second World War, public spending

increased significantly raising debt ratios to unprecedented levels, where advanced nations peaked to 120% of GDP and the global debt recorded 150% of GDP (Veseth, 1991). This is considered the largest spike in debt-to-GDP ratios that is currently about to be topped due to the COVID-19 pandemic. Towards the end of the financial crisis in the earlier 2000s, debt-to-GDP ratio has already exceeded that of the Great Depression. As a result of an extended period of growth, debt ratios eased after World War II, but as growth slowed and governments became continuously pressured particularly due to the increased cost dedicated to aging population through health care and pensions, advanced economy debt has been on unceasing rise (Abbas, Belhocine, El-Ganainy, & Horton, 2011).

Figure 1: Historical Trend of Public Debt in Advanced and Emerging Economies: 1880-2021



[1] Sources: IMF, Historical Public Debt Database; IMF, World Economic Outlook database; Maddison Database Project; and IMF staff calculations.

Public debt ratios of emerging markets and developing countries (EMDCs) have remained below 60% of GDP in the past forty years at least, making the recent trend in public indebtedness promising. However, EMDCs exhibit higher volatility responding

[1] Note: The aggregate public-debt-to-GDP series for advanced economies and emerging market economies is based on a constant sample of 25 and 27 countries, respectively, weighted by GDP in purchasing power parity terms.

to shocks and crises, evident during the Latin American debt crisis and the Asian financial crisis, as they borrow heavily and frequently at higher interest rates compared to advanced economies. The decent debt ratios in EMDCs have been remarkably driven by the declining debt ratios of low-income countries (LICs); a subset of the EMDCs, attributed to (1) strong growth, (2) better institutions and policies, and (3) debt relief programs conducted by their major creditors under the heavily indebted poor countries (HIPCs) initiative in 1996. EMDCs recorded an average growth rate that quadrupled that of advanced economies in the period 2004-2014, 6.13% vis-à-vis 1.45% respectively.

With developing countries progressively tapping foreign financial markets in order to finance their development needs, an improved access to external financing is now guaranteed (Guzman, Ocampo, & Stiglitz, 2016). This has been an indispensable ingredient contributing to the high growth rates. However, facing new sovereign and private creditors is yet introducing further risks to the debtor's economy. It is crucial to understand the new sources of risk, stemming from the exposure to new markets, that could potentially impose further uncertainties to the debt management policies and accordingly implement the appropriate fiscal rules to strengthen sovereign debt resolution.

2.1.1 A 'Fresh Start' to the HIPCs & EMDCs

Distressed debtors were in need of means for a fresh start in order to sustain a viable market economy. Massive inefficiencies may result had this opportunity not been provided to both debtors and creditors economies. The concept of domestic bankruptcy law is widely acknowledged whereas sovereign debts are not governed by similar international bankruptcy constitution. This is currently one of the increasingly discussed topics and the heart of global debate in debt sustainability; requiring the existence of "Sovereign Debt Restructuring Framework".

Since the late 1980s, debt relief measures have been advantageous to developing countries, and specifically low middle-income countries, either through rescheduling interest payments or partial/total forgiveness (Vaggi & Prizzon, 2014). The global crisis has worsened the situation and the extensive government intervention

in numerous countries has been encouraging a fast-growing unsustainable public debt which revitalized the interest of practitioners, policymakers, and academics in the inclement effects of a large public debt (Presbitero, 2012). Governments try to deal with the recessionary period through introducing counter cyclical fiscal policies to their economies, which increased the budget deficits and aggravated the debt sustainability indicators (Mahmood & Rauf, 2012).

However, a one-time debt relief, also known as 'haircut', has been accused of worsening the well-being of both the debtor and the creditor. This argument has been built on the fact that the financial markets tend to have a long-term memory, and keep introducing higher risk premiums to interest rates provided to those countries, remembering they had once defaulted or at least were on the verge of defaulting. Haircuts may cost the economy macroeconomic consequences that are inferior to the initial scenario without a debt relief. Following a first haircut, it is extremely likely that further debt reliefs will be required (Blueschke, Neck, & Wittmann, 2020).

2.1.2 Where Debt Has Gone?

Indebted countries may capture rival opinions regarding the favored megaprojects financed by the debt. The citizens of the debtor's country barely benefitted from the loans contracted by their governments as a sizable portion of the borrowed sums are in fact embezzled by authoritarian corrupt regimes. An example to that would be Zaire's three-decade president, Mobutu Sese Seko, who left a fortune valued at $8 billion; almost 70% of his country's debt through skimming off commissions for oneself. Haiti and the Duvallier family, and Argentine and Péron present other cases in point. Those junta's wealth and their entourage grew as fast as their country's debt did (Toussaint & Millet, 2010).

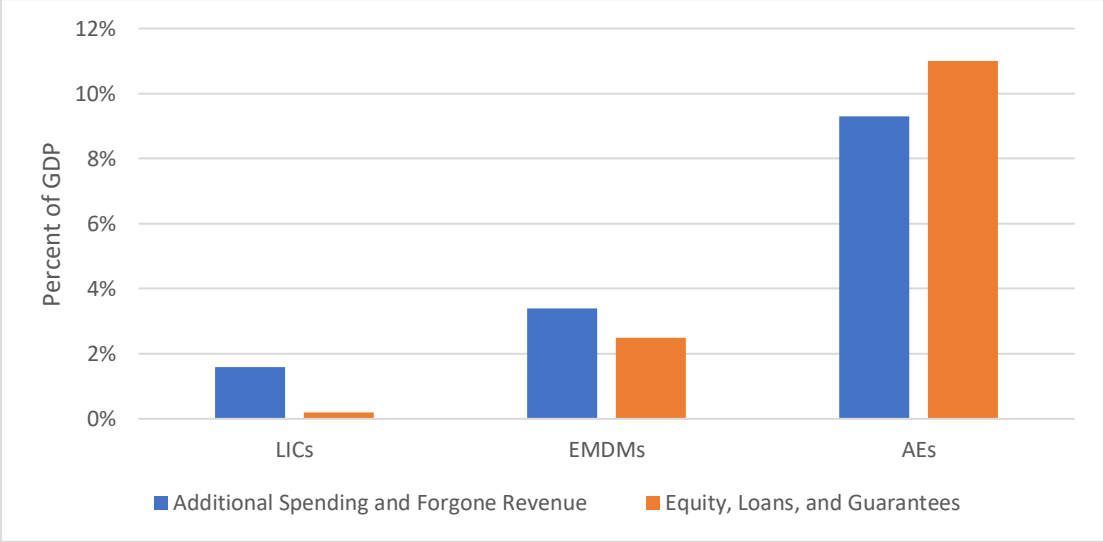
The money that successfully made its way to the economy has been used to finance the 'white elephants'; the massive infrastructure and energy projects that did not aim at improving the citizens' lives as much as it paved its way to transport the natural resources extracted at the cheapest cost to the international markets. Tarbela in Pakistan, Kariba between Zambia and Zimbabwe, Nam Theun in Laos, and many more are valid examples. In addition to financing the white elephants, the borrowed sums

may often act as a tied aid; a lumpsum of money that is constrained with the command to use it to buy manufactured goods from the creditor's economy whilst being inadequate and expensive. Lastly, indebtedness may also be the result of purchasing weapons and military equipment, allowing dictators to maintain a firm grip over their oppressed citizens. However, commenting on the military spending is not well demonstrated since government budgets do not reflect the actual spending directed to the military, and the actual military budget is undetectable in the general budget.

2.1.3 COVID-19 Drives Debt Surge

As the pandemic broke out, both public and private debt ratios increased significantly and particularly in EMDCs and the most indebted countries. Vacant hotels, plunging demand, and millions of suddenly unemployed workers urged an exceptional fiscal stimulus as evident in Figure 2 to bridge the chasm created with the lockdowns towards a much-needed recovery.

Figure 2: Fiscal Measures in Response to the COVID-19 Pandemic



[2] Source: IMF and the World Bank

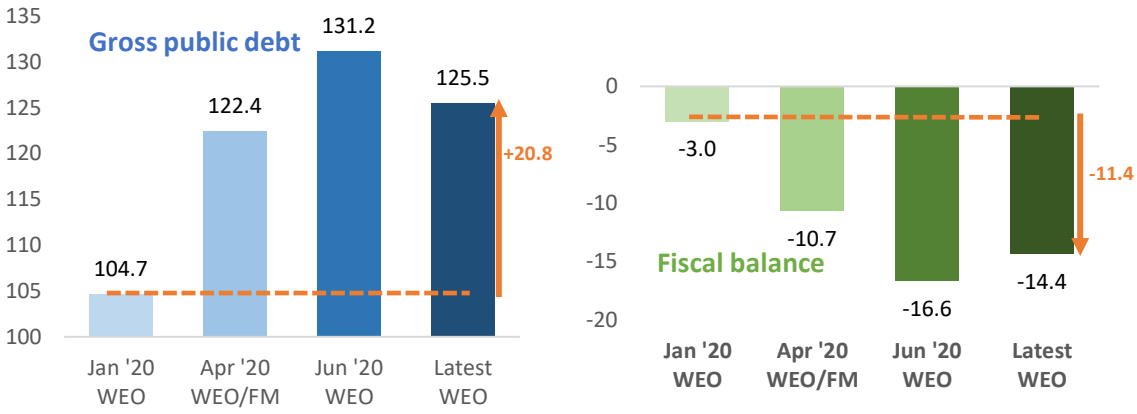
Today, and almost a year after combating the pandemic, the world has never been more indebted. Offsetting the economic ramifications caused by the pandemic

[2] Data are as of June 12, 2020. Country groups are weighted by GDP in purchasing power parity-adjusted current U.S. dollars. Revenue and spending measures exclude deferred taxes and advance payments.

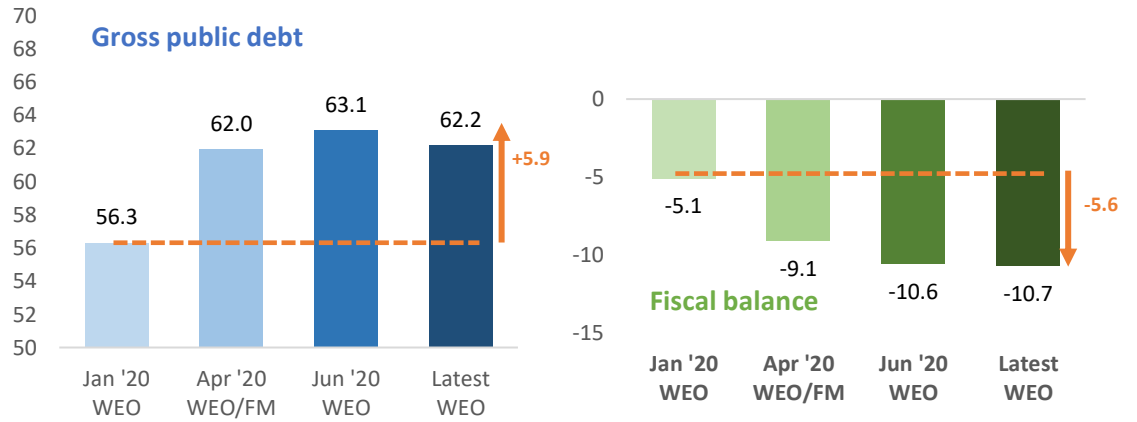
had cost the national economies $24 trillion last year, ushering the global debt to an all-time high of $281 trillion by December 2020. Debt to GDP recorded 432% and 248% in advanced economies and EMDCs respectively. Figure 3 shows the ongoing changes resulted from the pandemic based on the forecasts of gross public debt and fiscal balance in advanced economies, emerging and middle-income economies, and low-income developing countries.

Figure 3: Forecasts for General Government Gross Debt and Fiscal Balances, 2020 (Percent of GDP)

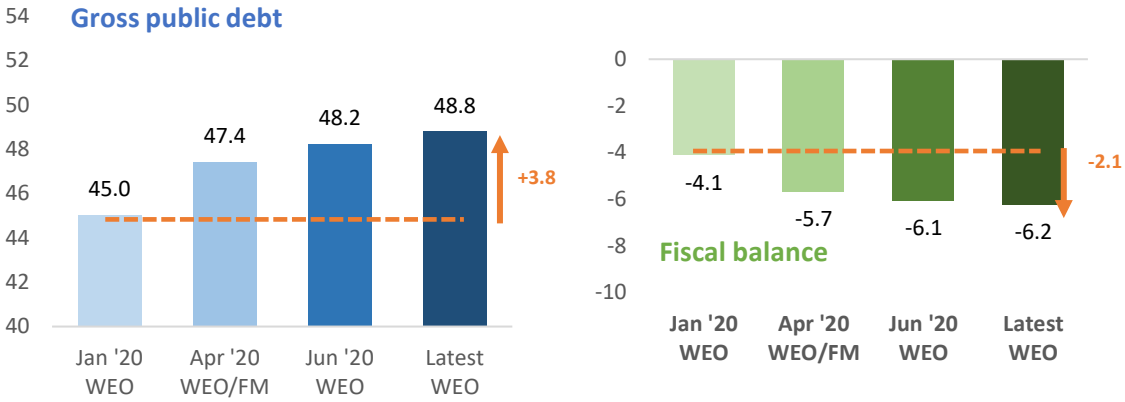
Advanced Economies



Emerging Markets and Middle-Income Economies



Low-Income Developing Countries



[3]Sources: IMF, World Economic Outlook (WEO) database; and IMF staff estimates.

This section highlighted the recent trends in the global economies regarding their public debt and the probable threats awaiting the economies due to the unprecedented circumstances the world is facing with the COVID-19 pandemic. It also outlined interesting discussions revealed in the literature regarding the nature of debt; whether productive or deadweight debt and evaluated debt relief packages received by less-fortunate economies.

2.2 Limitations to Assessing Debt Sustainability

As explained earlier, the lack of a unified definition for sustainability in itself presents a ground on which different approaches to debt sustainability may diverge. In addition, being a forward-looking approach, uncertainty introduces an impossibility principle to any approach's assessment, leading to far-reaching consequences (Wyplosz, 2005). The successfulness of an approach therefore would primarily be judged based on the validity of the imposed assumptions; which is again uncomfortably subjective. In spite of the concrete definition implied in theory by equating sustainability to government solvency, practitioners suffer to give sustainability a solid meaning, outlining a formidable hurdle.

[3] Note: Country groups are weighted by GDP in current US dollars adjusted for purchasing power parity. FM = IMF, Fiscal Monitor.

Another difficulty that is not tackled in different approaches is that debts are not born equal as some debts may be more prone to liquidity and rollover risks (Debrun, Ostry, Willems, & Wyplosz, 2019). Exposure to risks may vary according to the currency in which the debt is denominated, maturity, and ownership of the debt. Assumptions set about the aforementioned inputs further impose a broad array of potential shocks that may affect the public debt. This section commences with a detailed description of the IMF DSA Framework and proceeds with other alternative approaches. It further clarifies the debt dynamics and the correlation among the macroeconomic variables as deemed relevant in the literature. Finally, this section presents a summary regarding the productive debt vis-à-vis a deadweight debt and the relevance in a political economy context.

2.3 IMF Debt Sustainability Analysis Framework for Market-Access Countries (MAC)

Even though the analytical underpinnings of the notion of sustainability has a long pedigree, the approach adopted by the IMF in the current framework and template was designed back in 2002 and revised over the past years to align it with changes in the economic and financial environment while correcting for any realized shortcomings. In 2013, a reformed framework was introduced that is currently used in assessing debt sustainability in the context of both surveillance and program design and reviews.

2.3.1 A Standardized Approach

Market access countries are those countries with remarkable access to the international capital markets on sustainable and durable basis evident by the sovereign tapping international markets and issuance of external bonds in those markets. Egypt is considered a MAC under the IMF definiton, as well as all advanced economies and most EMDCs.

Focusing on the operational definition of debt sustainability in this frameowork, the public debt can be regarded as sustainable “when the primary balance needed to at least stabilize debt under both the baseline and realistic shock scenarios is economically and politically feasible, such that the level of debt is consistent with an acceptable low

rollover risk and with preserving potential growth at a satisfactory level (International Monetary Fund, 2013)."

Under this framework, projected debt levels over the medium term are evaluated under baseline and plausible shocks, keeping an eye on cyclical changes. Risks stemming from the rising or already-high levels of public debt and its financing requirements are also considered. A higher debt requires a higher primary surplus to be able to sustain it, and consequently, the higher the debt, the less likely that fiscal policy will be able to sustain the public debt. The analysis of debt levels is accompanied with realism of macroecnomic assumptions and projected adjustment of the primary balance. The IMF DSA Framework inherits the model assumptions for key macroecnomic variables including growth, interest rates, inflation, and primary balance.

2.3.2 Benchmarks in MAC DSA

The risk-based approach of the DSA Framework focuses on the sources of risk arising from uncertaining surrounding the central forecast. This addition has been the main aspect of the revamped MAC DSA, requiring more analysis for countries showing greater vulnerabilities. The template classifies countries as lower or higher scrutiny countries based on two elements; a set of benchmarks of debt burden and other indicators and access to fund resources. Higher scrutiny countries have a current or projected debt-to-GDP ratio above 50% for emerging economies, current or projected gross financing needs to GDP above 10%, and have or seek exceptional access to Fund resources. Benchmarks are 60% and 15% respectively for advanced economies. Such quantitative benchmarks are based on "early warning models", a class of models based on econometric estimates. A country may also be treated as a higher scrutiny country had it required more than 2% of GDP as a fiscal adjustment over 3 consecutive years. The second indicator deals with volatile growth measured through the coefficient of variation of real GDP growth; calculated using the past 10-year observations from historical statistics exceeding 1 for both advanced and emerging economies. Bond yield spreads over a relevant benchmark exceeding 600 basis points should also classify as higher scrutiny.

For the second sources of risk resulting from high external financing requirements, benchmarks for advanced economies and EMDCs are 25% and 15% of GDP respectively to reflect the higher ease of advanced economies to obtain external financing. Closer scrutiny is also warranted by a high share of public debt held by non-residents exceeding 45% of total debt. Residency here is not the ultimate concern but also the currency denomination of debt. A large share of foreign currency-denominated debt, defined in the case of emerging economies, as exceeding 60% of total debt, is another source of vulnerability. This benchmark is not defined for advanced economies, since they overwhelmingly finance themselves in their own currency and thus do not suffer from what is sometimes called in the literature, the "original sin" (Dell'Erba, Hausmann, & Panizza, 2013). Finally, the annual increase in short-term debt benchmarked at 1.5% and 1% in advanced economies and EMDCs respectively qualifies countries for higher scrutiny treatment.

2.3.3 Steps Towards DSA Assessment

The steps followed by the IMF in order to reach a 'definitive' assessment regarding the sustainability of the external part of the debt can be summarized in the following four steps:

(1) Forecasting the macroecnomic variables affecting debt dynamics for a period of 5 years, naming a baseline scenario.

(2) Calculating the resulting debt to GDP over the next 5 years, using the following formula:

$$b_t - b_{t-1} = (r - g)b_{t-1} - primary\ balance_t$$

where b is the debt to GDP, r is real interest rate, and g is the growth rate of GDP

(3) Conducting stress tests, for variables one-at-a-time by 0.5 standard deviation and then a combined shock to all variables concurrently of 0.25 standard deviation. At the beginning of the simulation period, exchange rate is shocked through a 30% depreciation.

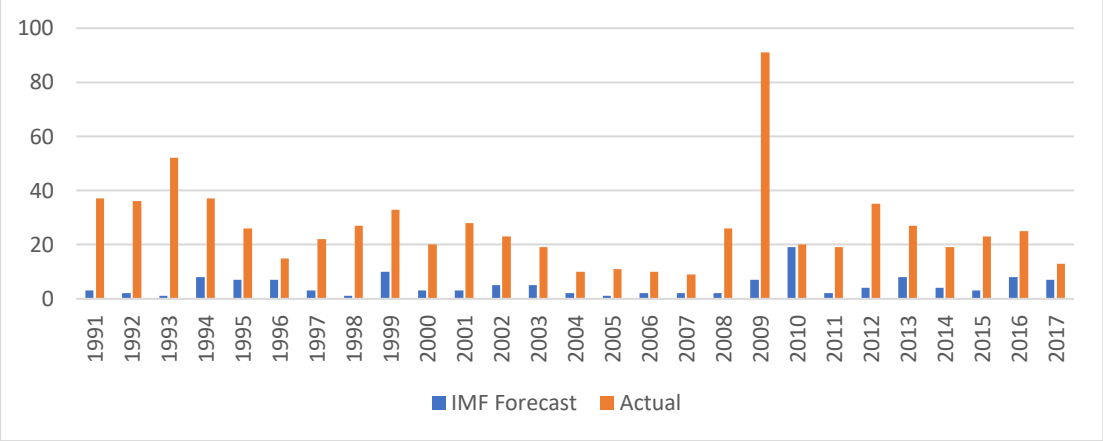
(4) Judging the sustainability of the debt using Country Policy and Institutional Assessment (CPIA) developed by the World Bank through submitting the country to the category fitting its threshold.

This annually-updated index classifies countries into three main categories according to their debt thresholds; low, intermediate, and high of 30%, 45%, and 60% respectively of debt to GDP. Such thresholds are chosen so that the probability of debt distress stays at 25% whenever reached (Wyplosz, 2005).

2.3.4 Shortcomings of the IMF DSA Framework

The IMF DSA Framwork suffers from overly optimistic forecasts, particularly growth and inflation forecasts, which may lead to deceiving assessments and inaccurate policy recommendations (Guzman & Heymann, 2015). One main reason why IMF's approach is exceedingly optimistic is the assumption that program countries will stick closely to all recommendations communicated in the Article IV reports, which scarcely happens (Kamar & Bakardzhieva, 2016). This 'optimistic curse' has been confirmed through the comparison between the IMF's five-year projections in Article IV consultation reports vis-à-vis the actual evolution of debt in the same period. Figure 4 shows the IMF forecast regarding number of countries in recession that is usually done in October of the previous year compared to the actual number; 2010 was barely the only year in the past three decades that showed some accuracy.

Figure 4: Number of Countries in Recession: IMF Forecast compared to Actual



Source: IMF Forecast and WEO

In addition to the above, one of the presented scenarios yielding debt evolution capitalizes on a ten-year historical average. This scenario can be catastrophically misleading had the country undergone noticeable changes in its economic policies in this recent period. For instance, a ten-year average for a country like Egypt in fact

includes the Arab Spring Revolution in 2011 and two presidents of tremendously contrasting agendas and policies. In fact, had those macroeconomic variables been better, the evolution of debt would suffer further from the optimistic curse presenting unrealistic projections.

The distinction between lower and higher scrutiny countries despite its complexity seems to have some loopholes. Some countries that classified as lower scrutiny and thus received less attention have ended up in debt distress and crises as Bosnia, Georgia, Spain, and Ireland. In addition, the risk-based analysis conducted for high-scrutiny countries does not really distinguish between the differences across the captured high-scrutiny countries as in fact it does not include any catered triggered stress-tests. Applying the same standardized deviation shocks to all countries does not capture the unique position of a particular country neither the real turbulence that may arise in the near future. Not only does the standardized and mechanistic tests dilute the benefits of sensitivity analyses, but the one-at-a-time shocks also ignore any existing correlation. This approach has also failed in providing early warnings to countries in debt distress.

The thresholds themselves present another shortcoming that sabotages debt sustainability assessment. A ratio in which one country may appear comfortable can signal distress for another or at least may not be favorable. This is exactly why Japan is able to sustain a debt over 200% of GDP while a country as Ukraine defaulted at 30% of GDP. Part of this may be attributed to the uses of debt in development which will have spillovers effects on the projected variables in the future; another ignored correlation.

The IMF DSA Frameowrk is highly geared towards debt dynamics more than debt sustainability in essence, and focuses on maintaining the current debt service level which may in many occasions be troublesome. This approach suffers from ‘too little too late’ phenomenon, and even when they come, they might take too long to respond as they are inefficiently delayed, even for debt relief (Guzman, 2016). The presented approach suffers from significant loopholes and cannot warrant a solid policy reaction.

2.4 Other Approaches to Measuring Debt Sustainability

2.4.1 Value at Risk and Stress Tests

The Value-at-Risk (VaR) approach calculates the probability distribution of debt ratios in order to judge fiscal sustainability. This approach is aligning with the IMF's stochastic simulation, however it is only concerned with historical data which may significantly bias the data. Based on some caveats imposed by this approach, the method needs to be interdependently used with other debt sustainability approaches; this is when the stress tests prove their importance as a complement to the VaR. However, this could not erode the benefits presented by this approach since it allows for computing the contribution of the various risk factors to the overall country's vulnerability (Rodlauer & Schipke, 2005).

This methodology was primarily developed in order to enumerate the market risk associated with financial portfolio and the enclosed volatilities. It basically measures the largest expected losses over target horizon for a particular predetermined confidence level (Jorion, 2001). Tail measures were further introduced in the literature through a conditional Value-at-Risk (cVaR) approach which is considered necessary in the debt sustainability context since an unsustainable debt is an infrequent event giving rise to fat tails.

Recently, Barnhill and Kopits (2003) extended the VaR approach to serve in the field of sovereign debt sustainability. In their paper, they aimed to model the government's probability of having a negative net worth position and obtain VaR for the balance sheet of the generalized public sector. A main limitation to this approach is the dependency on the government balance sheets which in many cases is not available or published especially for EMDCs.

Porter (2007) capitalized on the VaR approach while challenging the revenue volatility of Hong King's Special Administrative Region (SAR); the most volatile revenue among the Asian countries and one of the most volatile revenues in the world, putting huge pressures on the fical policy makers. The nature of this case qualified perfectly for the VaR approach due to its extreme fiscal nature. The paper concluded

that reserves are and will continue to remain indispensable to address the volatility of revenues and put Hong Kong SAR's fiscal policy on a sustainable path.

A paper by Adrogué (2005) also used this approach to measure the probability distribution of the debt ratios in Central America. This paper aimed at comparing the results of the conventional approach and the VaR technique. Results were not consistent as the VaR showed that different risks are applicable to different countries due to the variation in risk profiles; further undermining standardized stress tests.

In an attempt to judge Greece's debt sustainability, Consiglio and Zenios (2015) confirmed that the debt is unsustainable using 2014 data, and they manifested the appropriate haircuts, interest rate concessions and maturity extension needed in order to bring it back to the path of sustainability. Their results came against the judgment of the IMF in their 2014 analysis declaring sustainability before changing the assessment to unsustainable in 2015. They attributed the difference in conclusions solely to the attention given to the tail risk, naming it 'the devil in the tails'.

This approach seems to be unsurpassed in the accuracy of its risk analysis and stress tests, particularly by inducing the appropriate set of sensitivity analysis for every country. However, this model is complicated, arising from the general tradeoff between certainty and simplicity. Its data may also need a far-fetched historical data which is a constraint in many instances, and estimation results are hindered with limited availability.

2.4.2 Debt-Stabilizing Primary Balance

This approach answers the questions regarding the needed current account balance to ensure that public debt is on a sustainable path (Buiter, Persson, & Minford, 1985) . This can either be aiming at stabilizing debt at its current level or at any other desirable level. Obviously, this is one of the simplest, if not the simplest, approaches used in the literature; also embedded in the IMF DSA Framework. The limitation of this approach is that when used on its own, the mere outcome is that the debt is deemed sustainable when the projections indicate stability or declining path, and unsustainable otherwise.

Mupunga and Le Roux adopted the model in Zimbabwe to estimate the required primary balance, capitalizing on the inter-temporal budget constraint of the government to determine the factors that influence public debt (Nebson & Roux, 2016). Ashraf and Bhattacharya (2018) adopted the debt-stabilizing primary balance approach in order to judge the sustainability of public debt in Bangladesh. They concluded that sustainability will be achieved as long as the growth rates exceed the interest rates. A positive gap in the interest rate-growth differential (IRGD) presents a threat to sustainability and requires the existence of primary surpluses, whereas a negative gap puts debt ratios on a declining path even in the absence of fiscal adjustments. Ncube and Brixiová (2015) also confirmed that IRGD drove sustainability while assessing African countries' sustainability. The required surplus is in proportion to the inherited debt ratio and IRGD differential. With a positive IRGD, governments relying on rolling over the debt and the debt service will further balloon the country's debt ratio and eventually lead to debt distress. Experiences from countries like Greece and Portugal recorded a 10-year interest rate on government bonds of 29.2% and 13.9% respectively whilst annual growth of GDP was -7.3% and -3.5% respectively, exerting a colossal pressure on IRGD to grow boundlessly. Positive interest rate-growth differential prevents successful Ponzi schemes.

The approach gives an appropriate level of primary surplus, a surplus of ambition, that might in many occasions be extremely challenging and intolerable. Achieving overly-optimistic primary surpluses is in fact hectic; fundamental and fast structural changes are the main reason behind the nations' borrowing whilst global social and economic structures are rigid and inflexible, questioning further costs in the future. Also, economic theory provides reasons as for why IRGD remains positive in advanced economies and is consistent with data from the past several decades. Growth theories however provided insufficient information regarding the case of EMDCs, where IRGD should be whether positive or negative or even higher or lower than advanced economies. Those economies are only expected to have higher growth rates and higher interest rates compared to advanced economies (Escolano, Shabunina, & Woo, 2017). This approach to measuring debt sustainability prompts a fiscal adjustment to put the debt on a stable path, but outrageously ignores the realism of any policies or even the suggested one, which prohibits ensuring that the definition of

sustainability holds in the first place, quoting an 'unrealistically large fiscal adjustment' (Debrun, Public Debt Sustainability, 2019).

2.4.3 Reaction Functions

Moving from the previous limitation, the reaction functions focus primarily on ensuring that adequate policy reactions can sustain the debt ratio given the shocks to which the country has been subjected to. In the presence of such reactions from the authorities, debt is thus considered sustainable as an outcome of the demonstrated behavior. The advanced countries that resorted to this test for sustainability had generally passed the test, whereas EMDCs showed appropriate policy reaction when debt levels are moderate, but not necessarily the highly indebted countries (Wyplosz, 2005).

Reaction functions were introduced earlier in the monetary policy through Taylor reaction functions and the approach has turned to an established conventional one. More recently, application in the area of public debt has been explored and is yet subject to further developments. This approach is able to estimate the soundness of the fiscal reaction and pinpoint threshold beyond which the debt is considered on a stable path, and ensures sustainability.

This approach puts forward several advantages over the prementioned approaches: (1) no assumptions are required to be made regarding potential shocks and their likelihood, (2) no judgement is needed with respect to unjustifiable thresholds to assess sustainability (e.g., CPIA in IMF DSA), (3) it is catered to the particular experience of every country, and (4) it emphasizes the importance of appropriate policy making as the decisions are embedded in a framework that requires policymakers to take adequate actions to be reflected on the country's debt sustainability. In this case, debt sustainability is consistently treated as a policy objective. However, this does not come for free without limitations. A sustainable debt in the past does not bound the government to repeating the behavior in the future (Wyplosz, 2005).

In conclusion, different approaches vary in the way they define sustainability and the way they address the impossibility principle arising from making educated guesses about the future projections. Debt sustainability results may very easily be misleading according to the approach adopted. The IMF DSA Framework conclusions yet should be taken with a lot of caution. It is almost the case of all approaches the need to develop a representative threshold for the evolution of debt, which is considered a mission impossible. The debt-stabilizing primary balance might in that sense be regarded as superior to other approaches. Nevertheless, there are no grounds for incisive preference of an approach over another, and many instances, combining approaches as complementary methods of assessment is ideal.

2.5 Empirical Evidence and Classical Methods of Investigation

Determining the limit at which the debt becomes unsustainable is arbitrary (Alba, Al-Shawarby, & Iqbal, 2004). The solvency of the country to continue meeting debt service obligations can be different even for the same level of debt as it depends on various factors such as the government's policies, the country's stability and other macroeconomic factors. Different tools can be used to evaluate this debt sustainability.

2.5.1 Stationarity

One approach to analyze the sustainability of fiscal policy is to test the stationarity of the debt and/or deficit. The result of this approach can vary depending on the budget constraint (Uctum & Wickens, 2000). Many researchers have addressed the intertemporal budget constraint to evaluate the sustainability of the fiscal policy. The fiscal policy is defined as sustainable if it drives the discounted value of the debt to 0, meaning the government budget constraint holds in present value terms. The second requirement is that the fiscal policy should stay in place indefinitely (Wilcox, 1989). Thus, any empirical evidence showing a violation of the intertemporal budget constraint demonstrates the unsustainability of the fiscal policy and a change in policy is by consequent needed.

Hamilton and Flavin (1986) explored the use of a univariate time series approach to analyze the deficit inclusive of interest payments, by focusing on the stochastic properties of this deficit. In the continuity of Hamilton and Flavin's research,

Wilcox extended the possibilities and allowed for the use of stochastic real interest rates, nonstationary of the noninterest rate surplus and the stochastic violations of the borrowing constraint (Wilcox, 1989).

Another approach discussed by Trehan and Walsh (1988) focuses on the long-run properties of the flows of expenditures while using a multivariate time series analysis. Trehan and Walsh concluded, by gathering the two approaches, that the stationarity of the quasi-difference of the primary deficit must be satisfied as well as the existence of a cointegrating relationship between primary deficit and debt (Camarero, Carrion-i-Silvestre, & Tamarit, 2014). Moreover, Trehan and Walsh identified the interest of analyzing the stationarity of the deficit inclusive of interests, meaning the total deficit, as the stationarity of the primary deficit is neither necessary nor sufficient to guarantee the intertemporal budget balance (Trehan & Walsh, 1988). Consequently, the stationarity of the surplus inclusive of interest payments is a sufficient condition for affirming the stationarity of the public debt and thus for the intertemporal budget constraint to be satisfied (Greiner & Semmler, 1999). It is crucial to highlight that testing stationarity only does not give the details of the adjustment required in the case the debt becomes unsustainable.

Regarding the assumption of the unchanged continuity of the fiscal policy addressed by Wilcox, it can be in practice circumvented as there is a need in some cases to alter the fiscal policy to achieve sustainability. This urges the need to take into consideration expected future changes in fiscal policy when analyzing sustainability. By taking into account these potential changes, more details are provided regarding proceeding with the adjustments if there is evidence of unsustainability (Uctum & Wickens, 2000).

In the context of the Keynesian theory, debt finance was seen as essential tool to attain the appropriate level of aggregate demand, motivated by insufficient private investment to absorb national savings over a long period of time. This assumption was first brought into discussion by Evsey Domar (1944) who aimed to demonstrate the squinting threat to public debt resulting from continuous government borrowing, which will also require higher future taxes. Eventually, this might destroy the whole economy

and lead to outright repudiation of the debt, and thus a sovereign default. He showed that a constant overall deficit to GDP ratio guarantees convergence of both; debt to GDP ratio and interest to GDP ratio to a finite value as a share of GDP. Even though Domar assumed that the ratio needed to converge to a finite value to limit the tax burden, other economists (Buiter, Persson, & Minford, 1985) (Blanchard, Chouraqui, Hagemann, & Sartor, 1991) assumed that the indebtedness shall indeed converge to its initial level.

2.5.2 Cointegration

An integrated time series is a nonstationary series that can be converted into a stationary series by calculating the first order differences. A long-term equilibrium relationship is assumed to exist between cointegrated time series. The cointegration literature generally uses real levels of fiscal variables to test for cointegration and finds unit roots in real government spending, debt, and taxes.

Three hypotheses exist in reference to the influence that budgetary revenues have on expenditures, and vice versa. When the causality relationship between the two variables is bidirectional, it is a confirmed fiscal synchronization hypothesis; in the long-term, expenditure decisions are not made in isolation from revenue decisions. Another one states that when the causality relationship runs from revenues to expenditures, it is a confirmed revenues to expenditures hypothesis; the spending level adjusts to changes in revenue. Lastly, when the causality relationship runs from expenditures to revenues, it is a confirmed expenditures to revenues hypothesis; in that changes in spending induce changes in revenues.

Researchers tried to test for a bubble in financing of the fiscal deficit for Australia (Elliott & Kearney, 1988). Cointegration was primarily used, and showed no evidence to support unsustainability of government debt, over a period of thirty three years. Results showed that the overall level of debt as a ratio of GDP fell over the period as a result of strong GDP growth and inflation. A similar approach to capturing budget deficits was undergone using cointegration (Hakkio & Rush, 1991). Results showed that government spending was growing more rapidly compared to government revenue. In addition, interest inclusive expenditures were not cointegrated with revenues over a

period of twenty five years. This led to the conclusion that government debt drifted upwards with no bound. This will eventually lead the government to default on the debt at one point or another.

While some researchers used methods of cointegration to test for different situations and instances in order to prove the sustainability of a government's acts of closing the gap on budgetary deficits, others try to point to the presence of sustainability in the context of a budgetary deficit that has undergone structural shifts during a certain period in time. Tests on structural shifts are common in the literature, due to their eligibility to capture the intended outcome. Other researchers tried to capture the sustainability of budget deficits of a wide range of countries, and relating them to one another.

Further research pointed to the presence of sustainability in the context of deficit process that undergo structural shifts. Of the most distinguished studies tackled the prementioned context, Tanner and Lie (1994) and Quintos (1995) provided an eminent research. The first proposed a discrete break in the fiscal process occurring in the early 80's as a result of several policy changes. Evidence against the conclusions presented by the authors argued that the null hypothesis of no cointegration is rejected. The coefficient of cointegration is not statistically different from unity. Whereas Quintos gathered a set of data comprised of quarterly values for public revenues and expenditures and has undergone tests on structural shifts. The author researched for shifts in the rank of the cointegrating matrix and found a shift in deficit policy, also in the early 80's; concluding cointegration between revenue and expenditure, inclusive of interest payments, holding up until 1980. This led to the conclusion of a sustainable deficit process.

Payne (2006) found that in France, Japan and Italy, budget deficits of these countries might not be sustainable due to the lack of cointegration. And since cointegration is present between revenues and expenditures in UK, US and Canada, sustainability may exist despite the less-than-one coefficients indicating a faster growth in expenditures compared to revenues. In Germany, it appeared that for each dollar

increase in expenditures, revenues increase by an equal amount, and that is due to cointegration.

2.5.3 Fiscal Reaction Function

One of the most famed methods in the literature are the fiscal reaction function tests, aiming to determine the governments' reaction to their debt burden. The mighty of this method arose when the other classical tests (as unit root test) failed since time-series data got contaminated by structural breaks, lack of data, etc.

The fiscal reaction function established on the grounds of the government budget constraint, indicating a positive relationship between indebtedness and the country's primary balance. In consequence, the fiscal reaction function can be estimated by regressing primary balance on the public debt. Studies capitalizing on this method make use of copious explanatory variable including but not limited to business cycle, lagged primary balance, inflation, temporary government spending, and fiscal rules. The data is used to estimate a fiscal reaction function that relates the response of the primary balance to changes in the outstanding debt, depending on the control variables. When a positive coefficient of primary balance to outstanding debt is achieved, debt is said to be sustainable (Bohn, 1998).

Several researchers had capitalized on the model in further research; Fincke and Greiner (2012) analyzed the public debt sustainability for selected European countries over a period of three decades, where the results affirmed some governments' use of proper fiscal policies to ensure a sustainable debt path. In another study, Chandia and Javid (2013) focused on Pakistan's economy over the period 1971-2008 using the same reaction function where a long-run weak positive relationship was captured between surplus-to-GDP ratio and lagged debt-to-GDP ratio.

When focusing on the U.S. historical data in the period 1916-1995, Bohn concluded that the U.S. government used to respond to increases in debt ratios by adjusting their primary surplus or at least reducing the deficit. De Mello (2008) used monthly data for Brazil to assess the government's reaction to changes in indebtedness where he found that the government adjusted their behavior significantly to bring debt

to sustainable levels. On another level, some papers used a panel of data in order to judge and compare countries debt levels.

Based on Bohn, Mendoza and Ostry (2007) introduced a Model-based Sustainability (MBS) approach to analyze fiscal sustainability for a panel of industrial and emerging economies, concluding the existence of a strong empirical evidence of a robust positive conditional relationship between primary surpluses and public debt in both economies. Further studying 23 advanced economies and assessing room for fiscal maneuver, a strong support for the existence of a non-linear relationship between primary balance and lagged public debt was highlighted; exhibiting the fiscal fatigue characteristic (Ghosh, Kim, Mendoza, Ostry, & Qureshi, 2013). Câmpeanu, Stoian, and Roman (2006) used quarterly data for the period 1991-2005 to judge fiscal sustainability based on reaction function in Romania. The historical behavior of the country made the classical methods of investigation partially irrelevant, and thus resorted to the fiscal reaction function. They concluded that the fiscal policy in Romania exhibited a weak sustainability performance.

A complementary approach highlighted in the literature focuses on studying debt sustainability in a dynamic general equilibrium framework coupled with business cycle theory. This requires a solidly specified fiscal sector to analyze the effects of alternative fiscal policies in order to cater short-term risk of fiscal stress to the country level, and hence estimate the long-term requirements to maintain debt projections sustainable (Berrittella & Zhang, 2015). Also, Sakiragawa and Hosono (2011) investigated Japan's fiscal sustainability by supplying a dynamic stochastic general equilibrium; featuring low interest rate of the government bond relative to the country's economic growth rate in order to mimic the actual data. It endogenizes interest and growth rates to the debt problem. When concluding, they used Bohn's response function, and the sustainability improved.

Though empirically it is difficult to reject a unit root test in debt to GDP ratio, a non-stationary ratio is implied by various models of optimal government finance. As Bohn tried to establish how the US government reacted to the accumulation of public debt, he believed that despite the declining debt to GDP ratio, the difficulty of unit root

test rejection might be attributed to the lack of high economic growth or policy design (Bohn, 1998). He also believed that the unit root tests are inconsistent and misleading, and the unit root in debt levels is either not existing at all or primarily due to a unit root in GDP. Mello (2008) introduced another explanation that may bias the conclusion of the unit root tests; suspecting that seasonally unadjusted series may be the reason.

In conclusion, it is evident by empirical evidence that the use of multiple tests could lead to different conclusions. It is vital to understand that assessing public debt sustainability is a burdensome process and does not have a known rule to follow that could unsheathe an exact conclusion. Meanwhile, it remains pivotal for the highly indebted countries to manage their public finances efficiently and introduce corrective measures to corroborate public debt sustainability and minimize the solvency risk.

2.6 Public Debt and Macroeconomic Variables Dynamics

As illustrated above, there is merely any model or approach that isolated public debt and studied its sustainability apart from the debt drivers and dynamics. Both close and open economies show correlations among their macroeconomic variables which were, in some approaches, ignored. This part will focus on highlighting the relationship between the macroeconomic variables and the public debt.

2.6.1 Economic Growth

There are various means through which public debt could positively or adversely affect economic output and economic growth ((Dombia & Dedákb, 2019). Focusing on the negative effects, one of the most frequently cited consequences of rising public debt on economic growth is through crowding out the private sector (Elmendorf & Mankiw, 1999) as well as macroeconomic vulnerability. On the other hand, significant positive effects of the public debt also exist and are notorious in the literature, namely the Keynesian effect and the hysteresis effect. Those effects guarantee the policymakers ability to mitigate actual and natural rates of unemployment through the adopted expansionary fiscal policies during recessions and periods of decreased economic output (DeLong & Summers, 2012). Economic theory leads to the conclusion that the public debt-growth nexus is unique to every country and also subject to a number of

factors including the business cycle and the quality of the country's institutions (Krugman, 2012), (Reinhart, Rogoff, & Savastano, 2003), further confirmed by empirical analysis.

Dombia and Dedákb (2019) provided an estimate of the magnitude of the crowding out effect subject to different consumption behaviors. In the attempt to do so, they adopted several neoclassical growth models, including the RCK model, Blanchard model, and the Solow Model. Finally, they developed a general framework to gauge the burden of public debt, reaching a scrupulous conclusion. In the case where Ricardian equivalence does not hold, the change in savings accompanied by the rising population observed results in an enormous difference in output losses across the world caused by public debt. However, as the departure from Ricardian equivalence exceeds, the scale of the burden put on economies through public debt will increase.

Reinhart and Rogoff (2010) evaluated the relationship between public debt and economic growth for 20 economies using data for the period 1949-2009. Their conclusion varied based on the country's debt ratio; they presented 90% public debt to GDP as a threshold above which the public debt negatively affects economic growth and below it, no specific correlation exists. They also found no relationship between inflation and growth. A similar threshold was suggested by Checherita and Rother (2010). Schclarek (2004) also found no significant relationship between growth and debt for a sample of 24 industrial countries over the period of 32 years.

Clements et al. investigated a panel of 55 LICs for a period of 29 years and concluded also a negative correlation between external debt and the GDP growth (Clements, Bhattacharya, & Nguyen, 2003). The results were also confirmed between external debt and GDP per-capita growth by Patillo et al. for a panel of 93 EMDCs, experiencing the negative correlation for debt levels above 40% of GDP (Pattilo, Poirson, & Ricci, 2002). Additionally, Ogunmuyiwa (2011) assessed the relationship between external debt and Nigeria's economic growth for the years 1970-2007 using a vector error correction model (VECM). The results revealed a weak insignificant relationship between the external debt and economic growth, in addition to the lack of causality. The same results were revealed for Malawi's external debt (Tchereni,

Sekhampu, & Ndovi, 2013). Using the same methodology, Shah and Shahida (2012) found no robust impact of the debt on economic growth of Bangladesh for a study spanned 1980-2012 concluding that the public debt does not affect economic growth.

Kumar and Woo (2010), working on EMDCs as well, studied data that spans four decades and found that a long-run negative relationship exists between debt and economic growth. Panizza and Presbitero (2012) used the instrumental variable approach to evaluate the impact of public debt on economic growth for some OECD countries and their empirical results pointed towards a negative correlation. One of the few empirical studies conducted on the Egyptian economy disclosed a strong negative relationship between public debt and growth for the period 1981-2006 (El-Mahdy & Torayeh, 2009).

On the other hand, Baum et al. reported a positive and, in fact, a highly significant positive impact of the public debt on economic growth using a dynamic threshold panel methodology for several European countries as long as the debt levels were less than 67% of GDP. After this ratio, the impact becomes insignificant (Baum, Checherita-Westphal, & Rother, 2012). When studying Nigeria, Egbetunde (2012) concluded a positive relationship between the public debt and economic growth for the period 1970-2012. The study also outlined a bidirectional link that shows that the impact goes from public debt to growth and the other way around. Further studies disaggregated the Nigerian domestic and external debts impact on economic growth. Amin and Audu (2006) supported the results for Nigeria with external debt as well for the period 1990-2004. Anyanwu and Erhijakpor (2004) reported, on the contrary, a significant negative relationship between economic growth and the domestic debt and attributed this to high interest rates. However, the study mentioned that historical domestic debt had a positive effect on the country's economic growth. Maghyereh (2003) while studying the effect of external debt on Jordan's economic growth revealed a positive relationship for a debt level of 53% of GDP.

The literature as well as the economic theories manifested the relevance of public debt to economic growth. However, it is obvious that adverse impact of public debt on economic growth becomes inevitable with high debt levels. At best cases, it

becomes insignificant. Excessive public debt could likely have an ominous effect on growth and capital accumulation through interest rates, higher expected discretionary taxation, and inflation. In some cases, it may also trigger issues within the financial sector and the domestic currency, resulting in high volatility and thus lower economic growth (Dombia & Dedákb, 2019).

2.6.2 Inflation

Similar to economic growth, the literature has different views regarding the relationship between public debt and inflation. However, the most widely accepted basis is that inflation is a monetary phenomenon, and is controlled primarily within the scope of the monetary authorities through money supply. As a consequence, the assumption that monetary authorities are having full control over prices is the cornerstone of the monetarist theory of price level determination, naming an active monetary policy accompanying a passive fiscal policy yielding a Ricardian equilibrium (Erdogdu, 2002). A passive fiscal policy indicates that the monetary policy is only capable of affecting price levels and hence inflation through interest rates (Attiya, Umaima, & Abdul, 2008). According to Friedman (1968), the adoption of an expansionary policy raises real output and the general price level in the short-term, while on the long-term, the economy is only left with the price increase. Based on the above, government debt is not expected to have an effect on inflation and it does not create a net wealth effect (Barro R. , 1974). However, in the case where Ricardian equivalence does not hold, the intertemporal government budget constraint (IGBC) is a condition that is not satisfied for all price levels. In that case, the level of surplus is set in advance in order to mitigate any threat to the solvency through moving the price (Barro R. , 1989). Clarifying the above, in a non-Ricardian environment, the price level is only a function of several fiscal policy variables.

A pioneering study that opened a controversy on the relationship between government debt and inflation was conducted by Musgrave (1949). The study focused on domestic debt only and its impact on inflation. It outlined that in a case when the private holders of public securities aimed to liquidate a major part of their holdings, and the fiscal authorities were the sole buyers, an expansion of bank credit will be witnessed. Nonetheless, this expansion will not have an effect on the necessary

demands of an economy, but in fact will generate massive inflationary pressures. In fact, the validity of Ricardian policies in both developing and advanced economies has been questionable as well as the ability of monetary authorities to keep price levels stable and hence a congruous mix of monetary and fiscal policies is required (Aimola & Odhiambo, 2020).

Departing from the theoretical link between public debt and inflation, empirical evidence of this relationship has been studied through different estimation approaches. Some studies focused on empirically assessing the degree of interaction between monetary and fiscal policies in demonstrating relationship between public debt and inflation (Leeper, 1991), (Cochrane, 1999), (Walsh, 2010).

Wheeler (1999) explored the impact of the public debt on several macroeconomic variables in the United States. Through the use of VAR estimation and impulse response functions, the paper showed that as public debt increase, interest rates, output, and price levels decrease, concluding a negative relationship between inflation and public debt and consequently rejecting the existence of inflationary pressures. Taghavi (2000) found that the public debt of four European economies is inflationary in the long-run but shows no significant pattern in the short term, and concluded an overall adverse impact of public debt on inflation.

Nastansky and Strohe (2015) aimed to evaluate the relationship between public debt and inflation in Germany through employing a VECM estimation technique. The paper used data for the period 1991-2014 collected quarterly. They found a strong positive relationship between the country's public debt and consumer prices. They also highlighted the importance of money supply, aggregation demand, and expected changes in price level as crucial factors in determining this relationship.

Another interesting conclusion was outlined by Kwon et al. (2006) as they employed a VAR estimation technique to provide empirical evidence that an increase in public debt is considered inflationary in countries that are heavily indebted. The results concluded based on a sample of 71 countries for the period 1962-2004. They proved that public debt is in fact inflationary in developing countries with high debt levels and the relationship is rather weak in developing countries with low debt levels.

Whereas, in advanced economies, there was no proof of any significant relationship (Kwon, McFarlane, & Robinson, 2006). This paper emphasized that the fiscal policy may have a role in controlling inflationary pressures since the monetary policy alone will not be sufficient. The results were confirmed by Reinhart and Rogoff (2010) when examining 20 advanced economies and concluding the absence of a relationship between public debt and inflation, while confirming the robust relationship between highly indebted emerging countries' public debt and inflation.

Nguyen (2015) capitalized on GMM estimation technique to assess the relationship between public debt and inflation in 60 developing economies. The study focused on the direction of causation found, pointing out that the public debt has a remarkable positive effect on inflation whilst inflation has a significant negative effect on public debt. Following up on the relationship, the Nobel laureate Sims (2014) clarified that as a government wants to settle the debt without neither imposing further taxes nor engaging in benefit cuts, it is inevitable to print money and hence rolling over the debt. This is not considered a default but in fact, inflation. He also considered that the inflationary results of expanding nominal debt are in light of the assumption that future surpluses will not expand in correspondence to the current deficits.

The literature provided different conclusions based on the country perspective but most commonly prone towards a positive relationship between public debt and inflation. This is indeed the case for heavily indebted countries and less developed financial markets. Despite the lack of a solid termination to the debate in the literature, it can be claimed that a positive relationship is more likely to prevail. Based on that, policymakers shall be informed that monetary authorities will most of the time not be able to contain the inflationary pressures solely.

2.6.3 Interest Rates

Based on the assimilation of Keynes' point of view regarding the impact of public debt on interest rates, a balance between optimism and caution is indispensable. Expanding on this, optimism is the belief that the presence of solid and sound policies, the continuous pursuance of them, and the ability to convey to the public that the authorities are confident in their decision will allow the authorities to shape interest

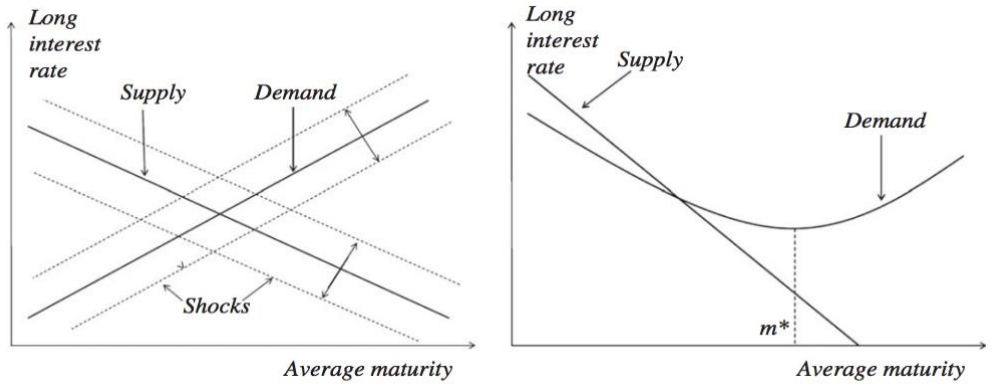
rates as deemed preferred by their objectives. Caution is needed to avoid failure of authorities to convey the above. The incident where public debt exerts an upward pressure on interest rate expectations is when all policy objectives are compromised (Aspromourgo, 2018).

Interest rates are currently low; lower than the nominal growth rates across the vast majority of countries, and it is expected to stay that way for the foreseeable future, but the gap is expected to narrow (Blanchard O. , 2019). Recent studies tried to explore the relationship between sovereign debt and interest rates. It appears that countries with better fiscal decisions and policies are usually associated with lower interest rates despite the varying conclusions regarding the relationship for different countries (Ardagna, Caselli, & Lane, 2007).

The theoretical framework studies the relationship between the average maturity of public debt and interest rates through a demand and supply context. Demand curve in that case is an upward-sloping demand clarifying the investors willingness to hold securities longer had they been compensated adequately. This may be justified by the partially dependent monetary authorities having a stentorian expansionary incentive, compared to independent ones, because the expansionary policy gains increase with the average debt maturity (Missale & Blanchard, 1994). On the other hand, a downward-sloping supply curve is expected as declining long interest rates urge the debt agent to extend the average maturity (Beetsma, Giuliodori, & Sakalauskaite, 2016).

Lengthening the maturity of public debts puts less pressure on highly indebted countries to run into debt distress. This has been illustrated by Alesina et al. (1992) through a U-shaped demand curve shown in Figure 5. With a sufficiently low average maturity, there is a huge risk of rolling over, and thus higher interest rates will be demanded. This could further be accompanied with monetization risks and inflationary pressures (Alesina, De Broeck, Prati, & Tabellini, 1992). Upon beholding the mentioned dynamics, monetary authorities might be reluctant to engage in a contracting policy to gauge the rising inflation, because increasing the short run interest rate will immediately effectuate higher debt service and borrowing costs to the government, as a decent proportion will need to be renewed in the future.

Figure 5: Demand and Supply Framework Average Maturity and Long Interest Rate



Source: Beetsma et al. from 'Long-term Interest Rates and Public Debt Maturity

Beestsma et al. (2016) found that with a stagnant debt to GDP ratio, increasing the average maturity of public debt leads to a decline in the long-run interest rate. In other words, a positive maturity shock decreases the long-run interest rate by approximately 30 basis points. This study was conducted on a sample of 16 OECD countries during the period 1980-2007. However, other studies suggested that increasing average maturity in fact raises long-term interest rates capitalizing on clientele effects (Greenwood & Vayanos, 2010) and changes in liquidity premia (Krishnamurthy & Vissing-Jorgensen, 2012). In fact, those studies were primarily focusing on the US Treasury debt and estimated that reducing maturity by one year would in fact lower the five and ten-year forward yields by around 150 basis points.

Either conclusions presented may call for optimal public debt management should the government has a say regarding the debt maturity. However, instances when governments are able to control their debt maturity are limited as a result of the financial pressures and the public's reduced confidence in monetary discipline. Generally, the authorities should not dictate the appropriate policies based on their isolated objectives, but rather the creditors point of view and the whole economy's well-being should also be accounted for. Preferring short-term debt appears to be consistent with an upward-sloping yield curve due to the low interest rates and low maturity. On the other hand, a policy aiming at reducing the long interest rates shall focus on lengthening debt maturities; the ones that are most pertinent to investment and economic activity (Beetsma, Giuliodori, & Sakalauskaite, 2016).

2.6.4 Exchange Rate

Another macroeconomic variable that has an impact on the public debt is the exchange rate, particularly on the external debt. It is in fact one of the crucial macroeconomic variables especially for transition and emerging economies. Based on the Keynesian point of view, budget deficits are correlated to the current account deficits through the concept of 'twin deficit' by means of interest and exchange rate changes. Expanding on this, rising budget deficits put pressure on interest rates which attract capital inflows to the country. As a result, an appreciation is expected based on the high demand on the domestic currency to buy domestic financial assets, resulting in an increase in trade deficit. On the other hand, the Ricardian Equivalence Hypothesis abrogates the existence of a relationship between the deficits.

The modern literature has confirmed the positive relationship between exchange rates and economic growth in developing countries. Countries with trade surpluses are expected to have an appreciating currency, and on the other hand, a currency depreciation is accompanied with trade deficits (Bunescu, 2014). Real exchange rate shocks only will affect the valuation of the real value of foreign debt. Bleaney and Ozkan (2011) focused on the relationship between the denomination of public debt and the choice of exchange rate regime, whether fixed or floating. Countries, mainly developing ones with a sizable foreign debt, see pegging more attractive due to the fears of floating, if credible. On the other hand, an advanced country like Japan has an exchange rate that does not tend to vary or respond to changes in public debt. This is the case of the largest indebted country in terms of debt to GDP, and thus concerns regarding public debt and exchange rate instabilities arise.

McMillin and Koray (1990) examined the relationship between government debt and the exchange rate in Canada using a vector autoregressive model, variance decompositions, and impulse reaction functions. They also adopted a Monte Carlo simulation to estimate the volatility and the standard errors. According to the variance decomposition, remarkable effects of the public debt exists on the exchange rate. Opposing to the traditional theory, the paper concluded that debt shocks lead to a short-term depreciation as per the impulse reaction function. Integrated with a negative effect

on the interest rate, the explanation was justified on the basis of Ricardian equivalence framework on the basis of an uncertainty concerning future taxation. Neaime (2015) focused on the case of Lebanon, with budget deficits accumulating now for decades. The paper was motivated by the increasing evidence in the literature that foreign debt and exchange rate crises are highly linked in EMDCs. The paper concluded that the debt is unsustainable and austerity measures are crucial in order to avoid a future depreciation.

2.6.5 Primary Balance

Primary balance is the excess of government revenues over expenditures net of interest payment. It is considered a central determinant of the public debt dynamics. Capitalizing on Bohn's influential sustainability test, public debt is sustainable if the primary surplus to GDP is a positive ratio of the debt ratio (Bohn, 1998). The intuition behind Bohn's tests is that since the governments are currently running into debts, corrective actions should be expected in the future by an expanding primary balance to be able to sustain the debt (Beqiraj, Fedeli, & Forte, 2018). As the primary balance positively responds to the accumulation of debt, the intertemporal government budget constraint holds and the impact of the negative shock is reversed. This is as long as the IRGD is positive; as traditionally assumed.

Statistically put, rising primary surpluses responding to increasing public debt signifies that the debt to GDP ratio becomes mean-reverting. Conversely, this mean reversion is conditional on a sufficiently large reaction by the fiscal authorities. Bohn expanded on the once-conventional assessment of sustainability through ensuring stationarity of public debt to GDP and introduced the fiscal reaction functions that prohibit any interest rate assumptions. Bohn required the primary surplus to GDP to increase at least linearly with debt to GDP ratio for highly indebted countries to ensure sustainability.

Izák (2009) studied the relevance to primary balance to the debt's implicit costs in ten members of the European Union. He concluded that governments that run primary deficits encounter noticeably higher borrowing costs. In a further attempt to quantify the magnitude, he found that an increase of 1% in the primary deficit is linked

to a 0.2% increase in the unit cost of debt servicing. Studying the disparity between a sample of emerging countries and advanced economies response to public debt, Mendoza and Ostry (2007) found evidence that emerging countries are able to provide stronger reaction. They concluded that, based on the stronger response, emerging countries are more likely to witness convergence of debt ratios to lower levels compared to the advanced economies. The stronger fiscal response however is not necessarily attributed to a better fiscal discipline, but rather to compensate for the riskier fiscal environment. In addition, they found that emerging market's positive response is weaker when their debt ratios exceeds 50% of GDP, contradicting Bohn's hypothesis that fiscal response has to strengthen with the debt ratios.

Beqiraj et al. (2018) found in fact a negative and significant long-run relationship between the structural primary balance and public debt in a panel of several OECD heterogeneous countries; deeming the debt unsustainable under Bohn's assessment (Beqiraj, Fedeli, & Forte, 2018). Plödt and Reicher (2014) found a strong response of primary balances to lagged debt levels in a sample of EU countries, with a coefficient of 0.09. Ghosh et al. (2013) also confirmed the weakening positive reaction with increasing debt ratios, and even a negative response with very high ratio of debt to GDP. Barro (1979) reported a positive effect of interim increases in government spending on the public debt.

Generally, studies have been focusing on the economic growth - debt nexus; impact of economic growth on public debt and little attention has been directed towards its relationship between public debt and the primary balance. Abubakar (2020) attempted to study the effect of fiscal tightening or loosening on the public debt in Sub-Saharan African (SSA) countries. He reported a negative and statistically significant relationship, outlining that a reduction in public debt to GDP resulted from increased primary balance, indicating that fiscal consolidation attempts lower public debt. A probable clarification is that following a tightening fiscal stance, government revenues outweigh the expenditure which has a twofold effect on public debt. The first explanation is that the additional revenue can be used to service the debt whether through amortization or interest payments and the second is that the increase in revenue reduces the government need to borrow, limiting the debt to the current stock. Other

authors however found that engaging in fiscal tightening policies worsen the public debt situation.

2.7 External & Domestic Debt: Substitutes or Complements?

Sovereigns opt to raise funds either domestically or abroad; each of both is inclined to bid for the sovereign's pledged of prospected disbursements to repay the debt. Though the literature has been extremely rich in debating the enforcement procedures that characterize sovereign credit markets, it is, on the other hand, quite unequipped with distinction between external and domestic debt. Considering the empirical literature, it emphasized external debt and focused on its analysis despite the fact that many governments that default on their debts do so selectively. Kohlscheen (2010) findings show that a good some of the defaults in emerging markets influenced both domestic and external debt instrument holders.

The literature has considerable evidence that external defaults trigger domestic ones, however there is not any evidence that supports the existence of the reverse link. That in itself could be an incentive for governments to substitute external borrowing by domestic borrowing. The majority of studies have done one of two: either ignored domestic debt altogether, or treated external and domestic debt crises as exceptionally independent occasions. Due to the lack of data, the few studies that attempted to analyze the factors deriving government defaults on domestic debts resorted to proxies as explanatory variables including but not limited to: M3/GDP ratio, accumulated budget deficits, and the growth rate of government expenditures (Van Rijckeghem & Weder di Mauro, 2004).

As for external debt, it is notorious in literature that both macroeconomic variables and liquidity indicators do have a remarkable explanatory power as determinants of debt crises, such as the ratio of short-term debt to foreign reserves and total debt to GDP. As per the findings by Detragiache and Spilimbergo (2001), sovereign debtors fail to repay their creditors had the economy been struggling to grow and the debt service burden is a huge chunk compared to the total revenues obtained by the country from exported merchandise. Likewise, a higher stock of international

reserves compared to imported merchandize tends to decrease the risk of default. Capturing a political angle, the concentration of power in the head of government's hands would also lead to more frequent breaches of international repayment promises.

2.8 Global Partisan Politics and Public Debt-Trap Diplomacy

The final part of the literature aims to shed light on the uses of debt and how global politics employed by massive lenders could be affected through their not-so-selfless goals.

2.8.1 Political Economy & Debt Relief

Paving the way to a new international economic order, low-middle-income countries seek to generalize debt relief, claiming it will provide an opportunity to reconcile the gap between the rich (creditors) and the poor (debtors). Those debtors usually burgeon their debt from the accumulation of penalties resulted from failure of debt service repayment. Cohen (1982) believes that past and forthcoming debt relief negotiations are a uniquely peerless political process due to the unprecedented political dynamics aiming for a new economic order upon which terms and extent of relief are based. Paris Club is the restructuring vehicle when the debt treated is an external bilateral sovereign debt. It has been glorified after the 1980s' debt crisis, arranging a few-hundred restructuring agreements ever since (Das, Papaioannou, & Trebesch, 2012).

The literature has been segmented when it comes to assessing the nature of debt relief and its hidden, if any, agenda. Notably, while Nwozor (2009) was evaluating the Nigerian debt relief, a vast majority, including revolutionaries and researchers, believed that a country's sovereignty shall be compromised upon receiving a debt relief package by Paris Club. More often than not, the negotiation terms grant the multilateral institutions of the IMF and/or World Bank the authority to consistently interfere with the national laws and regulations. Consequently, this curbs any successive government's policies and attempts towards any radical economic, political, or social decisions prior to referring to them. On the other hand, one could never trivialize the utility accompanied by a debt relief package; resources are finally freely available to be utilized in economic development, and contemporary economic growth models are developed. In addition to this, governments used to consider a debt relief package the

utmost blessing it brought to the country and signify it as a sign of confidence in the government. This has been known in literature sometimes as the "democracy dividend" (Wapmuk & Agbalajobi, 2012).

Turning to Egypt, with the acute drop in oil prices in the 1980s, the Egyptian government insisted on sustaining the high growth rates through accruing enormous amounts in foreign debt. Paris Club has also concluded an agreement with Egypt in May 1987 as it entered an era of debt trap where capital inflows were progressively consumed by debt-servicing obligations, and creditors lost confidence in the Egyptian economy. The agreement has delayed the complication rather than settling it; with rescheduling over 10-years inclusive of a 5-year grace period (Ikram, 2018).

2.8.2 Financing that Drives Debt Distress

Since the beginning of the 21st century, China surfaced the list of international creditors, now ranking the sixth largest group in the international development finance world (Koch & Remolona, 2018). The Chinese banks now have a strong presence in all major world economies and aimed to extend their financing to economies where other creditors and lending institutions recoiled from. Recently, China assisted in establishing a couple of multilateral development banks; the New Development Bank and the Asian Infrastructure Investment Bank, in addition to tens of bilateral funds. This came in line with the world's need to finance infrastructure and energy projects (Gallagher, Kamal, & Wang, 2016), as well as other hefty financing requirements.

Despite the rise of China as a global lender, many parties warned of the threats accompanied by its impact on developing countries, including the United States and other Western-denominated financial institutions (Singh, 2020), naming a 'new colonialism' particularly in relation to the Chinese-African ties. The name 'debt-trap diplomacy' emerged particularly to describe this behavior in the literature very recently by Brahma Chellaney; a New-Delhi based geostrategist. His argument was that China seeks to intentionally snare the developing countries through offering those unsustainable loans which they will stumble to payback. He also claimed that the loans are not intended to assist the citizens of the local economy and in fact China would prefer that the loans are not used to finance worthy projects but rather frivolous ones

and increase its leverage. In addition, those developing nations will be required to come to grips with China's influence whether politically or economically, and welcome terms that formulate an incessant debt.

Borrowing is considered deferred taxation aimed at financing an increased investment sentiment or increased consumption and evade otherwise unattainable budget constraints (Hassan, 2013). As a result, countries should borrow in order to boost economic growth and improve living standard of the citizens. It has been advised that public debt shall be transmitted to an economy's real sector instead of the social consumption. Based on this, two types of debt arose; productive debt and deadweight debt. Deadweight debt may mask various economic and political targets.

Bilateral donors may have several motives: (1) magnanimous motives to support less fortunate countries, (2) commercial motives to capture further markets to their own economy's exports, and most commonly (3) strategic motives to earn the desired influence over the recipient's economy. Multilateral institutions on the other hand ought to increase their disbursements so as to achieve and sustain their significance in the global order and incentivize their shareholders to finance an augmented chunk of their capital base (Ikram, 2018).

This research addresses two main gaps in the literature: (1) The lack of recent empirical studies judging the public debt sustainability of Egypt and (2) Challenging the IMF DSA Framework assessment compared to a country-specific model that corrects for several shortcomings that could potentially undermine the sustainability of debt. This shall assist the Egyptian authorities in pinpointing areas in which the IMF Approach could have been defectively performing, and accordingly, plan and implement the necessary policies to ensure debt sustainability.

Chapter 3 Stylized Facts about the Egyptian Economy

Upon setting forth the global circumstances binding the public debt, this section focuses on the Egyptian economy and its dynamic trends starting 1970s. This is the period of interest since it captures a series of events including but not limited to wars,

debt reliefs, financial crisis, the Arab Spring, and a pandemic. It was also the beginning of a pro-West stance by Sadat and continued with Mubarak's rule, that lasted for almost three decades.

3.1 Egypt's Relation with the International Financial Institutions

As Egypt adopted a post-West stance with the swap in its foreign policy, the role of the IMF and the World Bank significantly escalated and developed an importance of the country in regional and global politics. The projects financed by the World Bank were conditional on their financial viability and focused on the real sector yet the Egyptian authorities sometimes had reasons to resist their suggestions. However, and more interestingly for the scope of the study, the IMF focused on the macroeconomic side and the structural changes. As opposed to the World Bank, the IMF conditions extended to the whole economy, due to the nature of the ruthless decisions including but not limited to cutting subsidies, currency devaluation, and introducing taxes. The Egyptian authorities may very frequently then have strenuous negotiations with the IMF and conditions could in fact be softened based on the political support that Egypt has from major shareholders of the IMF; leaving structural reforms indispensable.

3.1.1 The Bread Riots and the Public Resistance

In the 1970s, Egypt was running enormously large budget deficits and expenditures were piling up from military expenses, public sector wage bill, interest payments, and subsidies. Subsidies were accounting in some years to quarter of the general government's expenditures. With regards to global trade, Egypt's exports did not succeed in keeping up with the rapid expansion of the international trade which urged for currency devaluation. The IMF's attention was directed towards the budget deficit and the weight of the cost-of-living subsidies. With the IMF attempting to restore the macroeconomic stability, subsidies were the most flexible item to cut. News about a potential increase in prices sent a spasm through the Egyptians, which was followed by the announcement of the budget declaring an increase in rice, gasoline, cigarettes, household cooking gas, and sugar by 16%, 31%, 12%, 46%, and 3.3% respectively. Unfortunately, this was met with large public vexation and the 1977 bread riots took place, leading to a major upheaval that led to the death of tens of people, and numerous

arrests reaching 1,270 people. As a result, leaders were traumatized and all the attempts to cut subsidies were reversed. In summary, a major condition for the program's initiative was cutting subsidies, which was ultimately resisted by the citizens despite being a last resort for the country to be able to sustain its fiscal stance.

For the whole period, Egyptian authorities perceived the issues arising in the economy as short-term symptoms and not structural ones, and thus saw the cure residing only in prompt additional financial resources. A substantial number of resources was needed to meet the increased spending resulted from the fiscal expansion. Conflicts arose among the government as Abou Ismail (Minister of Finance) was adamantly opposing the package whilst Zaki Shafei (Minister of Economy) thought it was indispensable. Abou Ismail kept showing his pride even decades later for not accepting the Fund's proposals on subsidies.

3.1.2 Paris Club I

External debt skyrocketed in the early 1980s under Mubarak's rule, averaging 9.6% a year, and hitting $45 billion by 1988. Not only was the rising external debt a concern, but also and most pressuring, the debt service; meeting it became impossible, surpassing a 100% of all current account receipts (Ikram, 2018). Despite the rising need for financial resources, the available resources in fact fell, especially with the decline in oil prices; the major commodity exported by Egypt during that time.

In the early days of Mubarak, the drop in oil prices in 1986 had severely affected Egypt as the terms of trade significantly deteriorated. In parallel, the economy was not strong enough to make up for the decline in GDP and in addition, there were no supporting policies to pave the way for it. The non-oil exports were thus discouraged, interest payments nearly tripled between 1982 and 1987 and huge arrears accumulated, expelling Egypt from the international capital markets.

In addition to the drop in oil prices, Egypt failed to transfer the appropriate incentives and comparative advantage. With the country's comparative advantage concentrated in labor, the labor-intensive commodities are the logical specialization, but with negative real interest rates, investors would buy cheap capital and invest in

capital-intensive commodities, thus not reflecting the real comparative advantage and resulting in suboptimal investment allocations.

Egypt succeeded in reaching an agreement with the Paris Club in 1987 to reschedule some arrears conditional to initiating a program with the IMF which Egypt expected would suggest a certain discipline on its budget as well as other macroeconomic variables. Egypt failed to fulfill many of the obligations required, and especially with rising oil exports and recovering tourism, this deal came to an end.

3.1.3 Paris Club II and the ERSAP

After the Western-led coalition of Egypt against Iraq in 1991, Egypt was rewarded by a massive debt-relief in addition to the Economic Reform and Structural Adjustment Program (ERSAP). The donors offered bountiful terms to writing off and rescheduling Egypt's outstanding external debt to the 17 members of Paris Club. The scope of debt relief under this package was extensive. Locking debt service obligations for the first three years, providing a minimum of 15% relief, on the net present value, was granted. This was also complemented by further debt arrangements that reduced debt by 50% of the net present value of debt service payments on the eligible debt. The debt that was considered eligible for rescheduling included all the concessional public and publicly-granted debt owed to members of the Paris Club with a maturity that exceeded one year. It also captured medium and long-term commercial debt, non-concessional bilateral debt and repayments due. This hefty debt relief package amounted to $19.6 billion, saving an average of an approximately 2% of GDP annually in debt servicing.

The IMF agreement was an obligatory condition for Egypt in order to benefit from the deal with Paris Club that enabled the above-mentioned debt relief package and allowed Egypt's debt to be sustainable for the first time in many years. In evaluation of the deal, it has been extremely successful regarding the reduction of debt service payments. However, it did not free the balance sheets enough to pile up further debt, which is another element of success; aiming to maintain the borrowing capacity. However, there has never been a middle-income country that received a generous debt forgiveness from multinational organizations like Egypt.

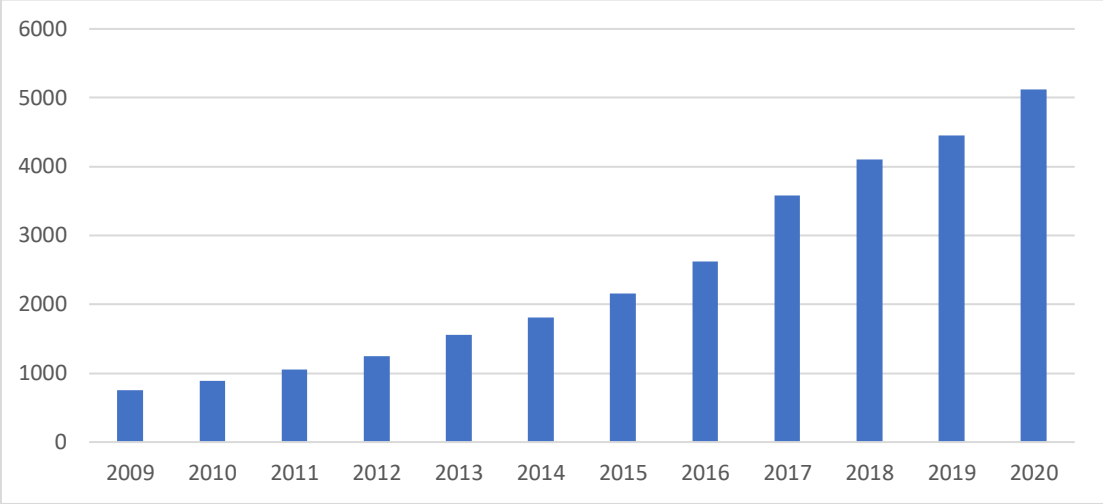
As for the structural part, the IMF also showed their willingness to finance the Social Fund for Development conditional on the initiation of the ERSAP. The program resulted in a huge reduction in the budget deficit, from 15.3% of GDP in 1991 to 0.9% in 1997. This was pushed by the increase in revenues, but most importantly the reduction in expenditures that resulted from rationalized public investment being halved as a percent of GDP, reduced subsidies from 5.2% of GDP to 1.6%, and privatization of public enterprises.

The years after, and particularly starting the early 2000s, witnessed the thrive of crony capitalism and the ERSAP was accused to direct the public funds into fewer hands (Ikram, 2018). Those businessmen political connections were able to provide them with lands at lower than market prices, allow them to dominate sectors in which they could be massive beneficiaries of government subsidies, speed their accession of permits and licenses, and limit their regulatory burden. Despite the need for urgent structural reforms to cover for labor market inefficiencies and other serious problems, the economy continued to sustain buoyant growth rates in the period 2004-2010. According to Ikram (2018), this fragile state led to the immense demonstrations against President Mubarak in January 2011 (Pollock, 2019).

3.2 The Political Economy of the Egyptian Public Debt (2011 – 2017)

Debt sustainability in Egypt and its context came to increasing attention after public debt almost tripled in the last decade, shown in Figure 6, accompanied with other deteriorating debt-related ratios. The situation called for new efforts to contain vulnerabilities stemming from increasing levels of debt.

Figure 6: Stock of Total Public Debt in billions of EGP: 2009-2020

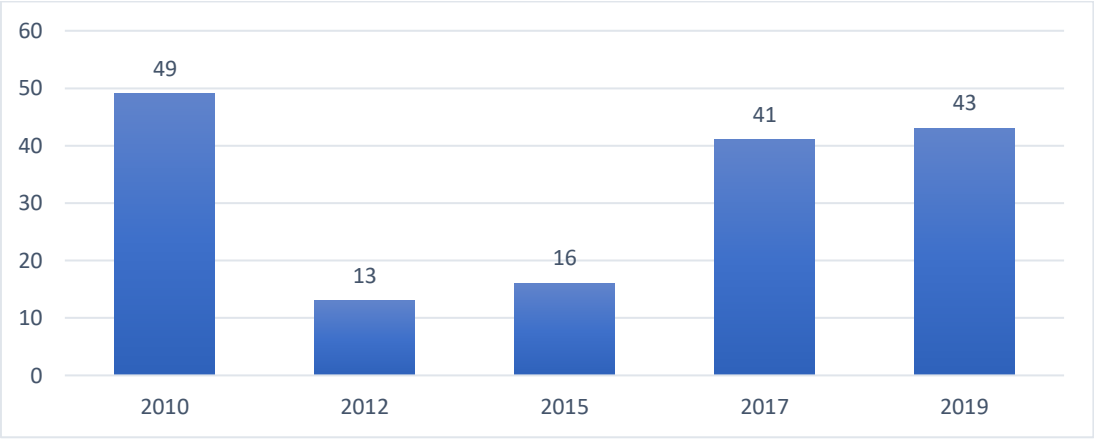


Source: Egyptian Ministry of Finance

3.2.1 Transparency vs Discretionary Fiscal Policies

Based on the recent Open Budget Index, shown in Figure 7 calculated annually by the International Budget Partnership, Egyptian fiscal transparency falls into a group of countries with 'insufficient' data provided by publishing 'limited information', with a score of 43 and ranked 61st of the 117 countries.

Figure 7: Egypt's Open Budget Index Score



[4] Source: International Budget Partnership

[4] The Open Budget Survey is a comprehensive analysis that evaluates whether governments give the public access to budget information and opportunities to participate in the budget process at the national level.

The erosion of fiscal transparency and discretionary policies might be the cornerstones of an unexpected surge in debt as explained in public finance management, coexisting with other adverse financial and economic consequences for both; taxpayers and the society. Focusing on the Egyptian context, public debt has been a threatening problem to the Egyptian economy in the post-revolutionary era since 2011. Throughout modern history, Egypt has been suffering from increasing levels of debt that reached prodigious levels in recent years; topped in 2017 with a ratio of 103% of GDP. Due to the increasing levels of government spending as well as declining sources of revenues, borrowing rates are being maintained at high levels in various cases. Looking back at the period 1985 – 2016, the growth rate of public debt surpassed the overall growth rate of the Egyptian economy. In the early 2000s, the increased public spending has been contributing to inefficient sectors; higher costs of imported goods, an apogee in subsidies and wages of employees in the public sector. In addition to this, agreements with the International Financial Institutions represent another main reason behind the increase.

However, it is worth noting that the fiscal transparency is only one factor of debt dynamics and it is captured in different approaches through the residual term. More interestingly are the discretionary policies. In essence, fiscal policy is seen as the authorities'' commitment to follow a particular rule and hence implies an automatic response to the state of the economy. Yet, discretionary fiscal policy is different from the automatic fiscal stabilizers that take place during recessions as the government attempts to spend more, whereas the discretionary fiscal policy aims at stabilizing the business cycle through changes in government spending and in taxes levied (Taylor, 2009). Enacting fiscal policy requires a longer time compared to changing monetary policies due to the existence of multiple lags. To start with, a recognition lag occurs to describe the time the economic statistics take to reflect an actual change or a downturn in the economic activity. Afterwards, as the policymakers became aware of the issues, they propose fiscal policy bills that are revised, negotiated, audited, and approved; presenting a legislative lag. Finally, the implementation lag occurs as the government disperses the funds to the legislated authorities and waits to reap the benefits of the program.

Expansionary and contractionary fiscal policies can help in ending recessions and reducing inflationary pressures respectively. However, given the uncertainties over the interest rate effects, the prementioned time lags, and unpredictable political environment, economists and policymakers may view the discretionary fiscal policy as a 'blunt' instrument, yet its importance arises in extreme economic situations including long recessions. Otherwise, policymakers prefer working with the automatic stabilizers and focus alternatively on monetary policy to steer the short-term countercyclical efforts (Hebous, 2010).

3.2.2 Egypt's 2016 IMF-Supported Reform Program

In 2016, Egypt engaged in a reform program under the IMF consultation upon approving a three-year extended arrangement under the Extended Fund Facility (EFF) for an amount of approximately $12 billion. The program primarily aimed to reverse the preceding policies that resulted in massive fiscal imbalances. The program also aimed at reducing deficits and public debt ratios as well as restoring the macroeconomic stability and promoting inclusive growth. The program is formulated on four main pillars:

i. Policy adjustment including liberalization of foreign exchange system, monetary policy aimed at containing inflation and strong fiscal consolidation to ensure public debt sustainability
ii. Strengthening the social safety nets for the first time by increasing the spending on food subsidies and cash transfers, protecting those who might be affected the most with the repercussions. The Fiscal Policy also included the shift to VAT for a projected increase in tax revenues by 2.5% of GDP
iii. Structural reforms including greater access to finance to SMEs, and new insolvency and bankruptcy procedures
iv. Fresh external financing to close the financing gaps. The financing gap for the program is about $35 billion, with about half of the gap resulting from the need to replenish reserves

. The Executive Board of the IMF (International Monetary Fund, 2017) completes a review every 6 months in an attempt to evaluate the performance of Egypt and projects any potential deviations. After the first review, the IMF praised the authorities' promising performance. In the process of completing the first review, the Executive Board has approved request for waivers of June performance criteria for the primary fiscal balance and the fuel subsidy bill. They were initially missed due to higher costs of imported food and fuel products caused by larger-than-expected depreciation of the Egyptian Pound. It was approved since it is considered a kind of an external shock, and the stronger fiscal adjustments were projected to keep the program objectives on track for the coming 2 years.

There were 3 measures that have been already met prior to the initiation of the program, counted as prerequisites illustrated in Table 1 below:

Table 1: Prerequisites of the IMF Program in 2016

Measure	*Objective*	*Timing*
Hold foreign exchange auction at a rate which eliminates the estimated real overvaluation	Eliminate misalignment and foreign exchange shortages	Met
Replace sales tax with a broad-based VAT while providing taxpayers with input tax credits and refunds	Modernize tax system and improve revenue collection	Met
Increase gasoline and diesel prices at the pump by an average of 35%	Continue implementing fuel subsidy reform to increase efficiency and reduce fiscal burden	Met

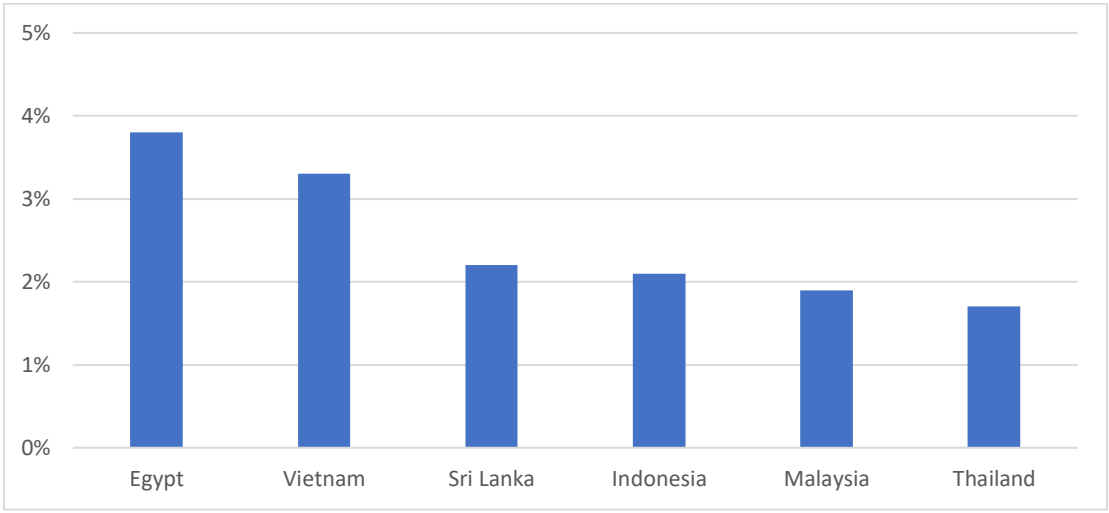
In the final review, dated October 2019, the IMF confirmed that Egypt had successfully completed the program and met its main objectives through the sound policies and the authorities' strong ownership of the program. Reported as broadly-

favorable, this is considered one of few successful programs with IMF following several attempts back in 1977 and 1987, and 1991

3.3 Recent General Overview

The close-to-zero interest rates made borrowing a painless decision with a nonexistent immediate cost. However, this does not mean that borrowing came gratuitously, in fact all nations now are exposed to greater risks had the interest rate risen in the future (Nagle & Sugawara, 2021). Even with vaccines rolling out, issuance is almost unchanged compared to pre-pandemic levels as a result of the low rates. The prevailing interest rates in advanced economies are below the ones charged in EMDCs on average. It is worth mentioning that Egypt now possesses the title of having the highest real interest rate in the world, as evident in Figure 8, as of March 2021. This came in line with the fact that foreign holdings hit a new high of $28.5 billion early in 2021.

Figure 8: Egypt has the Highest Real Interest Rate in the World: March 2021

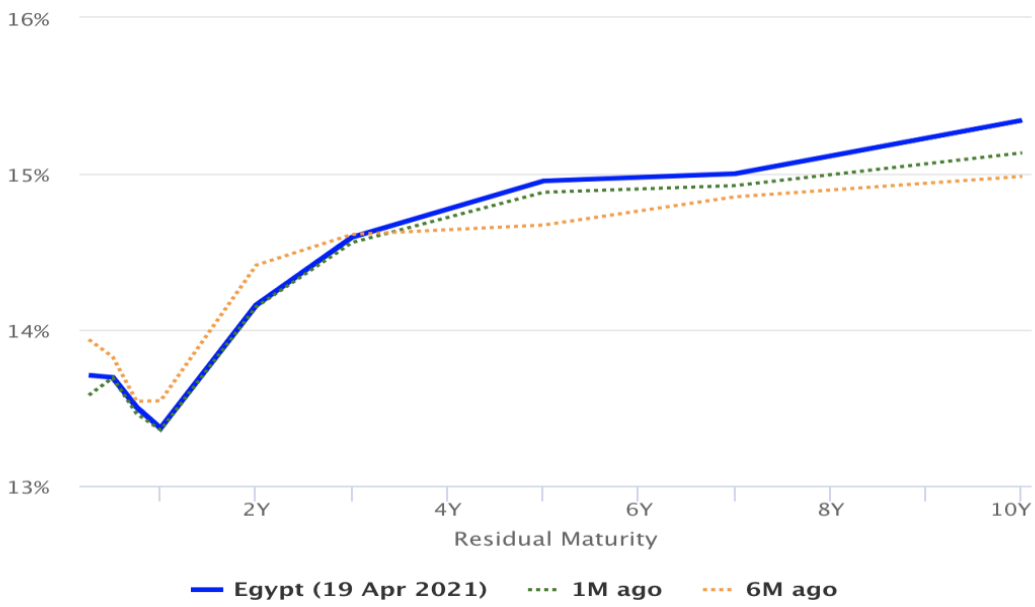


Source: Bloomberg

Policymakers should have an imaginative approach of dealing with the ongoing uncertainties and with the increasing debt-financed government spending. The fiscal costs may run excessively high, making the overall once-sustainable public debt unsustainable while running successive large deficits. A well-designed fiscal policy is indispensable to balance between rolling back on stimulus packages and exposing their economies to a cumbersome debt distress.

The yield curve assists investors in predicting the course of interest rates in the near future. Figure 9 shows Egypt's yield curve, demonstrating a positively-sloped normal curve, finally normalizing upon being inverted for almost 3 years following the Egyptian Pound depreciation. The rising long-term yields, in response to the expansionary efforts, may reduce the pressure on the budget through shifting investors from a short-term security to a higher-yield long-term security. Upon praising the Egyptian authorities' response during the pandemic, JP Morgan emerging-market government bonds index is expected to allow Egypt to re-join within six months, according to the Egyptian Minister of Finance, Mohamed Maait. It is noteworthy that Egypt has been delisted from the index since 2011. Extending debt maturities and adjusting the yield curve were the main drivers of the decision.

Figure 9: Egypt Yield Curve: 19 April 2021



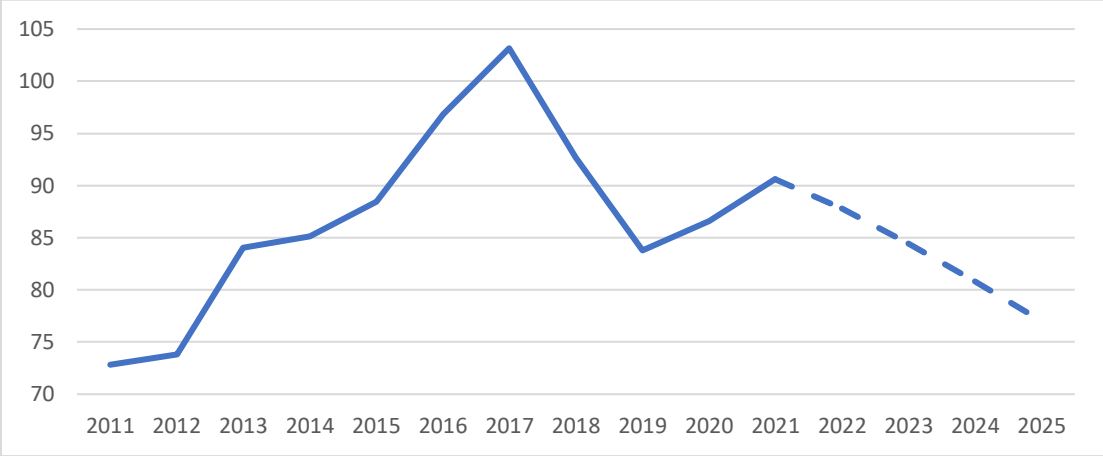
Source: World Government Bonds

Egyptian authorities were making significant progress in reducing public debt prior to COVID-19 Pandemic, from hitting a 100% to GDP in FY2016/17, upon being topped by a $12 billion loan by IMF; aimed at structural reforms, to 85% to GDP in FY2018/19. Unfortunately, the crisis has put once again serious pressures on public finances, expecting a debt ratio of 93% by the end of FY2020/21 (International Monetary Fund, 2021). As the crisis eases, running primary surpluses will become

requisite to restore public debt on a declining path. The Egyptian authorities are attempting to create fiscal space by extending debt maturities and beefing up revenue mobilization to manage the financing needs.

Egypt's total public debt-to-GDP has astutely risen over the last decade, particularly worsened following the exchange rate devaluation in late 2016. Since then, the government has made it a priority to curb the debt burden to 92% of GDP in FY2018/19 and 80% by 2022 as shown in Figure 10. The mentioned targets will definitely require amendments following COVID-19 circumstances, yet the desire to control the debt burden remains extremely strong. On the bright side, the Egyptian government benefits from relatively limited currency risk, with 74.3% of the total public debt denominated in local currency, and almost two-thirds of the external debt is either bilateral or multilateral.

Figure 10: Historical Values of Egypt's Public Debt to GDP and 5-Year Forecast

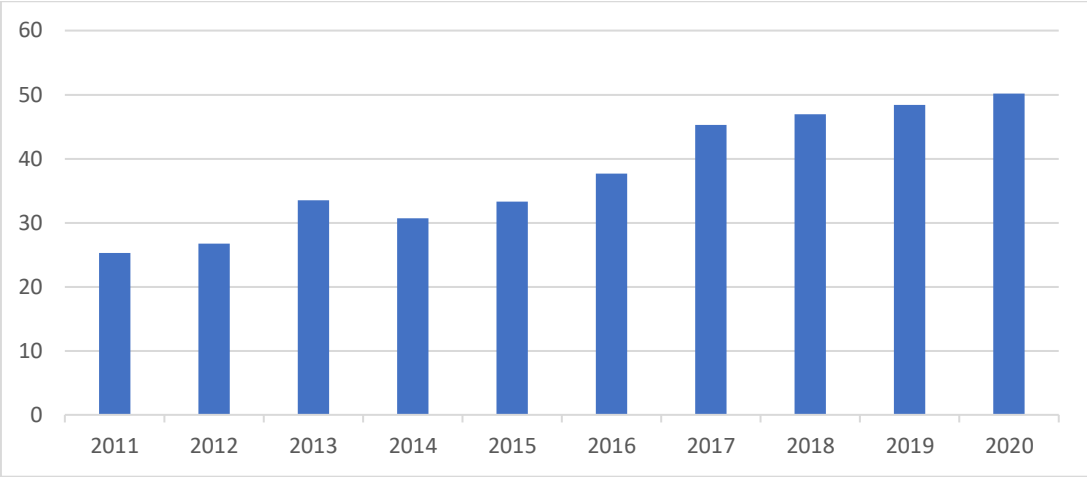


Source: Egyptian Ministry of Finance and IMF

Concessional debt attracts a below-market interest rate and can very likely have an extended grace period for repayment. In addition to this, the Central Bank of Egypt has been accumulating foreign exchange reserves to ensure that the country can cover the short-term obligations in foreign currency had there been any pressures on the exchange rate. Following 2016, there has been a rapid increase in short-term treasury bills which in turn imposes a great rollover risk along with a hefty interest expense

shown in Figure 11 (Fitch Solutions Country Risk & Industry Research, 2020). As per the Ministry of Finance (2020) , interest expense accounted for 50.2% of total revenues in the latest fiscal year. Extending the country's maturity profile can become probable though due to Egypt's ability to raise finance in the international debt markets with moderate borrowing costs. With the support of the regional heavyweights, and the relatively low external debt burden, there is a positive investor sentiment that might help Egypt pan out that threat.

Figure 11: Egypt's Interest Payments as % of Government Revenues



Source: Egyptian Ministry of Finance

Despite being a tiny chunk of the money borrowed, the focus on aid comes as an occasional alternative to debt relief in terms of closing the financing gaps, unlike the conventional rescheduling by Paris Club. With substantial pledges of financial assistance received by Egypt, availability of financial resources, at least in the short-run, have been guaranteed. This has happened at many points in history, especially and most notably, during the transition to democracy after 2011. Foreign aid in fact comes in many forms including grants, 'soft' loans, joint ventures, foreign direct investment, and technical assistance. It has been argued that foreign aid instigates several distortions in the domestic political economy of the recipients of aid. Distortions come in the forms of debt crisis, poverty, increasing technological gap, and a disequilibrium in the foreign sector (Omotolaa & Saliu, 2009).

3.3.1 Structural Fiscal Position

In spite of the fact that COVID-19 will urge the existence of some fiscal stimulus that might interrupt the narrowing fiscal deficit for a couple of years, it is expected that the trend will resume afterwards and over the long-term. In order to maintain the declining trend of the fiscal deficit, increased efficiency may be required in tax collection, public sector wage bill, and lower debt-servicing costs, whilst 'reform fatigue' might represent a major risk along with the implementation risk due to expected pushback from youth population.

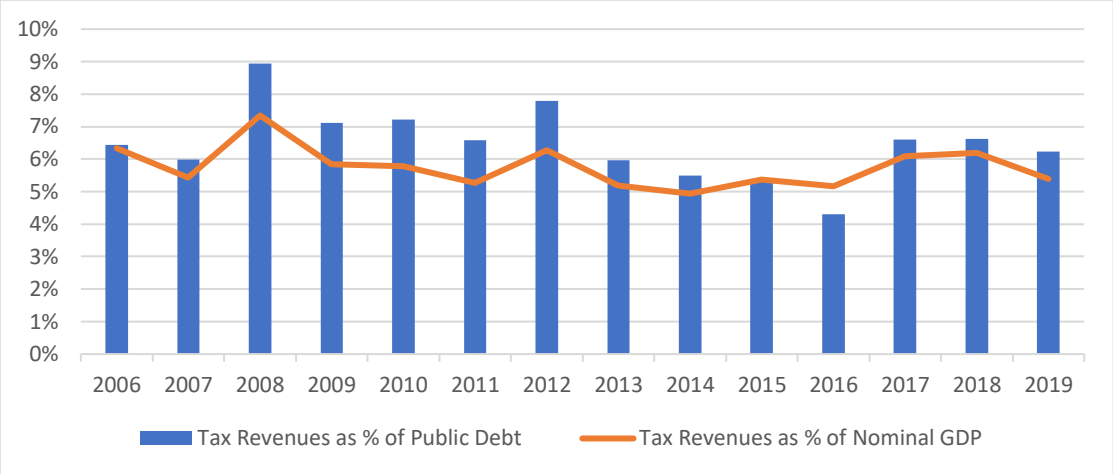
Egypt lacks a multi-year fiscal framework in place currently despite the presence of a medium-term debt framework since it does not specify certain targets that must be met whether on the revenues or the expenditure sides. However, certain reforms had been recently introduced to manage the government's expenditures; subsidy cuts on energy, electricity, and transport to align prices with international levels, introduction of a fully-fledged VAT system, and tighter control over new hires and modernization of the public employment framework.

Egypt is currently working on certain plans to set up a sovereign wealth fund, the Egyptian Fund, to assist in managing state assets, with an initial capital of EGP200bn. It is expected that 50% of this funding will come from selling the minority stakes in almost 20 state-owned enterprises on the Egyptian Stock Exchange to help boost state finances. If fully implemented, reforms like this shall help reduce the role of the public sector and promote a private sector-led growth. This could significantly help in reducing Egypt's contingent liabilities had they materialized sometime in the future, and hence stabilize the public debt.

On the revenues side, there has been sharp macroeconomic readjustments taking place since the initiation of the IMF reform program in 2016. It particularly highlighted a couple of weaknesses of the Egyptian economy: an overall low tax revenue to GDP ratio compared to MENA countries and a heavy reliance on revenues from indirect taxes; VAT alone constituted a third of total revenues in FY2018/19. Even though this reduces the imposed risks relating to collection, it introduces a fiscal

challenge in terms of the impact on the lower-income proportion of the population; which is huge in Egypt. Consequently, a ceiling to the government's ability to raise tax revenue is probable had it not enhanced the capacity to raise direct taxation receipts as shown in Figure 12. In order to do so, formalizing a bigger share of the economy will be needed; as the ILO estimates that around 50% of the workforce is informal.

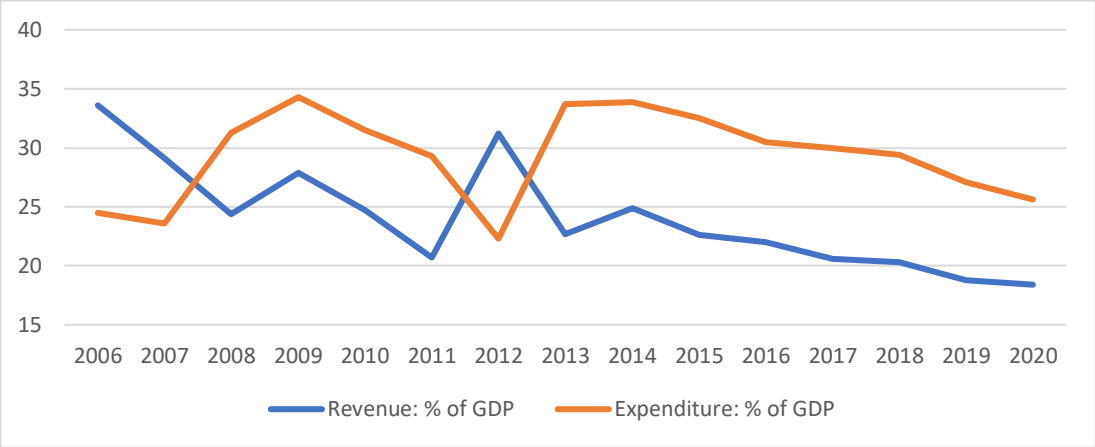
Figure 12: Tax Revenues as a percent of Public Debt and Nominal GDP



Source: Egyptian Ministry of Finance

Looking at the expenditures, interest payments explain the biggest chunk of the government's spending, followed by subsidies, grants, and social benefits. As the government eliminated fuel subsidies on almost all energy products, this should have generated substantial savings for the government, however, with spiking demands for wage increases and other capital projects on a sharp uptrend, the government still appears committed to reducing the fiscal deficit as spending growth does not appear to smooth at least in the medium term evident in Figure 13 (Ministry of Finance, 2020). Such changes to the primary balance may help in limiting Egypt's borrowing and debt accumulation efforts.

Figure 13: Government's Share of GDP on the Decline: Government Spending and Revenue



Source: Egyptian Ministry of Finance

3.4 Empirical Studies on Egypt

Of the few studies conducted on Egypt public debt sustainability, Neaime (2010) studied the Egyptian situation in his attempt to judge few countries debt sustainability in the MENA region using the present value constraint (PVC) framework. The approach ventures to evaluate whether the adopted fiscal policies violate the budget constraint. The study failed to reject the null hypothesis of nonstationary of Egypt's government revenues and spending. The empirical results concluded weak sustainability for Egypt as the government's budget deficit converged to zero, and with a cointegrating coefficient close to -1.

Alba et al. (2004) focused on understanding the debt dynamics in Egypt and attempted to justify the reasons behind the current debt ratios and the probability of its sustainability according to the present trends. Despite concluding that reasonable fiscal adjustments can improve debt trajectories in the foreseeable future, they pointed out to the threatening trends observed: a high debt to GDP ratio, debt changes on the basis of structural rather than cyclical basis, and structural weaknesses affecting the budget balance.

Through adopting a country-specific tailor-based multiscenario approach, Kamar and Bakardzhieva (2016)they carried out 3 scenarios: intermediate assessment, optimistic perspectives, and pessimistic outlook. Their conclusion turned out to point to a worrisome situation of the Egyptian public debt sustainability. When comparing the scenarios to the IMF's approach, even the optimistic scenario yielded more pessimistic data compared to the IMF's. The study also highlighted the role of political instability in undermining the debt sustainability.

El Mahdy and Torayeh (2009) evaluated the impact of Egypt's public debt on economic growth through estimating an equation with growth rate as the independent variable and a vector of control variables, debt ratio and a residual as the dependent variables. The study capitalized of cointegration, error correction term and the vector autoregression techniques for estimation. Despite running 5 scenarios beside the baseline's, the results returned an unsustainable debt under only one scenario with a shock to all macroeconomic variables.

Chapter 4 Different Methodologies for Measuring Sustainability

This research resides on the use of two different approaches towards measuring debt sustainability. The first approach is based on the adoption of the IMF DSA Framework and the second is the fiscal reaction function on the basis of two econometric methodologies: ARDL and VAR.

4.1 IMF Approach to Measuring Public Debt Sustainability

In order to ensure that the model is adopted properly, re-performing the baseline available in the 2021 Article IV report was the starting point. The forecasted values were taken from the World Economic Outlook; the same source used by the IMF to build its projections. Instances when the IMF teams of economists work with local and regional authorities to build their estimates, those estimates were used in the model. This study utilizes the MAC DSA Template made available by the IMF. The template is organized around an externally-supplied macroeconomic baseline from which debt evolution is calculated. The DSA analysis does not thoroughly publish the details

binding the macro-framework though. Instead, the DSA emphasizes the debt to GDP ratio as a result of the budget deficit, the interest rate, the growth rate, the inflation, and the exchange rate. The projected path of debt to GDP is then used to judge the sustainability according to its declining, stagnant, or explosive nature.

First, we define

$$\lambda_t = \frac{i_t - \gamma_t}{1 + \gamma_t} \tag{1}$$

Where i_t is the nominal interest rate in period t, paid on debt stock outstanding at the end of t-1, and γ_t is the nominal growth rate between t-1 and t.

However, under the assumption that the variables are constant over time, (1) can be rewritten as

$$\lambda = \frac{i - \gamma}{1 + \gamma} \tag{2}$$

Notice that

$$1 + \lambda = \frac{1 + \gamma}{1 + \gamma} + \frac{i - \gamma}{1 + \gamma} = \frac{1 + i}{1 + \gamma} = \frac{(1 + r)(1 + \pi)}{(1 + g)(1 + \pi)} = \frac{1 + r}{1 + g}$$

$$1 + \lambda = \frac{1 + i}{1 + \gamma} = \frac{1 + r}{1 + g} \tag{3}$$

and thus

$$\lambda = \frac{i - \gamma}{1 + \gamma} = \frac{r - g}{1 + g} \tag{4}$$

Where r is the real interest rate, g is the real GDP growth rate, and π is the change in GDP deflator.

Based on the above, the main equation that governs the dynamics of the debt ratio is

$$d_t = (1 + \lambda_t) d_{t-1} - pb_t \tag{5}$$

Where d_t is the debt at the end of period t, as a ratio to GDP at t, and pb_t is the primary balance in t, as a ratio to GDP at t.

The overall balance is linked to the primary balance by the following equation

$$b_t = pb_t - \frac{i_t}{1+\gamma_t} d_{t-1} \tag{6}$$

Where b_t is the overall balance at t, as a ratio to GDP at t.

Hence, the main recursive equation to debt ratio becomes

$$d_t = \frac{1}{1+\gamma_t} d_{t-1} - b_t \tag{7}$$

From equations (5) and (7), the primary balance and overall balance that are consistent with a constant debt ratio (d*) are shown below aw pb* and b* respectively.

$$pb^* = \lambda d^* \tag{8}$$

$$b^* = \frac{-\gamma}{1+\gamma} d^* \tag{9}$$

If the overall balance is set at b*, then the debt to GDP ratio will converge to d* asymptotically from any initial level it reached, provided that γ is positive. However, for primary balance, setting the primary balance at the constant level pb* will put the debt ratio on an explosive path, unless the starting debt ratio is already d* or λ<0.

In order to calculate the debt-stabilizing primary balance, that is the constant primary balance that will bring the debt to a desirable level over the long-run, equation (10) below should be employed. Given an initial debt ratio denoted as (d_0) and a target

debt to GDP ratio to be reached in N periods (d_N^*), the constant primary balance (pb^*) that allows an economy to reach the target ratio if sustained throughout the N periods is:

$$pb^* = \frac{\lambda}{(1+\lambda)^{-N}-1}((1+\lambda)^{-N} d_N^* - d_0) \quad (10)$$

Finally, the debt dynamics and the decomposition of changes in the debt ratio can be analyzed and expressed in terms of real terms of interest rates and exchange rates using the following equation:

$$d_{t+1} - d_t = \left(\frac{1}{1+g_{t+1}}\right) * \left(d_t * \left[r_{t+1}^d \frac{d_t^d}{d_t} + r_{t+1}^f \frac{d_t^f}{d_t} \right] - d_t^* g_{t+1} + d_t^f * \xi_{t+1} * \left(1 + r_{t+1}^f\right) \right) - pb_{t+1} + o_{t+1} + res_{t+1} \quad (11)^5$$

Contribution of the effective real interest rate

Contribution of real GDP growth

Contribution of the real exchange rate

Contribution of primary balance and other factors

Where $1+\xi_{t+1} = \frac{e_{t+1}}{e_t}$, e_{t+1} is the nominal exchange rate (LC/USD) at the end of period t+1, and $o_{t+1}$is other identified debt-creating flows in period t+1.

4.2 Econometrics Methodology Data

Timeseries quarterly data for the period Q3-2005 till Q2-2020 was used in the study, representing 60 observations. Limitation to this time period has been imposed as a result of the lack of data or the availability of only annual data but also preferred due to the inconsistency in definitions prior to this time period and changes in the consolidation level of the budget.

4.2.1 Definition of the General Government and the Public Sector

To ensure consistency between both approaches, the government referred to in this thesis is the general government. The general government in Egypt includes the budget

[5] Subscripts refer to time periods and the superscripts "f" and "d", refer to foreign-currency and domestic-currency denominated debt, respectively.

sector, National Investment Bank (NIB), and Social Insurance Funds (SIF). The budget sector includes the central government, local government, and the public service authorities. It is considered the narrowest definition of the public sector. The NIB is entirely owned by the government and is responsible to finance the investment projects of the government and the public authorities, with very tiny chink used to be directed to the private sector historically. The NIB finances itself through either borrowing from the SIFs or issuing certificates to the general public. On the other hand, SIFs are fully-funded benefit schemes that invest most of their reserves to pay for the government liabilities. They are funded by the contributions of the participants from employers and employees and the general government.

Defining the public debt accurately shall comprehend the whole range of liabilities of the public sector. Despite that the latter should include the central government, local governments, state-owned enterprises and authorities, and the central bank to capture all explicit debts and implicit guarantees, this is not the case in application. According to the Central Bank of Egypt, the public debt is limited to the definition of the general government as the public sector. However, it is crucial to note that SIFs debt is not netted out, and does not appear as internal to the public sector. The coverage of the public sector is an important issue because as the fiscal framework becomes decentralized, sub-national governments are given access to create more debt. In addition, the off-budget entities such as the state-owned enterprises and the public-private partnerships present contingent liabilities for the government which may offset all the country's fiscal adjustment efforts.

4.2.2 Dependent and Explanatory Variables

a. Primary Balance to GDP

Primary balance is the difference between government [6] revenues and government expenditures net of interest payment. This variable has been extracted annually and using a cubic spline interpolation quarterly data has been derived. Afterwards, the

[6] The government referred to in this section is the general government to ensure consistency with IMF Framework. The general government in Egypt includes the consolidated government budget, National Investment Bank (NIB), and Social Insurance Funds (SIF).

quarterly data is divided by the nominal GDP. The data is reported by the Ministry of Finance.

b. Public Debt to GDP

The general government's debt is divided into two parts:

i. Domestic Debt: This is reported by the Ministry of Finance in billions of Egyptian Pounds (EGP).

ii. External Debt: This is the debt owed to nonresidents by residents of an economy. It is reported by the Ministry of Finance in billions of United States Dollars (USD). The values are then transformed to EGP by multiplying it with exchange rate to unify the public debt in local currency (LC).

The total public debt is thus divided by the nominal debt to extract the debt as a ratio to GDP.

c. Output Gap

Output gap is the difference between the real GDP and the potential GDP. A positive output gap reflects a higher GDP than the potential one, and vice versa. The potential GDP is estimated using a Hodrick-Prescott (HP) filter of real GDP level data. The HP is a smoothing approach aims to fit a trend using the actual data and isolate the cyclical component. Refer to Appendices A and B.

d. Exchange Rate

The exchange rate used in this study refers to EGP/USD. That is the amount of local currency needed to purchase one USD. The data is reported by the Central Bank of Egypt (CBE).

e. Real Treasury Bill Interest Rate (12 months)

The real treasury bill is calculated through deducting inflation from the nominal interest rate. The data of the nominal rates is extracted from the International Monetary Fund.

f. Inflation

Inflation rates are calculated quarterly through the Consumer Price Index (CPI) Growth from monthly Consumer Price Index. The data is provided by the Central Agency for Public Mobilization and Statistics (CAPMAS) with base 2018-2019=100. Prior to Q1-2011, the data is sourced from the International Monetary Fund.

4.3 Stationarity Tests

In this study, a couple of unit root tests are employed in order to compare their results and reach a relatively definitive solution. The Augmented Dickey-Fuller (ADF) test (1981) and the Phillips-Perron (PP) test (1988), where the null hypothesis tests for the presence of a unit root in a timeseries, are based on equations (12) and (13) respectively.

$$\Delta y_t = \beta_1 + \delta y_{t-1} + \alpha_1 \Delta y_{t-1} + \alpha_2 \Delta y_{t-2} + \cdots .. + \varepsilon_t \quad (12)$$

$$y_t = \alpha + \rho y_{t-1} + \varepsilon_t \quad (13)$$

Where ε_t is a white noise error term

4.4 Autoregressive Distributed Lag Model

In modeling time series, this model has several advantages over others, primarily due to allowing a mix of I(0) and I(1) variables; overcoming the fact that different conclusions may arise from unit root tests. In addition, it is a single equation model and thus allows focus on the variable of interest and its dynamics and facilitate interpretations. The dependent variable here can be regressed on its own lags as well as lags of other exogenous variables.

The autoregressive distributed lag model of Pesaran and Shin (1999), and Pesaran, Shin, and Smith (2001) is employed in this study with the following specification:

$$y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{j=0}^{q} \beta_j' X_{t-j} + \gamma' Z_t + \varepsilon_t \quad (14)$$

Where y_t is the dependent variable which is primary balance to GDP (PRIM_BAL), X_t is a vector of explanatory dynamic variables, Z_t is a vector of

exogenous static variables that appear only contemporaneously and ε_t is a mean-zero uncorrelated error term.

In this study, all our regressors are dynamic regressors so the model changes to the following specification:

$$y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{j=0}^{q} \beta_j' X_{t-j} + \varepsilon_t \quad (15)$$

Hence, run the following regression:

$$PRIM\_BAL_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} PRIM_{BAL}{}_{t-i} + \sum_{i=0}^{q_1} \beta_{1i} PD_{GDP}{}_{t-i} + \sum_{i=0}^{q_2} \beta_{2i} OUT_{GAP}{}_{t-i} \sum_{i=0}^{q_3} \beta_{3i} EXCH_{t-i} + \sum_{i=0}^{q_4} \beta_{4i} T_{BILL}{}_{t-i} + \sum_{i=0}^{q_5} \beta_{5i} INF_{t-i} + \varepsilon_t \quad (16)$$

The dynamic regressors are allowed to have different lag structures denoted by p and q_i, i=1,2,3. Choice of lags determined by Schwarz Information Criterion.

The Bounds Test is conducted via the following regression:

$$\Delta PRIM\_BAL_t = \tilde{\alpha}_0 + \sum_{i=1}^{p} \tilde{\alpha}_{1i} \Delta PRIM\_BAL_{t-i} + \sum_{i=0}^{q_1} \tilde{\beta}_{1i} \Delta PD\_GDP_{t-i} + \sum_{i=0}^{q_2} \tilde{\beta}_{2i} \Delta OUT\_GAP_{t-i} + \sum_{i=0}^{q_3} \tilde{\beta}_{3i} \Delta EXCH_{t-i} + \sum_{i=0}^{q_4} \tilde{\beta}_{4i} \Delta T\_BILL_{t-i} + \sum_{i=0}^{q_5} \tilde{\beta}_{5i} \Delta INF_{t-i} + \delta_0 PRIM\_BAL_{t-1} + \delta_1 PD\_GDP_{t-1} + \delta_2 OUT\_GAP_{t-1} + \delta_3 EXCH_{t-1} + \delta_4 T\_BILL_{t-1} + \delta_5 INF_{t-1} + \eta_t \quad (17)$$

The Bounds Test is the test of a null hypothesis of these coefficients being jointly equal to zero. If they are jointly equal to zero, it means that the lagged levels do not matter, and thus we only need to focus on the short-term dynamics.

The Bounds Test is a F-Test based on the following hypothesis,

$$H_0: \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$$

Rejecting the hypothesis declares the existence of a long-run relationship among the variables. The test provides lower and upper bounds on the critical values based on the assumption that all variables are I(0) and I(1) respectively. A test statistic that lies above the upper bound confirms the long-run relationship. On the other hand, a t-statistic that is below the lower bound ensures that no cointegration exists. Whereas a t-statistic between the two values indicates an inconclusive result.

If there is evidence of cointegration, we can include an ECM term in equation (17). The coefficient of the ECM term could be interpreted as the speed of adjustment. Accordingly, this would be the lagged residual $\hat{\xi}_{t-1}$ from the long-run regression below:

$$PRIM\_BAL_t = \varphi_0 + \varphi_1 PD\_GDP_t + \varphi_2 OUT\_GAP_t + \varphi_3 EXCH_t + \varphi_4 T\_BILL_t + \varphi_5 INF_t + \xi_t \quad (18)$$

The coefficients derived from equation (18) represents the long-run response coefficients in the cointegrating relationship.

4.5 Vector Autoregression Model

The VAR Model, initially proposed by Christopher Sims, as well could be well-suited to examine the debt sustainability as illustrated in equation (19). An unrestricted VAR allows endogenous variables to interact without impinging theoretical structures on observations estimates. It is able to examine the joint dynamic behavior among the variables supplied to the model.

$$Y_t = \beta_0 + \sum_{k-1}^{p} \beta_k Y_{t-k} + \varepsilon_t \quad (19)$$

Where Y_t is a Kx1 vector stochastic process that includes all explanatory variables, β_k are KxK matrices, and ε_t is a vector white noise process satisfying three conditions:

E (ε_t) = 0,

E $(\varepsilon_t \, \varepsilon'_{t-s}) = 0$, and

E $(\varepsilon_t \, \varepsilon'_t) = \Sigma$

Where Σ is a positive definite matrix

Chapter 5 Employing the IMF Approach to Measure Egypt Public Debt Sustainability[7]

This section of the study focuses on adopting the IMF Approach to evaluate Egypt public debt sustainability. There has been an added value to re-running the exercise in comparison to the mere adoption of the IMF results in the Article IV report. Being a program country, in comparison to a surveillance country, limits the debt sustainability analysis of Egypt to a couple of pages inserted in the annex of the report. By adopting this methodology, the author has been able to identify the loopholes of the approach whilst digging deeper for the reasoning behind the application of the debt sustainability analysis in the way it is done. In doing this, the template provided by the IMF for MAC DSA Framework has been used. The template is supplied with data, capitalizing on the same sources used by the IMF to ensure comparable analysis.

5.1 Data Supplied to the MAC Template

This part concentrates on the different sheets embedded in the template and the exact data used to fulfill it. There are several issues related to the coverage of public debt in the MAC DSA. Those are namely, the coverage of public sector, gross vs net public debt, and the long-term financing pressures imposed on the country. As for the coverage of the public sector, it aims to be the broadest possible conditional on the data availability. The guidelines for the MAC DSA are consistent with the use of gross debt, however, the presence of a complementary net debt analysis is yet plausible. The long-term financing pressures are not captured in the template, however, an attached memo estimating their fiscal costs may be created had those pressures deemed significant.

[7] This approach adopts the IMF approach using the data and assumptions of the latest IMF Country Report published in January 2021 (International Monetary Fund, 2021)

The ‘Basics’ sheet includes the country name, its classification under IMF definitions, and some market information. It also includes the definition of the coverage of public sector in the country, sovereign risk rating under different credit agencies, and the scale of variables used.

The ‘Data’ sheet includes observations of twelve historical years (2009-2020), and projections of five periods ahead (2021-2026). This sheet is supplied with data regarding nominal and real GDP, exchange rates, and budget data including revenues and expenditures disaggregated to isolate interest receivables and payables.

The ‘Debt and Banking’ sheet is only concerned with historical data for the same period. Debt data are disaggregated on two dimensions: short-term debt vs long-term debt and domestic-currency denominated debt vs foreign-currency denominated debt. For the banking data, private sector credit is required for the past 4 years, as well as the latest observation of the bank foreign assets and loan to deposit ratio.

The ‘Forecast’ sheet commences with a ‘Macro and Debt Service Forecast’ requiring interest and principal payments on existing debt in domestic and foreign currencies. The second part focuses on ‘Issuance of New Debt to Fill Fiscal Needs’ as per projected by the Ministry of Finance and used by the IMF’s team.

Finally, the ‘Scenario Design’ sheet aims to structure the stress tests through selecting the shocks required in addition to the conventional ones. It requires inputs regarding the shock assumptions, and the description of the customized shock, if any. For Egypt’s case, a combined macro-fiscal and contingent liability shocks are added.

An optional fan chart sheet is embedded in the template. As a default, the historical 11 years are used in order to calculate averages, variances, and covariances, and for better results, data may be extended to capture more historical observations. This might be the primary source of differences in the output because the IMF does not announce the exact data used and the results ensured that it was different from the historical 11 years.

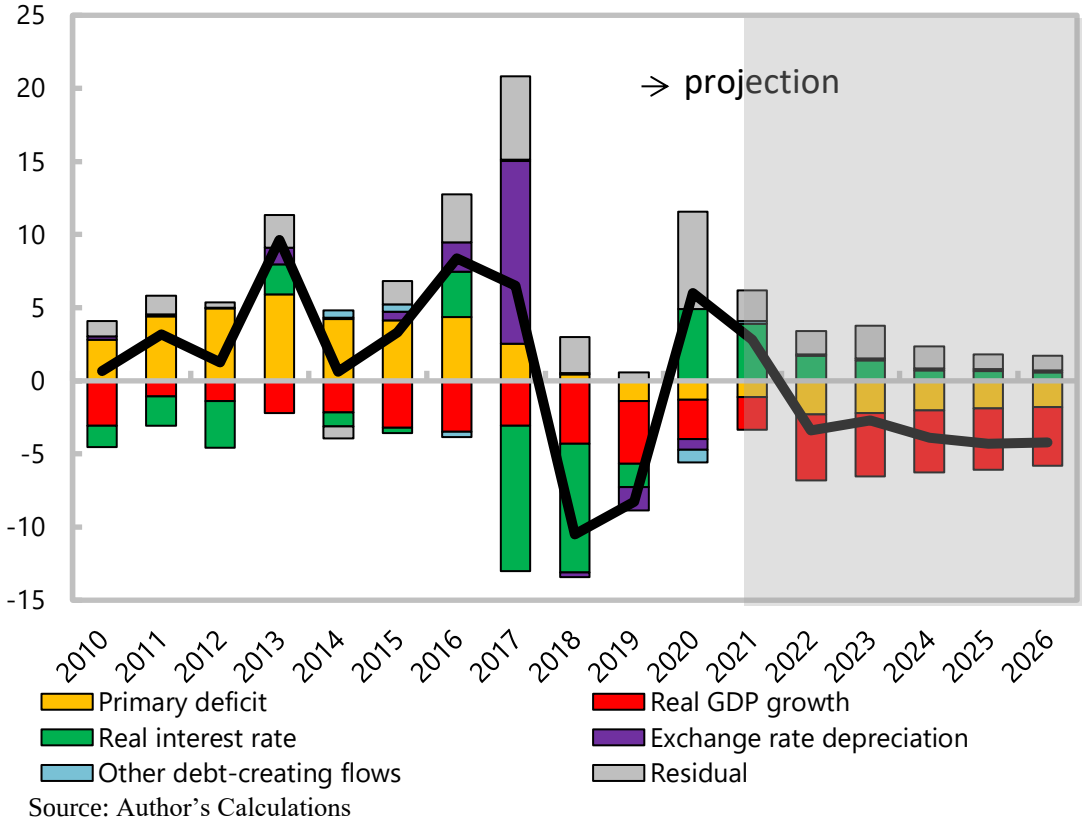
5.2 Results of the IMF Approach

Upon inserting the needed information, the template is responsible for generating the outputs necessary to comment over public debt sustainability. The outputs are also distributed over several sheets, which will be discussed thoroughly below.

5.2.1 Constructing the Baseline Scenario

The first analysis presents the projection of the baseline scenario as evident in Figure 14 below. This scenario is built around the macroeconomic framework; the one that is most likely to prevail under the programmed macroeconomic adjustment. It also focuses on the debt dynamics and outlines the contribution of the macroeconomic variables to changes in debt, capturing historical and projected debt ratios, as debt-creating flows.

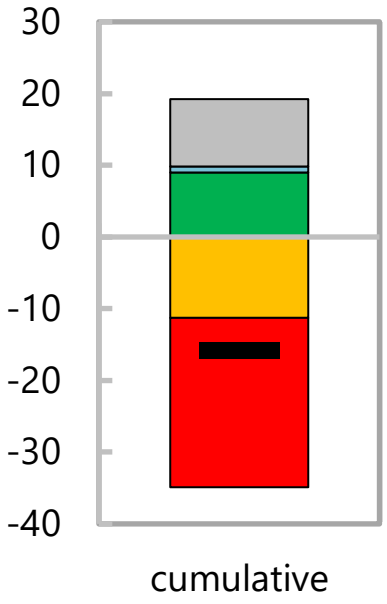
Figure 14: Debt-Creating Flows (in percent of GDP)



Source: Author's Calculations

The baseline projection indicates that Egypt shall continue to run primary surpluses for the foreseeable future, shown by the contribution of primary deficit to the downward trajectory of debt ratios of 11.3%. However, the real GDP growth remains the major source in reducing debt ratios and bringing it down to expected levels according to the baseline scenario with a cumulative contribution in the forecasted period of 23.6%. The economy, under IMF assumptions, is expected to recover modestly, from 2.8% in FY2020/21 to 5.5% in FY2021/22 and reaching 5.8% in FY2025/26, which is, in the author's point of view, overly optimistic. Those two components assist most in resuming the downward trajectory of the public debt to the projected 75% of GDP in FY2025/26.

Figure 15: Debt-Creating Flows: Cumulative



Source: Author's Calculations

On the other hand, effective real interest rates on the general government debt are projected to decline as a result of the declining inflation, expected to stabilize around 7% in the forecasted period, limiting the positive effect on increase in public debt to 9%. Other debt-creating flows are also expected to increase the debt by 0.9% represented in the general government net lending. Finally, the residuals[8], used to maintain the identity and ensure consistency between the definition of the stock and flow variables, remain a sizable portion of the drivers of debt, increasing the debt ratio by 9.4%, heightening particularly in FY2021/22 to an estimate of 2.2% of GDP. Overall, the primary surpluses and the real GDP growth are reckoned to allow debt to reach the projected ratio despite the opposing forces, with a net change of -15.7%. This has yielded a debt-stabilizing primary balance of 3.3% of GDP.[9]

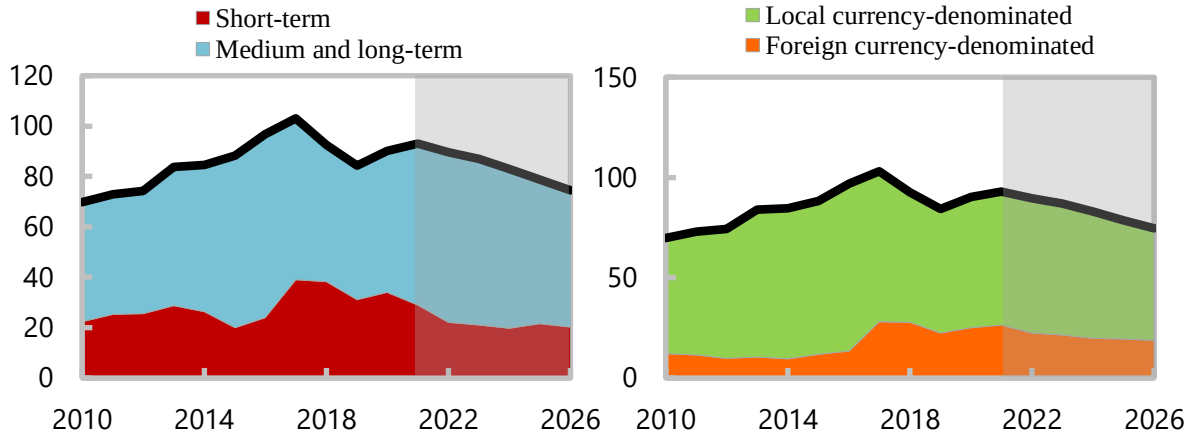
[8] Residuals include asset changes and interest revenues (if any). For projections, it also includes exchange rate changes during the projection period.

[9] This assumes that key variables remain at the level of the last projection year.

5.2.2 Forecasted Composition of the Public Debt

Proceeding with the second analysis, it starts with the composition of public debt in correspondence to the 'Debt and Banking' input sheet. Referring to Figure 16, there are risks stemming from the high level of public debt and the gross financing needs compared to the benchmarks presented earlier. The denomination of local-currency debt, representing 74% of total public debt, may mitigate some risks. Also, only 22% of the debt is held by nonresidents. Moving to maturity, the Egyptian authorities had already begun extending the maturities as shown in Figure 16 with declining short-term debt and are expected to continue further with this plan.

Figure 16: Composition of Public Debt by Maturity (left) and by Currency (right)



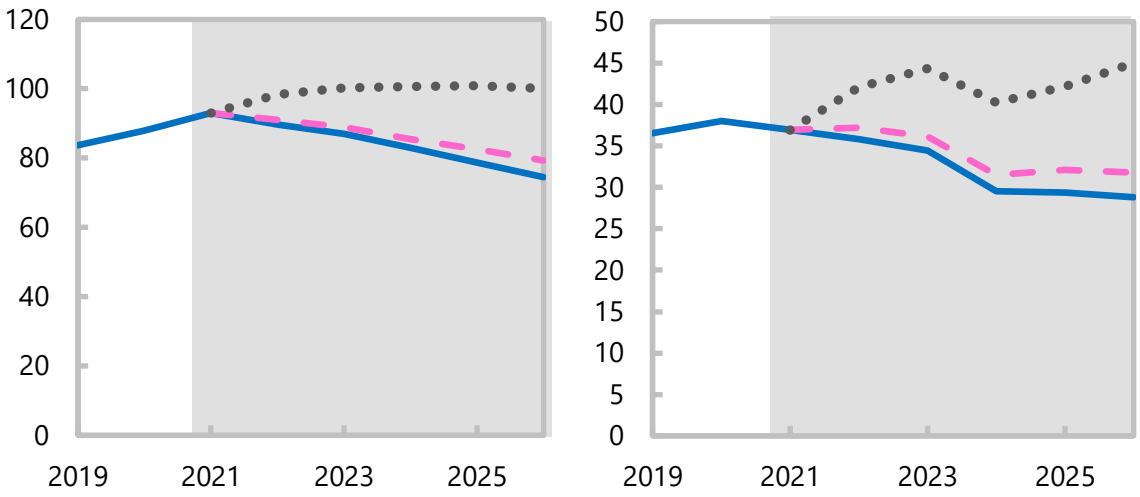
Source: Author's Calculations

5.2.3 Dealing with Uncertainty: Alternative Scenarios

The second part of this output focuses on the standardized alternative scenarios, which are part of the sensitivity analysis, besides the baseline's; historical and constant primary balance scenarios (also known as a no-policy change scenario) as shown in Figure 17. The historical scenario holds real GDP growth and primary balance at their 10-year historical average. It shows that gross nominal public debt and public gross financing needs would reach 100% and 45% in percent of GDP by FY2025/26 respectively, compared to 75% and 30%. Alternatively, stabilizing the primary balance at 1.1% of GDP, while having all other variables maintained at baseline levels, results in a ratio of 77% of public debt to GDP and approximately 32% of gross financing needs. The underlying assumptions are shown in Appendix C. This part could be used in order to judge whether the baseline assumptions are overly optimistic had the ratios differed substantially under the alternative scenarios. The historical scenario though

has the limitation of not being an appropriate benchmark due to the recent changes in the economy.

Figure 17: Alternative Scenarios: Gross Nominal Public Debt (in percent of GDP) (left) and Public Gross Financing Needs (in percent of GDP) (right)



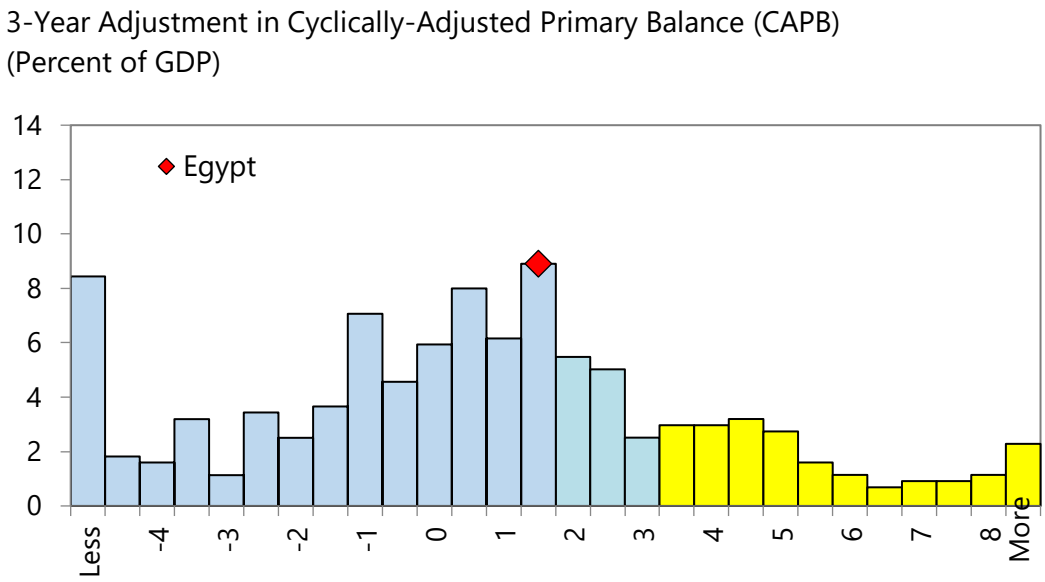
Source: Author's Calculations

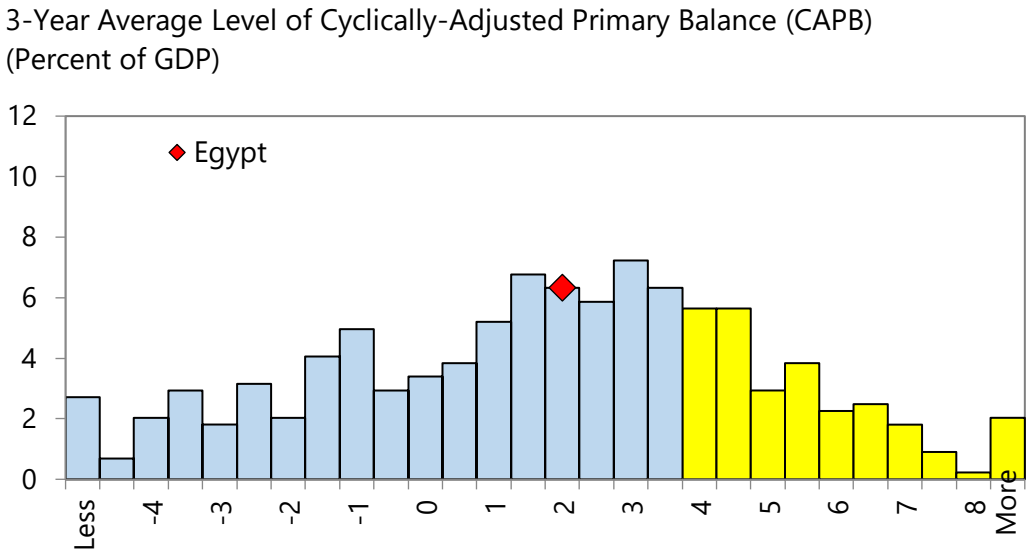
5.2.4 Realism of the Baseline Assumptions

'Realism' is one of the most influential outcomes and many risks stem from it by focusing on the realism of baseline assumptions. This is indispensable for a credible assessment of debt sustainability, and is the cornerstone of the revamped MAC DSA Framework. This relies on employing certain country-specific information as well as cross-country analysis. It starts with a forecast track record compared to program countries, shown in Appendix D. Afterwards, and more interestingly for the scope of the study, this output assesses the second realism tool; realism of the projected fiscal adjustment in a cross-country perspective as shown in Figure 18. The maximum 3-year adjustment in CAPB is plotted against a histogram of cross-country consolidation episodes. The part of the histogram shaded in yellow represents the top quartile having consolidations that exceed 3% of GDP. The below graph pointing out the level of the maximum projected 3-year average of cyclically-adjusted primary balance, and both graphs indicate that Egypt does not fall in the place that requires closer scrutiny; the top quartile.

A higher-than-usual uncertainty is entailed form the staff forecasts. An insignificant optimistic bias was recorded from the historical forecasts, which the staff attributed to the political instability, especially due to the fact that the forecast accuracy has ameliorated in the last couple of years. However, the current circumstances impose exceptional uncertainty on the forecast accuracy, not only on Egypt, but the global economy. A delayed recovery would further increase debt ratios vis-à-vis the baseline scenario, and the authorities expected reaction of tightening financial conditions may result in higher interest rates which will deviate the debt from its trajectory. In addition, the government may be encouraged to increase the public support to assist deteriorating sectors of the economy. Contingent liabilities can also arise from various factors including a call on the publicly guaranteed debt (materialization of contingent liabilities).

Figure 18: Assessing the Realism of Projected Fiscal Adjustment



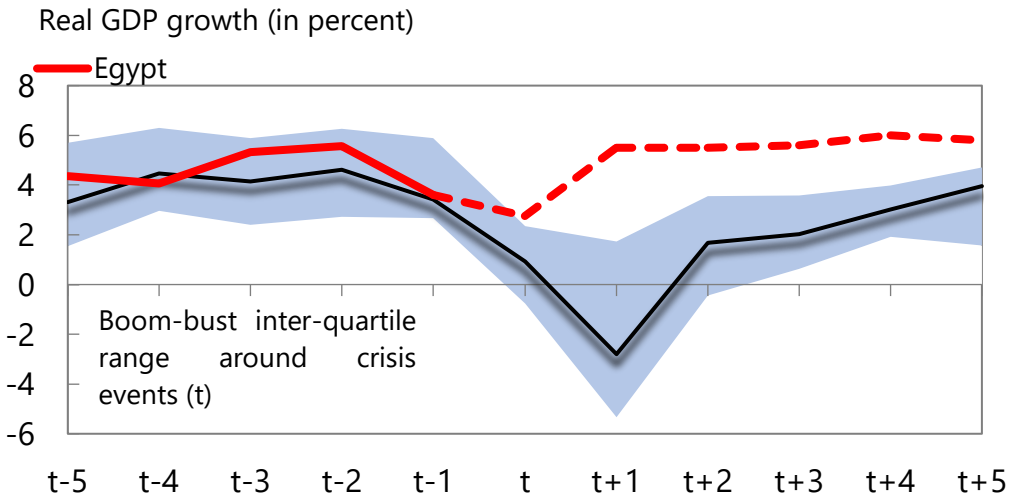


Source: Author's Calculations

5.2.5 The Boom-Bust Tool

Finally, a boom-bust analysis is performed to assess the growth projections in countries which are susceptible to a probable painful bust upon entering a boom-bust cycle. This analysis is only applied to countries that are identified to be in a boom, and the IMF chose to apply it to Egypt due to the positive output gap during the last 3 consecutive years. It juxtaposes the projections with incidents when boom-bust cases occurred in the past. The tool provides a warning that had Egypt entered a bust, the observed values may be a lot lower than the projected levels shown in Figure 19.

Figure 19: Boom-Bust Analysis[10]



Source: Author's Calculations

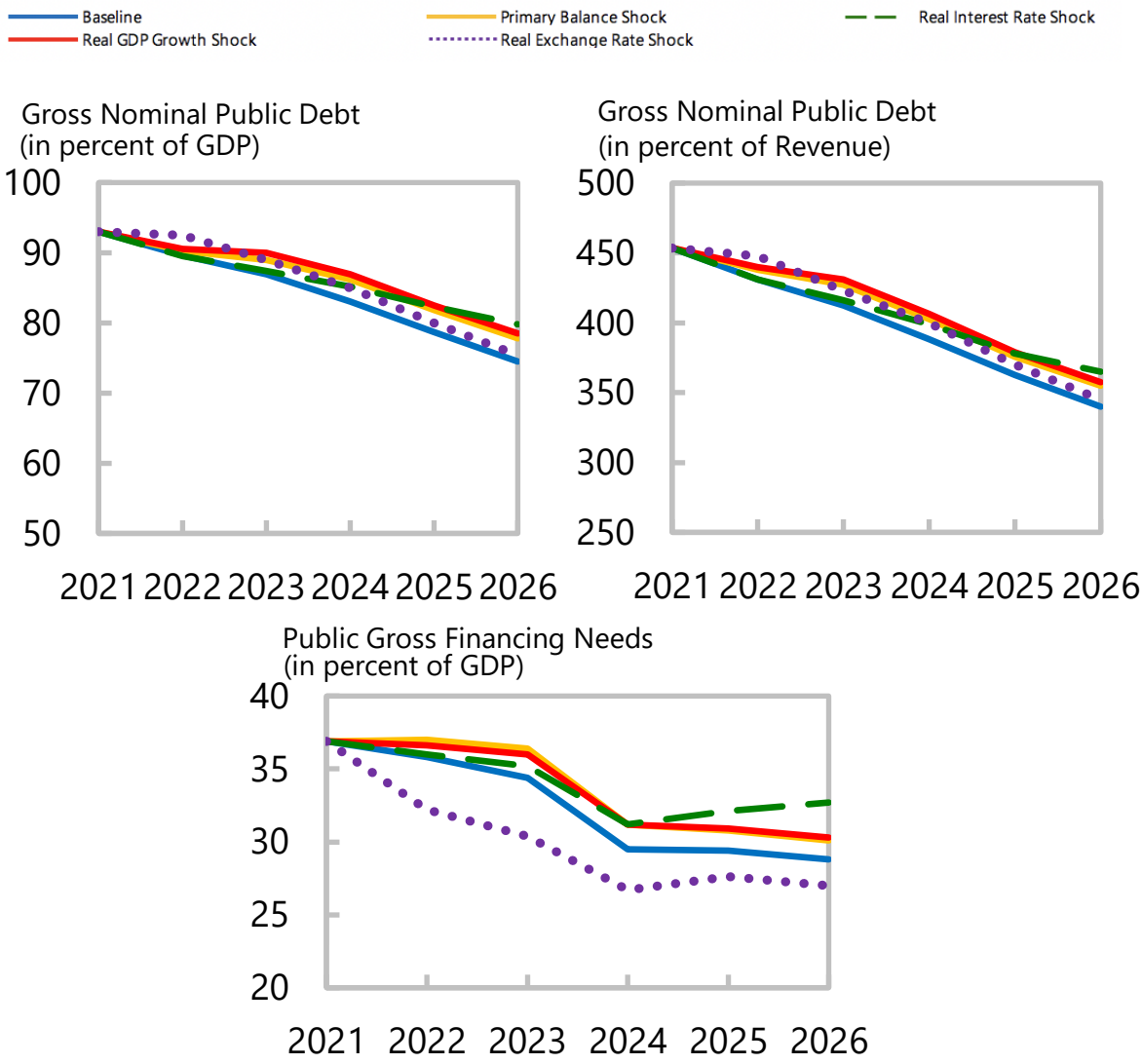
[10] t corresponds to 2021

5.2.6 Standardized and Customized Macroeconomic Shocks

Corresponding to the 'Scenario Design' input sheet, the shocks are created and reported. It is paramount to complement the baseline scenario with an assessment tool that focuses on the main macro-fiscal risks.

The primary balance shock is set to the maximum of (worst of) 50% of planned cumulative adjustment in the baseline or the baseline minus half of the 10-year historical standard deviation of the primary balance. A default interaction to this shock is an increase in interest rates. The real GDP shock is modeled as a reduction of 1 standard deviation for 2 consecutive years. This is linked to deterioration in the primary balance, and as a result, interest rates increase, and inflation is also decreased with the reduced output. Under the interest rate shock, it is modeled as a maximum of 200 basis points or the difference between average real interest rate level over the projection period and maximum real historical level. This shock has no interactions among other variables. Finally, the exchange rate shock is determined by the maximum of an estimated overvaluation or the maximum historical movement of the exchange rate. The only default interaction here is the pass-through to inflation with a default elasticity of 0.25 for emerging markets. A worst-of-all-worlds scenario is represented through the combined macro-fiscal shock. Figure 20 represents the results of the stress tests on gross nominal public debt in percent of GDP, in percent of revenue, and public gross financing needs in percent of GDP.

Figure 20: Macro-Fiscal Stress Tests

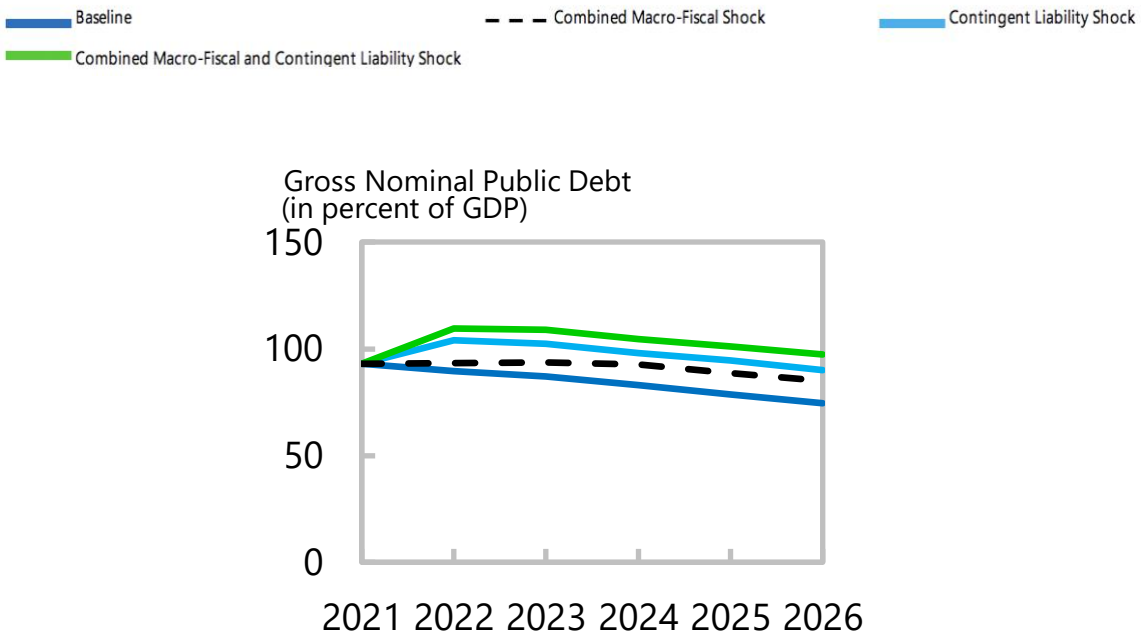


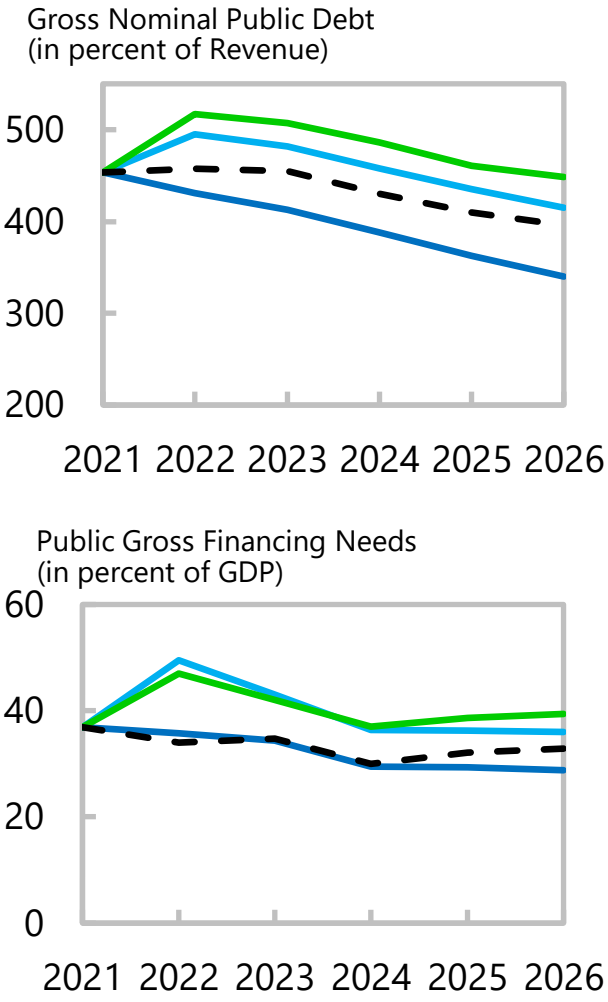
Source: Author's Calculations

According to the above criterion, a one standard deviation growth shock applied to Egypt is equivalent to a decline of 1.2% in the real GDP growth and an 0.3% decrease in inflation compared to the baseline. This would increase debt to GDP from 75% in the baseline scenario to 77%, and from 340% of revenue to 358% respectively. A real interest rate shock would increase the interest rate by approximately 350 basis points compared to the projection period. This will increase the public debt to GDP ratio to hit 80% in the medium-term and is considered the most influential shock in the one-at-a-time shocks. The criterion yields a huge exchange rate shock, equivalent to a depreciation of 100% of the Egyptian Pound. However, the effect on the debt to GDP ratio over the medium-term is a modest increase, recording 76%.

Figure 21 now focuses on the additional stress tests employed in the sensitivity analysis. The combined macro-fiscal shock weakens the debt dynamics remarkably. This shock includes the 1.2% decrease in GDP growth, a 1% looser fiscal stance, and a 140% nominal exchange rate depreciation; together, those shocks bring debt up to 85% of GDP at the end of the projected period by FY2025/26, 10% higher compared to the baseline. A contingent liability shock is captured through a materialization of a contingent liability equivalent to 13% of GDP. This would have implications on the primary balance, interest rates, and other macroeconomic variables, spiking debt ratio to 104% of GDP in FY2021/22 compared to 90% under the baseline scenario. Finally, the most acute shock is implemented through combining the macro-fiscal shock and the materialization of a contingent liability. In this case, the debt to GDP ratio will jump by more than 20% in the medium-term framework, 110% increase in debt to revenues ratio and around 10% increase in gross financing needs to GDP ratio vis-à-vis the baseline. The underlying assumptions for the 7 scenarios are attached in Appendix E.

Figure 21: Additional Stress Tests





Source: Author's Calculations

5.2.7 Risk Assessment

The 'Heat Map' focuses on the DSA risk assessment. The debt burden indicators are classified of low, moderate, or high risk. Macro-fiscal and contingent liabilities risks are assessed through their impact on the debt burden indicators under the baseline scenario as well as the stressed scenarios. As for the debt profile risks, the assessment relies on certain benchmarks for emerging economies.

A standardized summary of the risks arising from the template modules is reported in the heat map. Reported risks are classified as high (red), moderate (yellow), and low (green). The heat map consists of three rows: the first and second rows outline the impact from macro-fiscal and contingent liabilities shocks on the debt to GDP ratio

and the gross financing needs-to-GDP ratio. The third and final row gives a precis of the likelihood of risks from the debt profile in terms of maturity, spreads, and portion of public debt held by non-residents. Egypt's heat map, shown in Figure 22, shows various areas of constraints impeding the Egyptian economy to sustain its debt.

Figure 22: Heat Map [11]

Debt level	Real GDP Growth Shock	Primary Balance Shock	Real Interest Rate Shock	Exchange Rate Shock	Contingent Liability shock
Gross financing needs	Real GDP Growth Shock	Primary Balance Shock	Real Interest Rate Shock	Exchange Rate Shock	Contingent Liability Shock
Debt profile	Market Perception	External Financing Requirements	Change in the Share of Short-Term Debt	Public Debt Held by Non-Residents	Foreign Currency Debt

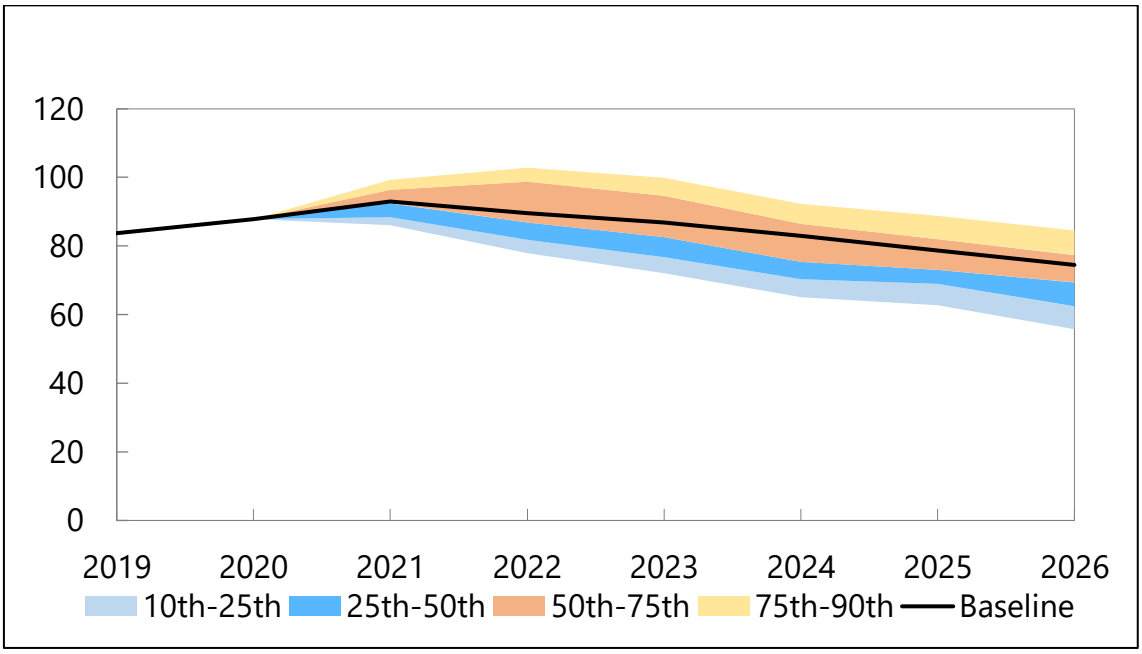
Source: Author's Calculations

It is important to note that the heat map is not qualified to produce an overall debt rating. In essence, its usefulness is limited to bringing all sources of uncertainties, presented earlier in other outputs, into one place. Upon integrating this with the DSA write-up and fan charts, an objective opinion of debt sustainability can be achieved.

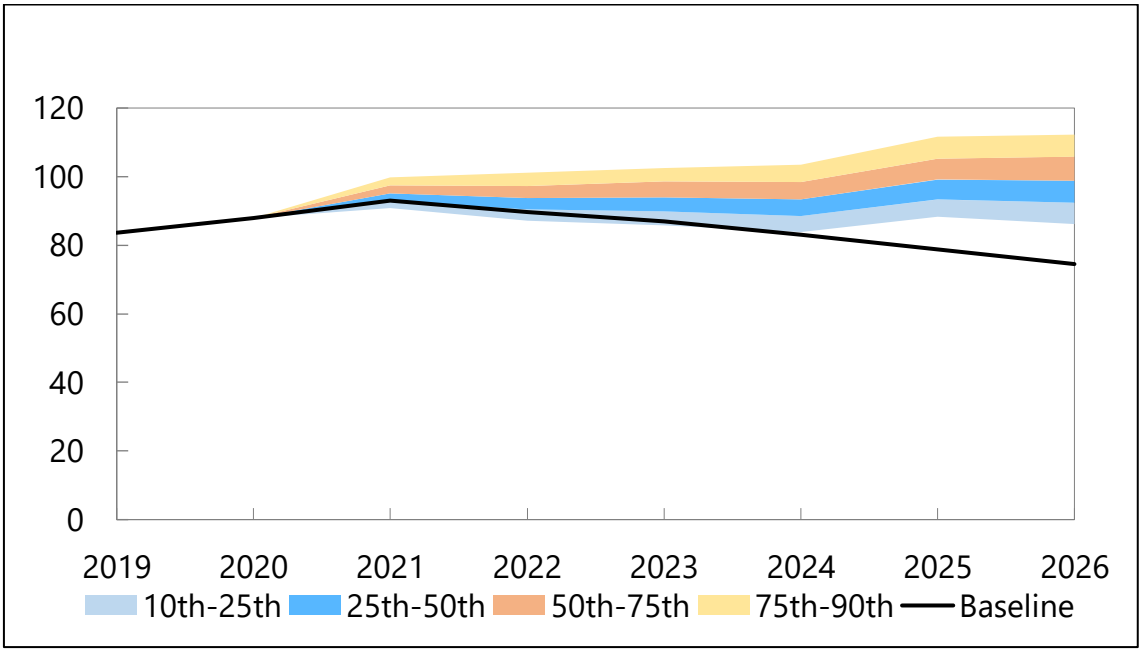
Two fan charts are required for the higher scrutiny countries, representing symmetric (centered around the baseline) and asymmetric distribution of risks, highlighting the best assessment of the likely distribution of risks by the team. Consequently, the asymmetric fan chart produced by the author differs significantly from the one proposed by the IMF DSA Framework. The author's fan charts reported below in Figure 23 indicates that with asymmetric distribution of risks, the baseline may in fact reflect a far-fetched debt to GDP ratio. The IMF fan charts are shown in Appendix F.

[11] Debt Level: The cell is highlighted in green if debt burden benchmark of 70% is not exceeded under the specific shock or baseline, yellow if exceeded under specific shock but not baseline, red if benchmark is exceeded under baseline, white if stress test is not relevant.
Gross Financing Needs: The cell is highlighted in green if gross financing needs benchmark of 15% is not exceeded under the specific shock or baseline, yellow if exceeded under specific shock but not baseline, red if benchmark is exceeded under baseline, white if stress test is not relevant.
Debt Profile: The cell is highlighted in green if country value is less than the lower risk-assessment benchmark, red if country value exceeds the upper risk-assessment benchmark, yellow if country value is between the lower and upper risk-assessment benchmarks. If data are unavailable or indicator is not relevant, cell is white.

Figure 23: Evolution of Predictive Densities of Gross Nominal Public Debt (a) Symmetric Distribution and (b) Restricted Asymmetric Distribution



(a)



(b)

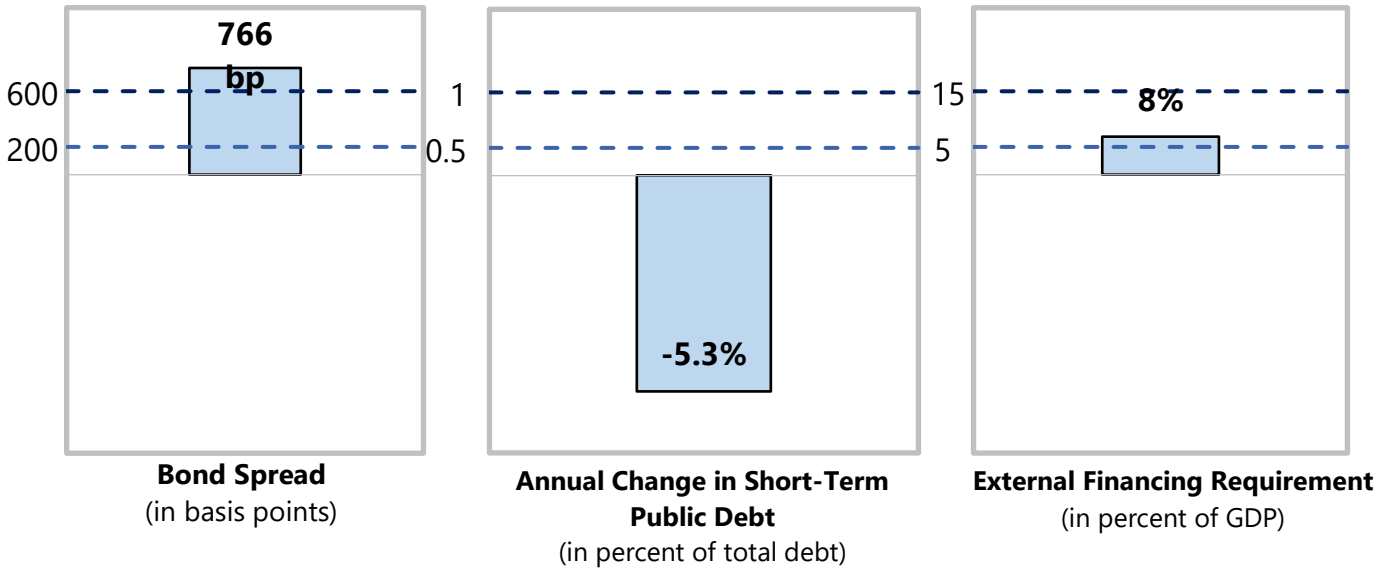
Source: Author's Calculations

Finally, the very last part of the analysis is the debt profile vulnerabilities in Figure 24. In this diagram, indicators are plotted vis-à-vis the assessment benchmarks. A country is deemed to be high risk when the latest data available puts it above the

upper benchmark with respect to a specific indicator. On the other hand, a country is deemed to be low risk when the data is below the lower benchmark. Finally, moderate risk applies when the data is in between the lower and upper benchmarks.

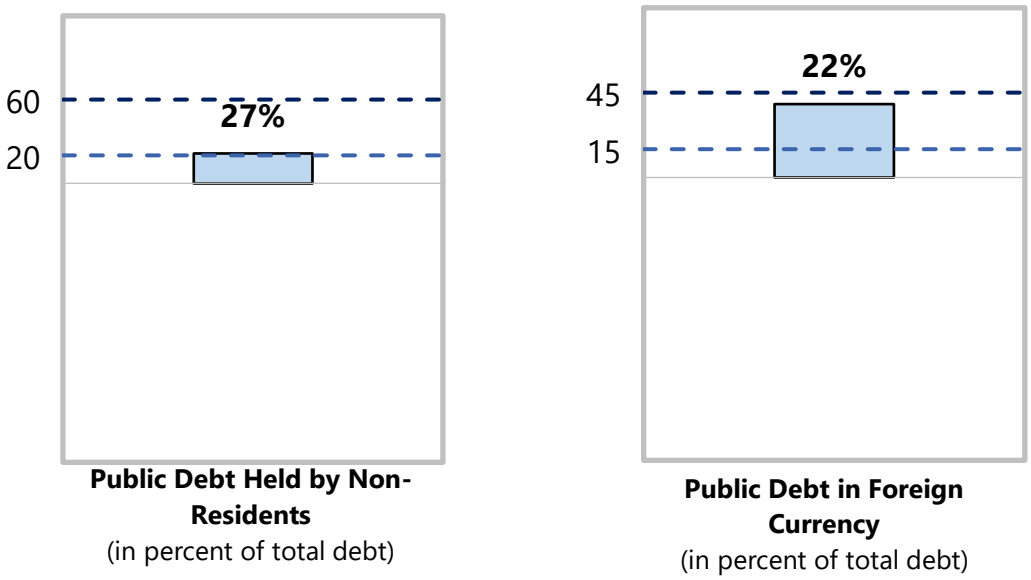
The Emerging Market Bond Index Global (EMBIG)[12] in basis points for Egypt is 766; surpassing the upper early warning benchmark. External financing requirement[13], public debt held by non-residents and public debt in foreign currency all lie between the lower early warning and upper early warning bounds. The reduction in short-term public debt as a result of the authorities plan to extend maturities puts Egypt in a comfortable point a lot below the lower early warning as of 2020.

Figure 24: Debt Profile Vulnerabilities



[12] EMBIG, an average over the last 3 months, 2nd March 2020 – 2nd June 2020

[13] External financing requirement is defined as the sum of current account deficit, amortization of medium and long-term total external debt, and short-term total external debt at the end of the previous period.



Source: Author's Calculations

The results of the IMF Approach to measuring Egypt's public debt sustainability outlined very close results compared to the latest Article IV Report. In fact, most of the analyses deemed the same understanding and concerns with the exception of the asymmetric fan charts inducing further risks on the debt trajectory as opposed to what was highlighted by the IMF. Debt Sustainability Analysis concludes that Egypt's public debt remains sustainable but 'not with a high probability'. The IMF's conclusion ranges between three options: sustainable, sustainable but not with a high probability, and unsustainable. As per the latest framework published by the IMF to define those thresholds, a debt that is sustainable but not with a high probability is one that allows the IMF to grant exceptional access whilst ensuring other financing resources to maintain non-fund exposure to improve debt sustainability and enhance safeguards for fund resources (International Monetary Fund, 2015).

The uncertainty existing around the baseline projection is primarily represented in the skepticism regarding the COVID-19 circumstances, and predictability of the recovery path and pace. However, the disruptions imposed on the Egyptian economy by the COVID-19 pandemic were dealt with properly, and most importantly, with strong consumption, the shock was partly offset (International Monetary Fund, 2021). In addition, the resuming portfolio inflows have relaxed the financing pressures and improved the foreign exchange supply in the domestic market. However, with the

continuing circumstances, considerable risks exist in keeping tourism at the existing halt and convulsing the remittances; the major sources of foreign currency. Egypt is specifically vulnerable to changes in financial conditions due to its high debt ratio and financing needs, impeding its ability to withstand further any capital outflows. Restoring the pre-pandemic primary surplus of 2% of GDP is vital to stabilize macroeconomic variables and anchor a return of the public debt to the downward trajectory. Maintaining the vision of shifting from short-term debt to long-term debt is also essential to guarantee that the gross financing needs are limited to minimal as well as the rollover risk.

Chapter 6 Empirical Results of the Fiscal Reaction Function

This part reports the results of the other approach employed in this study apart from the IMF's; the fiscal reaction function.

6.1 Unit Root Tests

In Tables 2 and 3, the unit root tests are presented. Both the Augmented Dickey Fuller and the Phillips-Perron tests have the null hypothesis of having a unit root. The test has been applied for both the levels and first differences of the variables employed in the study. Different tests may have different conclusions as apparent in our case. It may not be easy to reach a definitive conclusion about the variables. However, the results indicate that the variables are a mix of I(0) and I(1). Primary balance and inflation are stationary under the ADF and I(1) under the PP test. The output gap is stationary at first difference under the ADF test but stationary at level under the PP test. Public debt to GDP has confirmed being an I(1) when neither an intercept nor a trend where included, returning a t-statistic of -2.107 significant at 5 percent of significance for the ADF and -9.753 with the PP test, significant at the 1 percent level of significance. Exchange rates and the interest rate on treasury bill are I(1) variables under both tests. Hence, due to the inconclusive results, the ARDL is the appropriate estimation method for this data set.

Table 2: Augmented Dickey Fuller (ADF) Unit Root Test

	Intercept		*Trend + Intercept*		
	Level	1st Difference	Level	1st Difference	Conclusion
PRIM_BAL	-3.332**	-0.076	-1.570	-1.780	I(0)
PD_GDP	-1.076	-2.145	-2.659	-3.266*	I(1)
EXCH	-0.535	-7.593***	-1.951	-7.585***	I(1)
T_BILL	-1.918	-4.995***	-2.803	-4.984***	I(1)
INF	-3.570***	-4.974***	-3.459*	-5.010***	I(0)
OUT_GAP	-2.008	-15.798***	-2.074	-15.705***	I(1)

This table has the values of the t-statistics from the ADF unit root tests, where SIC is used for lag selection. ***, **, and * respectively mark statistical significance at the 1, 5, and 10 percent levels of significance.

Table 3: Phillips Perron (PP) Unit Root Test

	Intercept		*Trend + Intercept*		
	Level	1st Difference	Level	1st Difference	Conclusion
PRIM_BAL	-0.356	-2.559**	0.047	-2.874	I(1)
PD_GDP	-1.320	-10.124***	-1.986	-10.933***	I(1)
EXCH	-0.534	-7.593***	-1.976	-7.585***	I(1)
T_BILL	-1.576	-4.891***	-2.089	-4.873***	I(1)
INF	-2.612*	-4.589***	-2.460	-4.618***	I(1)
OUT_GAP	-7.190***	-16.435***	-7.343***	-16.152***	I(0)

This table has the values of the t-statistics from the PP unit root tests, where automatic bandwidth selection is applied using the Newey-West bandwidth selection. ***, **, and * respectively mark statistical significance at the 1, 5, and 10 percent levels of significance.

6.2 ARDL Model Estimation Results

The ARDL runs with primary balance as the dependent variable, and the independent variables are public debt, output gap, exchange rate, treasury bill interest rate, and inflation; all existing as dynamic regressors. The model allowed for a maximum lag of 4 dependent variables and regressors. In Table 4, the parameter estimates are reported, according to equation (16). The chosen lag structure according to the Schwarz Information Criterion (SIC) is (p,q1,q2,q3.q4,q5) = (4,4,0,0,3,0) for the variables above respectively. This is the model that minimized the schwarz criterion at -3.126. The criteria graph is attached in Appendix G. Inflation, exchange rates, and the output gap appear to be insignificant when investigating the short-run dynamics of the primary

balance to GDP ratio. Despite having significant coefficients for the other variables and with the expected signs in many instances, the author chose not to comment over the short run dynamics due to the nature of the budget process. The process starts in September and the final phase takes place in December of the following year. Refer to Appendix H. Changes to any macroeconomic variable does not happen on quarterly basis, hence the short run dynamics to the fiscal policy appear irrelevant.

Table 4: ARDL Model Estimation Results

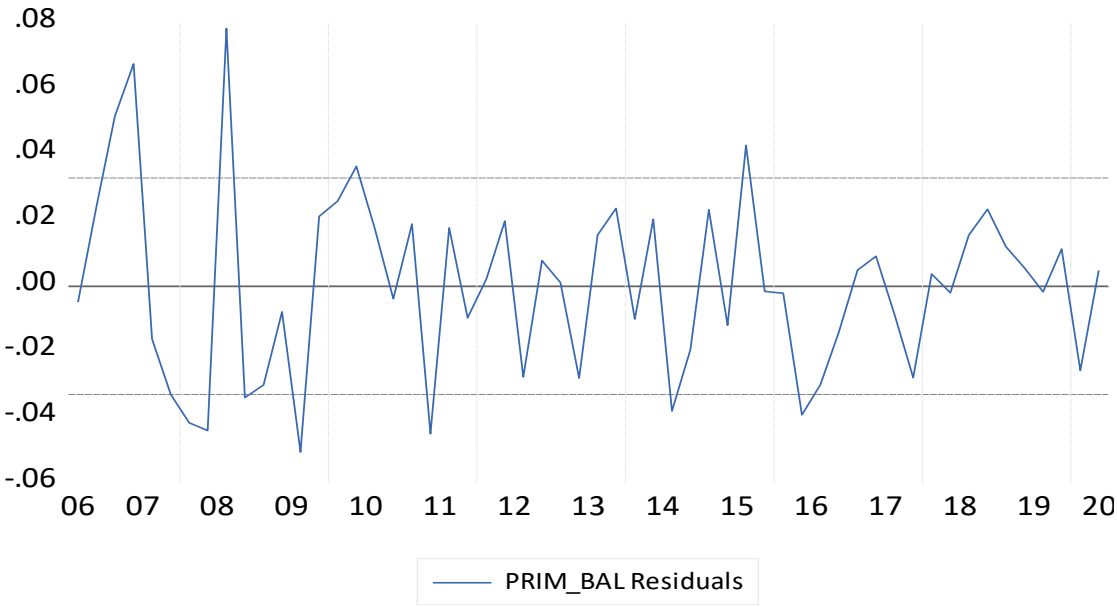
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.**
PRIM_BAL(-1)	2.978300***	0.112043	26.58171	0.0000
PRIM_BAL(-2)	-3.671624***	0.287953	-12.75077	0.0000
PRIM_BAL(-3)	2.168182***	0.282163	7.684158	0.0000
PRIM_BAL(-4)	-0.496419***	0.105061	-4.725070	0.0000
PD_GDP	-0.004819***	0.001658	-2.906825	0.0060
PD_GDP(-1)	0.000544	0.001253	0.433966	0.6667
PD_GDP(-2)	0.002973***	0.001275	2.331791	0.0250
PD_GDP(-3)	-0.001491	0.001323	-1.126715	0.2667
PD_GDP(-4)	0.005845***	0.001674	3.491518	0.0012
OUT_GAP	0.000602	0.000394	1.525736	0.1351
EXCH	0.008171	0.005207	1.569174	0.1247
T_BILL	-0.019419***	0.006800	-2.855694	0.0068
T_BILL(-1)	0.028186***	0.009099	3.097557	0.0036
T_BILL(-2)	-0.026332***	0.009083	-2.899145	0.0061
T_BILL(-3)	0.011142*	0.005736	1.942599	0.0593
INF	-0.001571	0.001365	-1.151594	0.2565
C	-0.278738***	0.089599	-3.110950	0.0035

The dependent variable is$PRIM_BAL_t$. *** marks statistical significance at the 1 percent level of significance, **marks statistical significance at the 5 percent level of significance, and* marks statistical significance at the 10 percent level of significance.

Prior to proceeding further with model, diagnostic checks on residuals (shown in Figure 25) are crucial. The serial correlation LM test was adopted with a null hypothesis that there is no serial correlation up to 2 lags, and the results failed to reject the null hypothesis and shows that the residuals are free from serial correlation. The normality test, according to Jarque-Bera, indicates that the residuals are normally distributed at the 5 percent level of significance, as the null hypothesis was not rejected. Finally, the Breusch-Pagan test for heteroskedasticity, with Prob. Chi Square returning a value of 0.0687, implied that the data is free from heteroskedasticity. The residuals

tests are all included in Appendix I. In conclusion, the regression is well-specified as the residuals are free from serial correlation, heteroskedasticity, and the residuals are normally distributed according to the Jarque-Bera test statistics with a p-value of 1.597.

Figure 25: Residuals



The Bounds Test of Pesaran et al. (2001) returned an F-statistic of 5.08, which exceeds the I(1) upper bound of 4.15 at the 1 percent level of significance. It found that the change in primary balance is influenced by lagged levels, and this is evidence of cointegration. We reject the null hypothesis that all of the coefficients are jointly equal to zero. As mentioned earlier, this confirms the existence of a stable long-run relationships among the variables. The long-run coefficients are presented below in Table 5, according to equation (18).

Table 5: Parameter Estimates of the Long Run Cointegrating Relationship

Variable	**Coefficient Estimates**	**Std. Error**	**t-Statistic**	**Prob.**
PD_GDP	0.141539**	0.072676	1.947535	0.0487
OUT_GAP	0.027906	0.018080	1.543473	0.1308
EXCH	0.378968**	0.191482	1.979131	0.0449

T_BILL	-0.297942	0.178852	-1.665860	0.1038
INF	-0.072883	0.059625	-1.222342	0.2289
C	-12.92817**	5.829023	-2.217896	0.0325

The results show that inflation and output gap do not have long-run relationships with the primary balance. Also, a 1 percent increase in Public Debt to GDP increases the Primary Balance to GDP by 0.14% in the long-run. If the public debt to GDP ratio increases, government should respond by improving the primary balance, to arrest and even reverse the rise in the public debt to GDP ratio. The rationale behind this is rooted in the budget constraint of government. Moving on, a 1 percent increase in Exchange Rate increases the Primary Balance to GDP by 0.38% in the long-run. Whenever the country's currency depreciates, an increase in that case, it makes its exports cheaper and imports expensive. This can lead to a current account deficit and will have negative effect on balance of payment. The country reacts by engaging in fiscal contraction to counteract the inflationary effects of the depreciation. In this part, there is an assumption that the sum of elasticities of exports and imports is less than 1, so an inflation deteriorates the current account balance. This assumption is justified on two grounds: (1) most of the imports are necessary items, and (2) most of exports' prices are determined by international markets. A 1 percent increase in real T-Bill rate decreases the Primary Balance to GDP by 0.30% in the long-run, but this case represented a borderline significance at the 10 percent level.

Table 6: Error Correction Model (ECM) Regression

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(PRIM_BAL(-1))	1.999861	0.094307	21.20584	0.0000
D(PRIM_BAL(-2))	-1.671763	0.148467	-11.26017	0.0000
D(PRIM_BAL(-3))	0.496419	0.080679	6.153036	0.0000
D(PD_GDP)	-0.004819	0.001270	-3.794533	0.0005
D(PD_GDP(-1))	-0.007328	0.001500	-4.886055	0.0000
D(PD_GDP(-2))	-0.004355	0.001265	-3.442641	0.0014
D(PD_GDP(-3))	-0.005845	0.001333	-4.386341	0.0001
D(T_BILL)	-0.019419	0.004943	-3.928935	0.0003
D(T_BILL(-1))	0.015191	0.004975	3.053300	0.0041
D(T_BILL(-2))	-0.011142	0.004645	-2.398834	0.0213

CointEq(-1)	-0.021561	0.003365	-6.407808	0.0000

As expected, the ECM term, here represented as CointEq(-1) in Table 6, is negative with an associated coefficient estimate of −0.021561. This implies that about 2.16% of any movements into disequilibrium are corrected for within one period. Moreover, given the very large t-statistic, namely −6.407808, we can also conclude that the coefficient is highly significant. In conclusion, the error correction term, which captures the pace of adjustment between the short run dynamics and the long-run equilibrium, shows a statistically significant coefficient of -0.021561; such a slow correction from disequilibrium.

Lastly, the cointegration graph is presented in Figure 26. After parliamentary elections, the same cabinet was reappointed in December 2005 and pressed ahead with its program, concentrating on public finance management, privatization, and financial-sector restructuring. The economy continued to respond to policy changes, with real GDP growth in 2006 reaching 7 percent. Capital formation, national savings, and official reserves increased and total external debt fell as percentages of GDP. With a financial crisis hitting world markets in 2008, it was almost inevitable that economic activity in Egypt would also slow down. The current account of the balance of payments showed a deficit of 2.5 percent of GDP, a noticeable swing from the modest surpluses in each of the previous three years. The fiscal situation continues to be delicate and the general government balance fell into a deficit of 7 percent of GDP. The Egyptian authorities reacted quickly by providing a sizable fiscal stimulus to limit the spillover effects of the crisis. The economy recovered in 2010 with GDP increasing by 5.1 percent over the previous year. However, the IMF continued to be concerned by fiscal weakness; the overall budget balance, excluding grants, was a deficit of 8.5 percent of GDP.

Huge public demonstrations erupted against President Mubarak and the president was compelled to resign on February 11, 2011, ending a rule of three decades. An upheaval of this magnitude could not fail to have drastic impact on the economy. From 2011 to 2016, Egypt demonstrated a very high degree of instability. Gross public debt had risen from about 70 percent of GDP to nearly 95 percent. The external

accounts continued to weaken: imports of goods and services increased from 20.7 percent to 22.3 percent of GDP. The government bit the bullet and on November 3, 2016 the Central Bank of Egypt devalued the Egyptian pound by 32.5 percent against the U.S. dollar and allowed the exchange rate to float. Egypt entered into a three-year program with the IMF under the Fund's Extended Fund Facility for a loan of $12 billion. Major policy adjustments were a main pillar of the program such as liberalizing the foreign-exchange system, directing monetary policy to contain inflation, and strong fiscal consolidation (including introduction of VAT, phasing out energy subsidies and holding down increases in the public wage bill) to reassure debt sustainability. Since then, the primary balance has started to record some surpluses.

Figure 26: Cointegration Graph

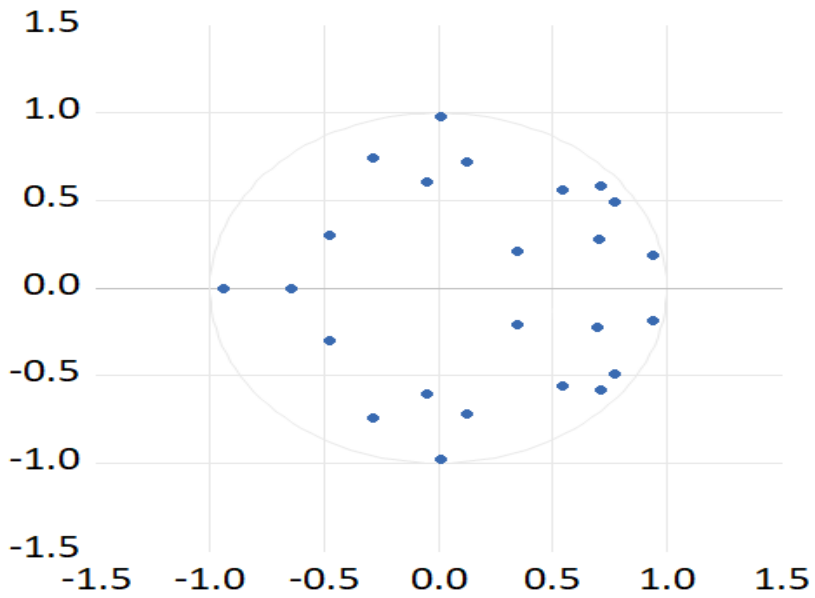
6.3 VAR Model Estimation Results

The VAR model is adopted in this study to supplement the results of the ARDL model and confirm the conclusions. It also provided further analysis that could be of interest to this study, as demonstrated later in this part. Variables are transferred to be presented in log forms in order to allow smooth application of the model. While allowing for 8 lags has been recommended with reference to Schwarz and Akaike Information Criterion, an 8-lag VAR should have been employed. However, when number of lags were limited to 4, a four-lag VAR is the lag order selected by the criterion (refer to Appendix J). The paper proceeded with the four-lag VAR because (1) estimated VAR with 8-lags was not stationary, (2) number of parameters become exceedingly huge affecting estimation efficiency, and (3) avoid multicollinearity. The impact remains

influential for 4 period and it appears that persistence may even last longer when allowing for higher-order lags. An exclusion Wald Test was performed to further ensure that the 4 lags are necessary for the model. It tests whether certain lags are needed or not. The Chi Square-test leads to rejection in all lags, implying the importance of the 4 lags evident in Appendix K.

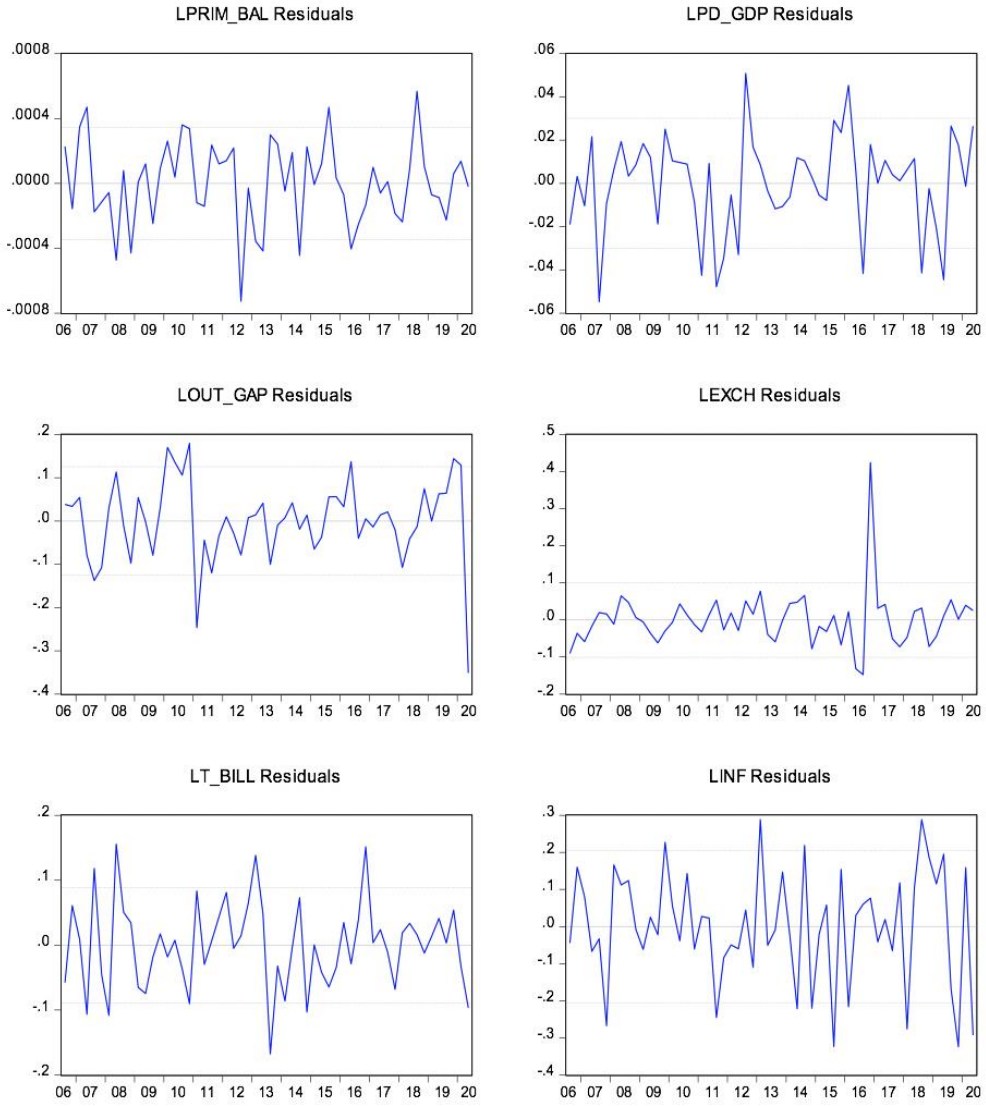
The VAR estimations results are presented in Appendix L with 4 lags. Even though many lags appear to be insignificant, the SIC detects, as a system, the joint significance of lags. Checking for VAR stationarity, root graph has been employed to ensure all complex eigenvalues are less than 1 (within the circle) as apparent in Figure 27. This is extremely important to guarantee that the impulse reaction functions will not be explosive for any innovation and its response. VAR satisfies the stability condition (stationary VAR), and the dynamic analysis will exhibit mean-reversion.

Figure 27: Inverse Roots of AR Characteristic Polynomial



Testing the residuals was also vital prior to proceeding with the cointegration testing. The residuals graphs in Figure 28 outlines that an assumption that we had maintained true could be challenged; that is the constant variance. This is one of the probable caveats of the dataset. Other tests including heteroskedasticity, normality test, and serial correlation show that the regression is well-specified.

Figure 28: VAR Residuals



Afterwards, the Johansen Cointegration test is conducted in order to test for any cointegrating relationships among the variables. The results are reported below in Table 7. The null hypothesis of the Johansen test is that there is no co-integration equation and the decision criteria is based on two values; the trace and maximum eigenvalue statistic; if they are bigger than the 5% critical value, the null hypothesis is to be rejected. According to the test results, both the trace and maximum eigenvalue statistic values are bigger than that of their corresponding critical values at most 5 and at most 2 respectively; rejecting the hypothesis at the 0.05 level. Consequently, there are 6 co-integrating equations and 3 cointegrating equations respectively confirming that the series exhibit long-run relationship. The null hypothesis is rejected.

Table 7: VAR Cointegration Johansen Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.592923	156.6846	95.75366	0.0000
At most 1 *	0.475760	107.2533	69.81889	0.0000
At most 2 *	0.436131	71.73395	47.85613	0.0001
At most 3 *	0.296049	40.22264	29.79707	0.0022
At most 4 *	0.203761	20.91507	15.49471	0.0069
At most 5 *	0.141371	8.382984	3.841465	0.0038
Trace test indicates 6 cointegrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	*Eigenvalue*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.592923	49.43139	40.07757	0.0034
At most 1 *	0.475760	35.51930	33.87687	0.0316
At most 2 *	0.436131	31.51131	27.58434	0.0148
At most 3	0.296049	19.30756	21.13162	0.0883
At most 4	0.203761	12.53209	14.26460	0.0922
At most 5 *	0.141371	8.382984	3.841465	0.0038
Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Focusing on one cointegration relationship displayed below in Table 8, in the long-run, public debt to GDP has a positive impact on the primary balance to GDP with a t-statistic of -4.552, thus significant at the 1 percent level, on average, ceteris paribus. With cointegration confirmed, we specify the VECM with (p-1) lags.

Table 8: Cointegrating Equation

1 Cointegrating Equation(s)				*Log likelihood*	*738.1989*
Normalized cointegrating coefficients (standard error in parentheses)					
LPRIM_BAL	***LPD_GDP***	***LOUTGAP***	***LEXCH***	***LT_BILL***	***LINF***
1.000000	-0.678620	-0.346001	0.273428	-0.196125	0.047492
	(0.14909)	(0.09975)	(0.10677)	(0.11034)	(0.01623)
Adjustment coefficients (standard error in parentheses)					

D(LPRIM_BAL)	0.002268
	(0.00277)
D(LPD_GDP)	-0.220993
	(0.24514)
D(LOUTGAP)	0.350697
	(0.92445)
D(LEXCH)	-1.617734
	(0.70308)
D(LT_BILL)	-0.090260
	(0.69856)
D(LINF)	-5.692597
	(1.10515)

The Vector Error Correction estimates are shown in Appendix M. The error correction term (CointEq1) is -0.011571. The negative sign implies convergence to long-run equilibrium. The result shows that previous errors will be corrected in the following period at an adjustment rate of 1.16%. This rate is comparable to the ARDL pace of 2.16%, both models highlighting a slow pace of adjustment. This slow pace of adjustment may be the result of the adoption of discretionary fiscal policy that needs more lags to reflect the results. Based on the VECM results, the following equation is generated:

$$ECT_{t-1} = lprim\_bal_{t-1} - 0.152751 lpd\_gdp_{t-1} - 0.170746 loutput_{t-1} + 0.050570 lexch_{t-1} - 0.071241 lt\_bill_{t-1} + 0.014878 linf_{t-1} - 3.078369$$

6.3.1 Correlation Matrix and Granger Causality Tests

The dynamics among the variables are of interest to the study in order to grasp the way macroeconomic variables interact and propose the necessary and appropriate policies. Starting with the correlation matrix, it has been used instead of the covariance since the covariance needs to be standardized in order to be interpreted, so instead, we interpret correlations. Some shocks appear to be strongly correlated as evident in Table 9 below, particularly between the primary balance and the real T-Bill 12-mointh interest rate. This is in line with the theory highlighting that countries with better primary balances or fiscal policies tend to have lower interest rates. In addition, the correlation between the exchange rate and real T-Bill 12-month rates seems strong. As exchange rate

depreciates, the government raises interest rate to attract foreign investors and buy local T-Bills. Also, higher interest rate encourages savings, reducing local output and thus increase imports. Repaying interest on T-Bills becomes very costly as well. This also clarifies that in fact every monetary decision has fiscal implications. It is important to note that the country-specific correlations are not in line with the IMF interactions among the one-at-a-time shocks.

	PRIM_BAL	*PD_GDP*	*OUTGAP*	*EXCH*	*T_BILL*	*INF*
PRIM_BAL	1.000000	-0.197637	0.156098	-0.095147	-0.459633	-0.113090
PD_GDP	-0.197637	1.000000	0.233974	0.243160	-0.103435	-0.146968
OUTGAP	0.156098	0.233974	1.000000	-0.009425	0.029612	0.224119
EXCH	-0.095147	0.243160	-0.009425	1.000000	0.438189	0.032645
T_BILL	-0.459633	-0.103435	0.029612	0.438189	1.000000	0.226504
INF	-0.113090	-0.146968	0.224119	0.032645	0.226504	1.000000

Table 9: Correlation Matrix

Moving on, granger causality has a null hypothesis in the negative; x does not granger cause y. It is exclusive to vector analysis and is considered the standard method to determine whether one variable is useful in predicting another and it is a good indicator of whether a VAR is needed. The term 'causality' is misleading. It is in fact a temporal precedence rather than causality. Because it could be that there is a z variable excluded from the system causing the changes of both variables (does not account for indirect effects). As a result, granger causality indicates that one variable's movement tends to precede the other. The results in Table 10 indicate that inflation is the only variable that affects the primary balance and other variables necessitate for accepting the null hypothesis. However, the system as a whole tends to be extremely efficient in explaining variations caused to the primary balance. Granger causality tables for other variables are reported in Appendix N.

Table 10: Granger Causality: Dependent Variable PRIM_BAL

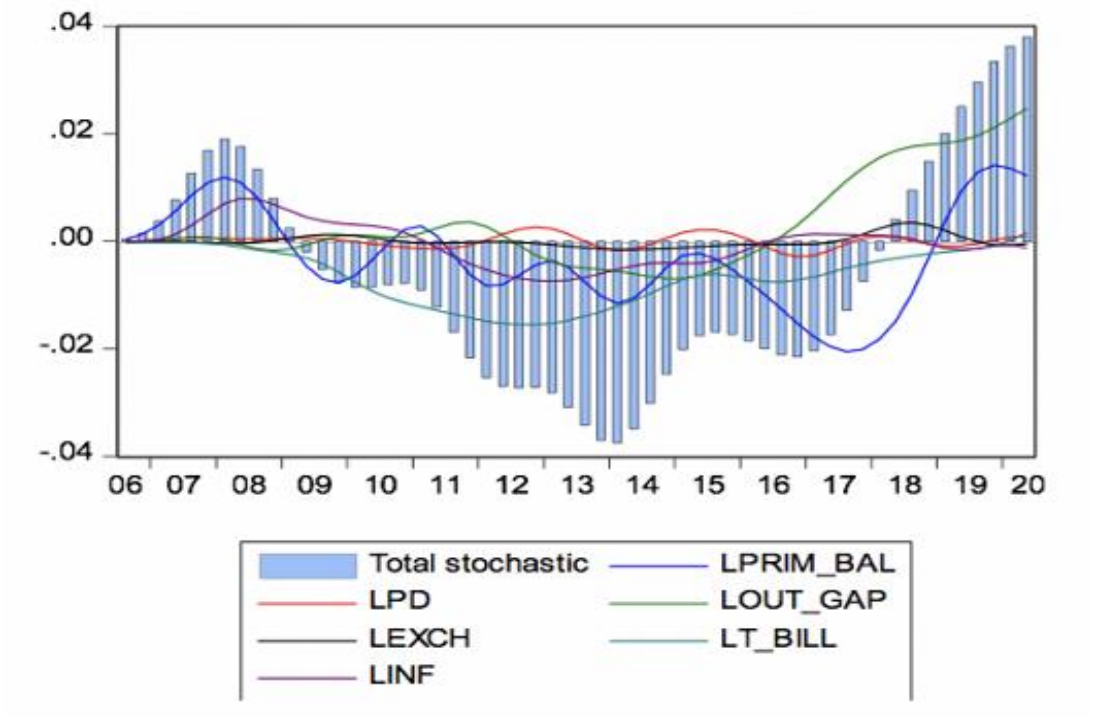
Dependent variable: PRIM_BAL			
Excluded	**Chi-sq**	**df**	**Prob.**
PD_GDP	2.496398	4	0.6453
OUTGAP	4.844815	4	0.3036
EXCH	2.841720	4	0.5847

T_BILL	2.261759	4	0.6877
INF	10.57494	4	0.0318
All	43.06674	20	0.0020

6.3.2 Variance Decomposition and Impulse Response

Finally, employing variance decomposition is interesting for the sake of the study. Since the dependent variable is the primary balance to GDP, the only historical captivating variance decomposition is the one corresponding to the dependent variable. Figure 29 shows that in the short-run, primary balance itself reflects most the shocks to primary balance. Whereas, in the long run, fluctuations to the output gap are also influential relatively intense.

Figure 29: Historical Decomposition using Cholesky (d.f. adjusted) Weights: Decomposition of PRIM_BAL



Looking at 10 periods ahead in Table 11, that is equivalent to two years and a half, the period could be disaggregated to capture the short-run (up to 4 periods) and the long-run (at period 10). In the short run, that is quarter 4, a shock to primary balance accounts for 89.8% variation of the fluctuation in primary balance (own shock). Primary balance hence appears to be strongly endogenous. A shock to the output gap

can also cause 6.4% variation in the primary balance. In the long run however, the shock to primary balance is explained by its own by only 60% and the contribution of output gap increases to 31.4%. The output gap is the least exogenous variable. The most influential variable following the output gap is inflation, with a contribution of only 2.3% and 5.7% of its own shock on primary balance in the short run and the long run respectively.

Table 11: Variance Decomposition of Primary Balance

Period	S.E.	LPRIM_BAL	LPD	LOUT_GAP	LEXCH	LT_BILL	LINF
Average		81.50635	0.9607536	13.3143196	0.1836458	0.3697529	3.6751773
1	0.000393	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.001423	98.04587	0.291347	1.385240	0.000682	0.205539	0.071321
3	0.003191	94.47212	0.724617	3.599263	0.010157	0.360566	0.833277
4	0.005624	89.82086	1.090747	6.400643	0.051029	0.351547	2.285171
5	0.008482	84.53337	1.326348	9.804890	0.118644	0.301851	3.914895
6	0.011426	79.20461	1.407232	13.64960	0.213294	0.265078	5.260183
7	0.014142	74.16195	1.356218	17.80383	0.309148	0.265995	6.102863
8	0.016457	69.43453	1.236710	22.22524	0.375087	0.339110	6.389319
9	0.018370	64.91337	1.099715	26.83759	0.392253	0.560261	6.196812
10	0.020006	60.47682	0.974602	31.43690	0.366164	1.047582	5.697932

In Table 12, it is apparent that the forecasted error variance of public debt to GDP is explained by its own dynamics instantaneously and the contribution decays to minimal in the long run accounting only for 11.8%. This variable is weakly endogenous in the long run. At period 10, the primary balance shock has an influence on public debt to GDP equivalent to 28.5%, the highest of all variables. An impulse to the output gap accounts for 21.6% variation in the fluctuation of public debt to GDP, another dominant effect.

Table 12: Variance Decomposition of Public Debt

Period	S.E.	LPRIM_BAL	LPD	LOUT_GAP	LEXCH	LT_BILL	LINF
Average		19.172402	38.45243	15.265511	5.4189384	10.5053435	11.1853715
1	0.031244	10.34148	89.65852	0.000000	0.000000	0.000000	0.000000
2	0.037988	13.24490	76.55254	2.434571	0.058949	0.941580	6.767456
3	0.046807	13.22018	57.85600	11.09435	3.177979	2.090242	12.56125
4	0.057249	15.48987	42.34086	11.84951	10.28609	5.073791	14.95987
5	0.080199	16.76180	32.71120	20.03451	8.168198	9.795542	12.52875
6	0.097552	20.51107	24.26524	19.92667	6.854169	15.14639	13.29646
7	0.112385	22.47501	19.49000	21.56362	6.568490	16.42020	13.48269
8	0.127114	25.09527	15.86211	21.06829	7.295261	17.53942	13.13964
9	0.149258	26.11784	13.97088	23.10078	6.257424	18.17847	12.37460
10	0.168322	28.46660	11.81695	21.58281	5.522824	19.86780	12.74300

There is an increasing contribution of fiscal drivers as time passes accompanied with the decline of the contribution of the debt's own shock. Based on the above, contributions to debt changes over time. It appears that the debt becomes fiscally driven in the long run, while in the short-run, the monetary policy - reflected in T-bills and exchange rate – tend to contribute more.

Chapter 7 Conclusion and Policy Implications

This thesis attempted to judge the public debt sustainability of Egypt and shed light on the caveats of the IMF DSA Framework[14], the one that is adopted by Egyptian authorities. The used approach, besides the IMF Framework, is the fiscal reaction function capitalizing on both ARDL and VAR as estimation methods to outline whether the government responds to changes in public debt, and whether the response, if exists, is in the right direction and of the necessary magnitude.

7.1 Comparison of Approaches

The results show that the Egyptian authorities respond to accumulation of public debt by fiscal consolidation evident in the rise of the primary balance, reversing the impact of the negative shock. However, the magnitude of the response and the pace of adjustment may be insufficient and the timing of the adjustment is also critical. In fact, if we capitalized on Bohn's requirement of having the primary balance growing at least linearly with public debt, the public debt sustainability will not hold. It is also apparent that the depreciation of the domestic currency in fact prompts the fiscal adjustment. With the growing burden of public debt, interest rates rise putting further pressure on the fiscal adjustment, and promoting a debt spiral. The results also show that the government fail to react appropriately to increases in interest rates, which further aggravates the risk of higher public debt. However, this result is of a borderline significance. While rising primary surpluses responding to increasing public debt indicate that the debt to GDP ratio becomes mean reverting and thus sustainable, the slow adjustment rate raises worries to whether Egypt may sustain further shocks. This

[14] Appendix O includes the workbook of the IMF analysis

is especially true with empirical evidence pointing that weaker fiscal response is expected from highly indebted emerging countries, unlike Bohn's suggestions.

As mentioned earlier, the IMF definition of debt sustainability requires that the fiscal adjustment is not 'unrealistically' large, which is an assumption that is now trembling, particularly with an already weak sustainability expected with the optimistically projected variables. The pragmatically accepted definition requires both, the ability and willingness of the government to repay the debt. The scenario on hand exhibits one part of the definition, the willingness, whilst the ability remains questionable. The higher the debt, the higher the primary surplus needed to sustain it. The global economy witnesses a fiscal stimulus that may very likely hinder the primary balance performance, and access to further financial resources is probable for Egypt. With all of this, the IMF still projects that Egypt will continue to run decent primary surpluses for the foreseeable future. The optimistic curse has been confirmed by the historical forecasts. The boom-bust analysis adds to the uncertainty, with significantly higher than expected growth rates. The standardized shocks also impede the performance of the IMF Framework. In addition, the default interaction among shocks does not seem to hold for Egypt as per the fiscal reaction function and the granger causality tables. The theoretical economic theory showed that the dynamics between macroeconomic variables are exclusively dependent on the public and markets belief about future fiscal policy and could not be standardized. As this study re-performed the last Article IV Report published by the IMF, assessment of the public debt is based on the heat map, the fan charts, and the write-up that yielded weak sustainability under the IMF. With the variation in the production of fan charts, the conclusion may further point towards unsustainability.

Based on the variance decomposition, the debt dynamics presented by the IMF whether through the standardized shocks or their interactions are not consistent with the fiscal reaction function evidenced in the different contribution of macroeconomic variables as debt-creating flows. The IMF approach concluded with a weak debt sustainability and the fiscal reaction function as well returned a positive reaction of the authorities with a slow pace of adjustment, partially explained by the adoption of discretionary fiscal policies.

7.2 Limitations and Future Research

It is vital to point out that the definition of the public sector employed in this study does not capture the whole public sector, but only the general government. SIFs', part of the general government, debt is not netted out[15]. Having this part presumably included, their liabilities does not materialize as public debt, lowering the overall figure. Also, the consolidation of SIF may be in favor of primary balance calculation as it adds more to the non-tax revenues compared to the non-interest expenditure. In addition, the Central Bank of Egypt's (CBE) debt is not part of this calculation, and this could significantly hinder the value of the public debt in two ways: (1) when direct credit from the CBE is considered a huge chunk of debt financing and (2) the CBE itself is not included as a public entity with a decent-sized negative net worth.

In addition, employing an unrestricted VAR may be a caveat of the study. In addition, allowing for structural breaks to capture the changes in the fiscal classification of the budget, several political events and the fiscal consolidation in 2016 are all areas where future research may add to the existing literature by accounting for this in the exogenous vector of the VAR.

7.3 Policy Implications

For policymakers, it looks like it is high time to reduce dependency on the IMF DSA Framework in order to judge the country's public debt sustainability and depart to another reliable approach. Meanwhile, knowing the potential caveats and areas where this approach underperforms is indispensable. In addition, fiscal transparency, that enhances the public understanding of the government's position, is essential in order to contribute to quality and sustainable policies and also strengthen the credibility of the Egyptian authorities. This can also be a driver to sustain the consolidation efforts through the public support. Communication regarding the latter requires the existence of an effective public finance management institution and the publication of a multi-

[15] Debt owed by Egyptian state authorities to the SIFs is not captured because they are legally considered private entities. They also have public-like operations such as the obligation to transfer surpluses to the NIB.

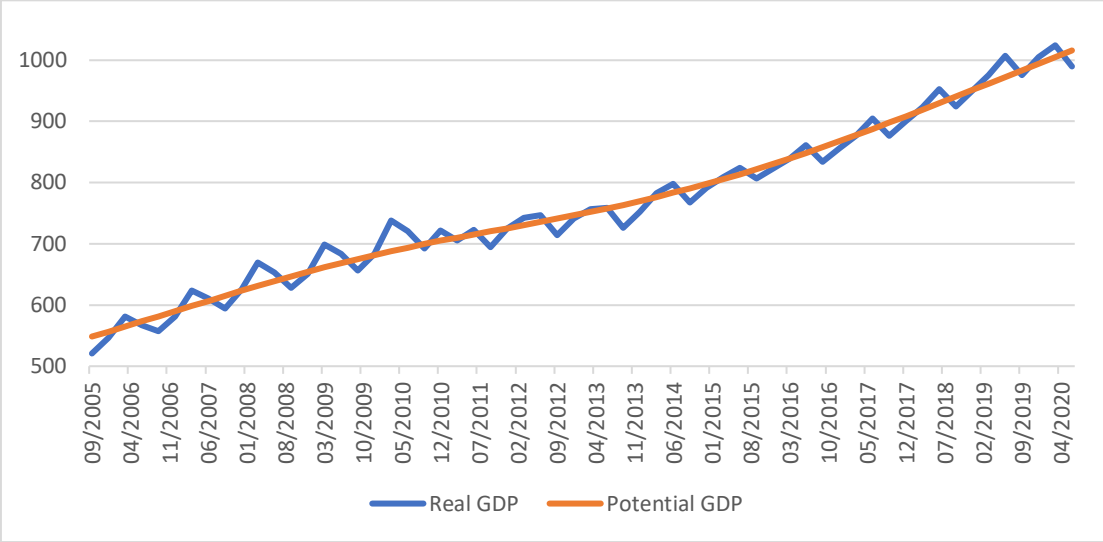
year fiscal framework for the public debt. Governance is also pivotal in ensuring the optimal use of resources and settling on the quality fiscal adjustments. Closely related is the public spending, public expenditure reforms are sometimes needed to lessen the government spending. Reducing spending should be pragmatic upon judging the public spending through its impact on economic growth and the investment culture. The need for adjustment should not diminish the pre-eminence of its quality and durability. Calls for a sovereign debt restructuring framework are also supported.

In summary, the main policy implications are as follows:

- Complement the IMF Approach with another unbiased country specific indicators in order to judge public debt sustainability
- Ensure fiscal transparency to anchor solid policies and strengthen the credibility of the authorities
- Employ an effective public finance management institution and publish a multi-year fiscal framework
- Pledge firm governance and impose public expenditure reforms to better direct the resources of the economy and induce inclusive economic growth

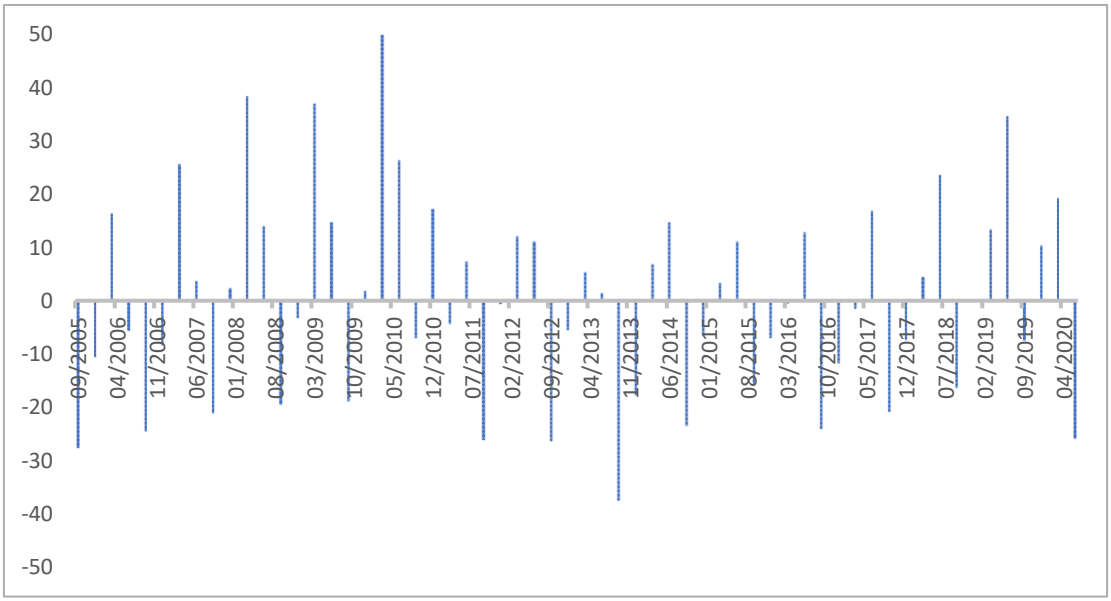
Appendix

Appendix A: Real GDP vs. Potential GDP



Source: Author's Calculations and The Ministry of Finance

Appendix B: Output Gap



Source: Author's Calculations

Appendix C: Underlying Assumptions of Alternative Scenarios (in percent)

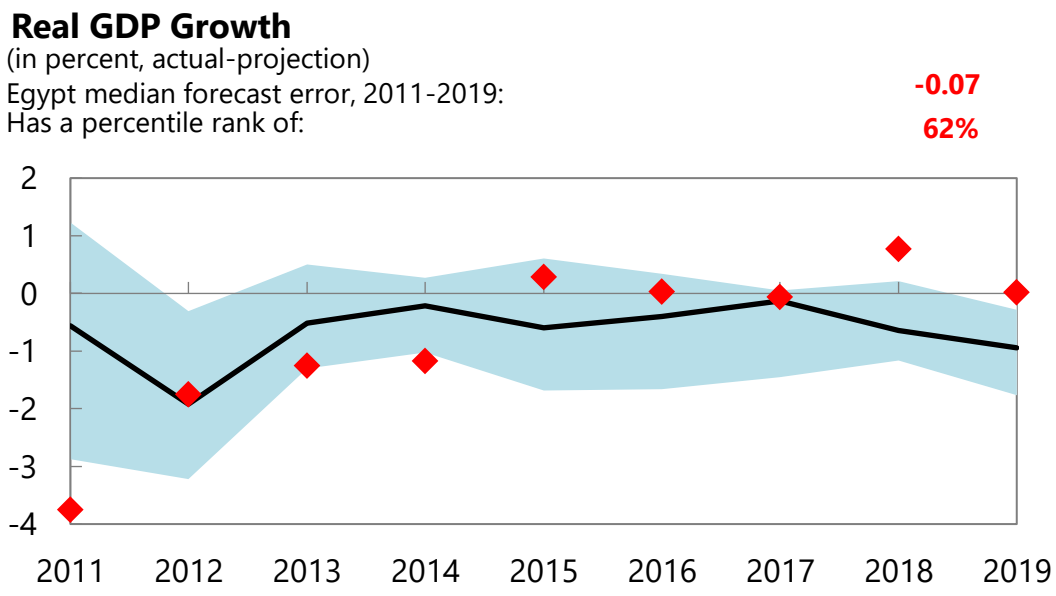
Baseline Scenario	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary Balance	1.1	2.3	2.2	2.0	1.9	1.8
Effective Interest Rate	10.2	10.1	10.0	9.1	9.0	8.8

Historical Scenario	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	3.7	3.7	3.7	3.7	3.7
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary Balance	1.1	-2.9	-2.9	-2.9	-2.9	-2.9
Effective Interest Rate	10.2	10.1	8.8	7.4	7.0	6.5

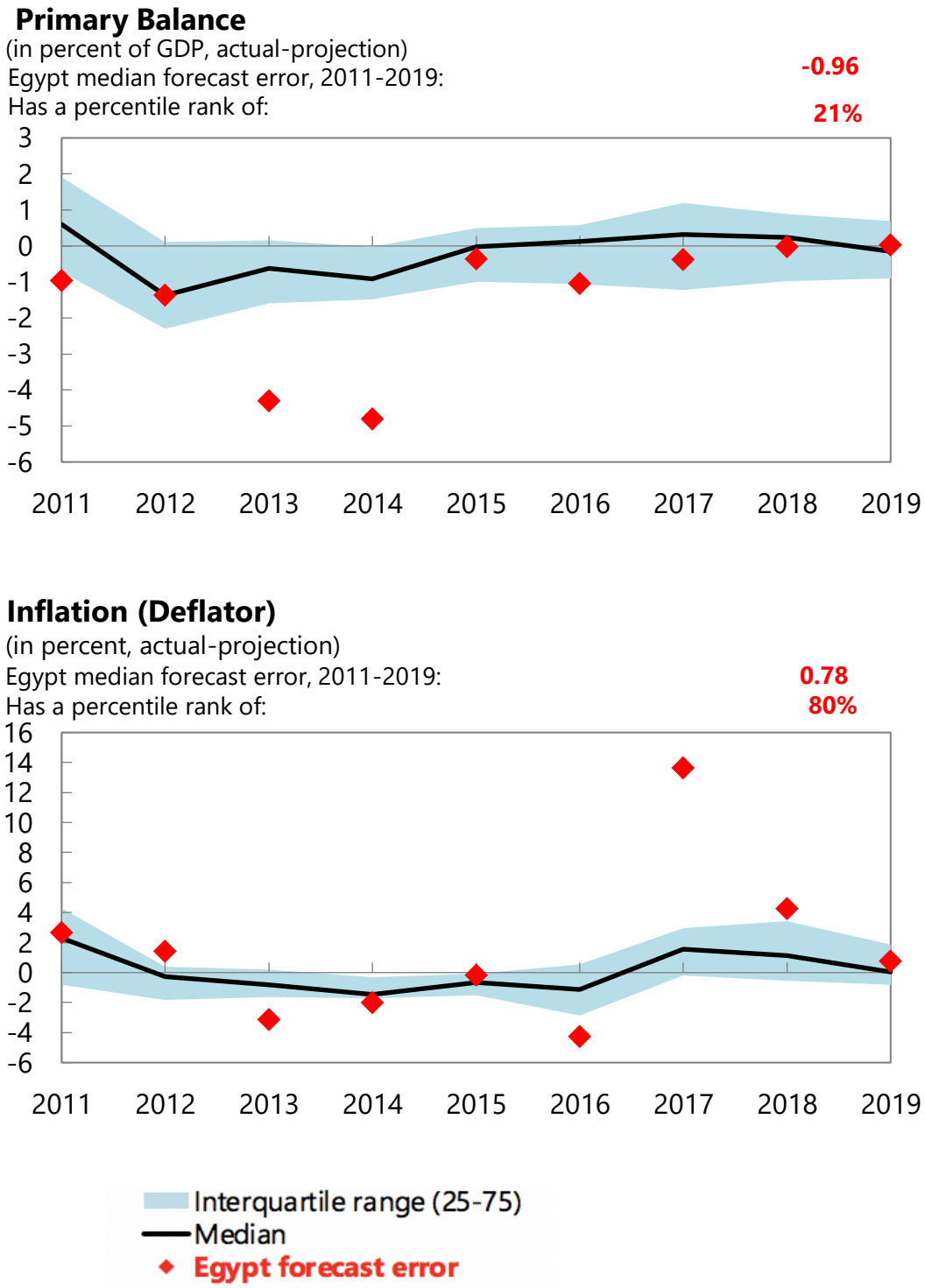
Constant Primary Balance Scenario	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary Balance	1.1	1.1	1.1	1.1	1.1	1.1
Effective Interest Rate	10.2	10.1	9.9	9.1	9.0	8.7

Source: Author's Calculations and IMF Estimates

Appendix D: Forecast Track Record, versus Program Countries[16]



[16] The plotted distribution includes program countries, percentile rank refers to all countries.



Appendix E: Alternative Scenarios of Stress Tests (in percent)

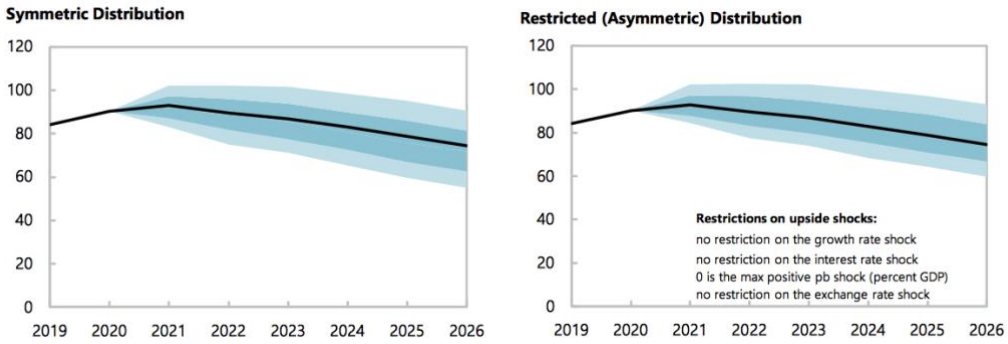
Primary Balance Shock	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8

Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary balance	1.1	1.0	0.8	2.0	1.9	1.8
Effective interest rate	10.2	10.1	10.0	9.2	9.1	8.8
Real Interest Rate Shock	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary balance	1.1	2.3	2.2	2.0	1.9	1.8
Effective interest rate	10.2	10.1	11.0	10.9	11.1	10.9
Combined Shock	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	42.3	7.8	7.8	7.6	7.5
Primary balance	1.1	1.0	0.8	2.0	1.9	1.8
Effective interest rate	10.2	11.4	9.4	9.6	9.9	9.9
Combined Macro-Fiscal and Contingent Liability Shock	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	42.3	7.8	7.8	7.6	7.5
Primary balance	1.1	-12.0	0.8	2.0	1.9	1.8
Effective interest rate	10.2	11.4	9.4	9.9	10.1	10.0
Real GDP Growth Shock	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	7.2	7.4	7.8	7.6	7.5
Primary balance	1.1	2.0	1.6	2.0	1.9	1.8
Effective interest rate	10.2	10.1	10.0	9.1	9.1	8.8
Real Exchange Rate Shock	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	42.3	7.8	7.8	7.6	7.5
Primary balance	1.1	2.3	2.2	2.0	1.9	1.8
Effective interest rate	10.2	11.4	8.5	8.0	8.1	7.9
Contingent Liability Shock	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	7.2	7.4	7.8	7.6	7.5

Primary balance	1.1	-10.7	2.2	2.0	1.9	1.8
Effective interest rate	10.2	10.1	9.7	9.2	9.1	8.8

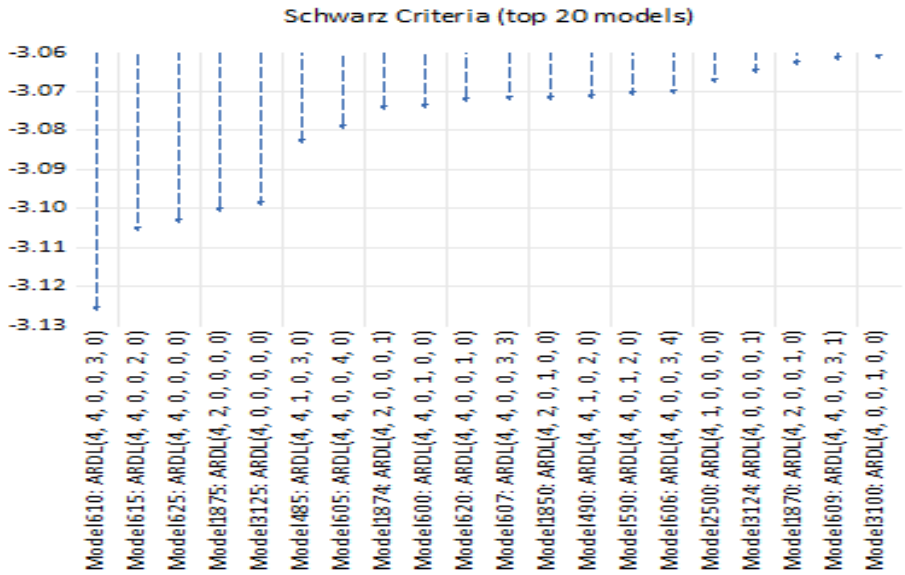
Source: Author's Calculations and IMF Estimates

Appendix F: IMF Fan Charts

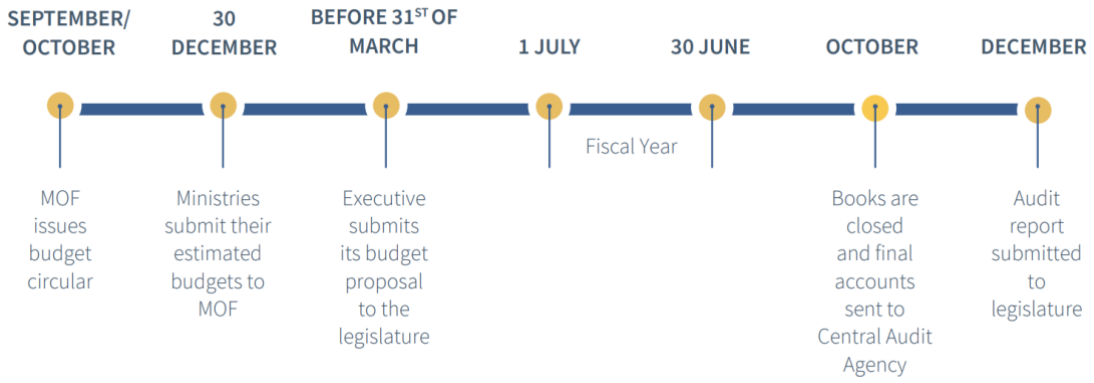


Source: IMF Estimates

Appendix G: Criteria Graph



Appendix H: The Budget Process in Egypt



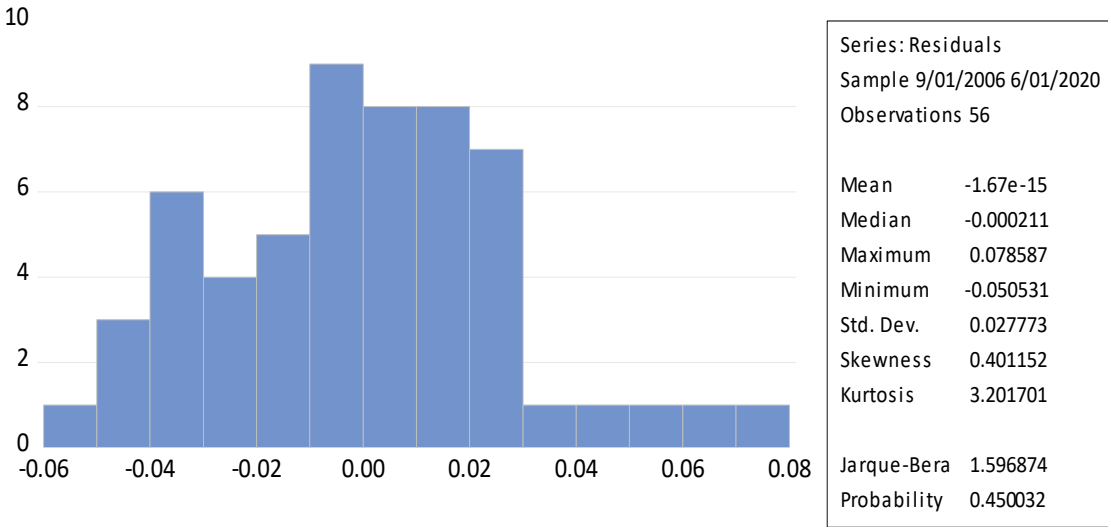
Appendix I: Residuals Test for ARDL Model

Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.034689	Prob. F(2,37)	0.9659
Obs*R-squared	0.104807	Prob. Chi-Square(2)	0.9489

Conclusion: We cannot reject null hypothesis; no serial correlation

Residuals Normality Test



Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	1.974752	Prob. F(16,39)	0.0420
Obs*R-squared	25.06342	Prob. Chi-Square(16)	0.0687
Scaled explained SS	13.38202	Prob. Chi-Square(16)	0.6446

Appendix J: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria						
Endogenous variables: PRIM_BAL PD_GDP OUTGAP EXCH T_BILL INF						
Exogenous variables: C						
Date: 03/21/21 Time: 12:34						
Sample: 9/01/2005 6/01/2020						
Included observations: 52						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	194.7062	NA	2.84e-11	-7.257932	-7.032789	-7.171618
1	485.9641	504.1001	1.56e-15	-17.07554	-15.49954	-16.47134
2	559.2057	109.8624	3.94e-16	-18.50791	-15.58104	-17.38582
3	636.8883	98.59713	9.19e-17	-20.11109	-15.83336	-18.47111
4	717.8936	84.12097	2.21e-17	-21.84206	-16.21348	-19.68420
5	768.3761	40.77430	2.25e-17	-22.39908	-15.41963	-19.72333
6	846.9279	45.31833	1.25e-17	-24.03569	-15.70538	-20.84204
7	1082.046	81.38693	4.70e-20	-31.69406	-22.01289	-27.98253
8	2931.058	213.3475*	6.44e-48*	-101.4253*	-90.39326*	-97.19587*

VAR Lag Order Selection Criteria						
Endogenous variables: PRIM_BAL PD_GDP OUTGAP EXCH T_BILL INF						
Exogenous variables: C						
Date: 03/21/21 Time: 12:44						
Sample: 9/01/2005 6/01/2020						
Included observations: 56						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	207.3881	NA	3.03e-11	-7.192431	-6.975429	-7.108300
1	519.2897	545.8278	1.61e-15	-17.04606	-15.52705	-16.45714
2	593.2284	113.5488	4.33e-16	-18.40102	-15.57999	-17.30731
3	682.1813	117.5448	7.33e-17	-20.29219	-16.16915	-18.69370

4	763.1617	89.65686*	1.87e-17*	-21.89863*	-16.47358*	-19.79535*

Appendix K: VAR Lag Exclusion Walt Tests

VAR Lag Exclusion Wald Tests							
Date: 03/21/21 Time: 13:29							
Sample (adjusted): 9/01/2006 6/01/2020							
Included observations: 56 after adjustments							
Chi-squared test statistics for lag exclusion:							
Numbers in [ ] are p-values							
	PRIM_BAL	**PD_GDP**	**OUTGAP**	**EXCH**	**T_BILL**	**INF**	**Joint**
Lag 1	684.2510	36.52571	4.262190	29.05315	56.91724	47.15593	1134.701
	[0.0000]	[0.0000]	[0.6412]	[0.0001]	[0.0000]	[0.0000]	[0.0000]
Lag 2	152.2123	17.84961	2.754637	7.754781	8.865284	6.900730	280.0361
	[0.0000]	[0.0066]	[0.8390]	[0.2566]	[0.1813]	[0.3301]	[0.0000]
Lag 3	47.97501	12.07143	1.540104	6.220746	5.766978	6.139035	114.4245
	[0.0000]	[0.0604]	[0.9568]	[0.3989]	[0.4498]	[0.4078]	[0.0000]
Lag 4	35.50144	75.12268	14.07498	9.978673	7.020037	9.587159	173.6386
	[0.0000]	[0.0000]	[0.0288]	[0.1256]	[0.3190]	[0.1431]	[0.0000]
df	6	6	6	6	6	6	36

Appendix L: Vector Autoregression Estimates

Vector Autoregression Estimates						
Date: 03/21/21 Time: 13:28						
Sample (adjusted): 9/01/2006 6/01/2020						
Included observations: 56 after adjustments						
Standard errors in ( ) & t-statistics in [ ]						
	PRIM_BAL	**PD_GDP**	**OUTGAP**	**EXCH**	**T_BILL**	**INF**
PRIM_BAL(-	3.119268	3.542233	50.18877	-29.78719	-22.33284	-149.2213
	(0.13781)	(11.9669)	(49.9119)	(40.0761)	(35.3208)	(81.4618)
	[22.6346]	[0.29600]	[1.00555]	[-0.74327]	[-0.63229]	[-1.83179]
PRIM_BAL(-	-3.896619	-19.36464	-105.1917	61.15248	28.66270	346.6652
	(0.35395)	(30.7356)	(128.193)	(102.931)	(90.7177)	(209.226)
	[-11.0090]	[-0.63004]	[-0.82057]	[0.59411]	[0.31595]	[1.65689]
P R	2.295718	25.62239	81.70658	-51.11296	-10.20851	-310.5086

	(0.34575)	(30.0240)	(125.225)	(100.548)	(88.6173)	(204.382)
	[6.63974]	[0.85340]	[0.65248]	[-0.50834]	[-0.11520]	[-1.51926]
PRIM_BAL(-	-0.516065	-12.34681	-25.47678	16.74529	-0.655961	107.1268
	(0.12867)	(11.1733)	(46.6019)	(37.4183)	(32.9784)	(76.0594)
	[-4.01075]	[-1.10503]	[-0.54669]	[0.44752]	[-0.01989]	[1.40846]
PD_GDP(-1)	-0.001478	0.353316	-0.431874	-0.092858	-0.152054	-0.674405
	(0.00179)	(0.15536)	(0.64798)	(0.52029)	(0.45855)	(1.05757)
	[-0.82631]	[2.27418]	[-0.66649]	[-0.17847]	[-0.33160]	[-0.63769]
PD_GDP(-2)	0.002601	0.146130	-0.475562	0.203993	0.238456	-0.834883
	(0.00195)	(0.16940)	(0.70655)	(0.56731)	(0.50000)	(1.15317)
	[1.33305]	[0.86262]	[-0.67308]	[0.35958]	[0.47691]	[-0.72399]
PD_GDP(-3)	-0.001088	0.263658	-0.004740	1.037893	-0.743761	1.546605
	(0.00207)	(0.17978)	(0.74983)	(0.60207)	(0.53063)	(1.22381)
	[-0.52569]	[1.46656]	[-0.00632]	[1.72388]	[-1.40166]	[1.26376]
PD_GDP(-4)	0.001360	0.770692	1.027298	0.376928	0.341943	0.790883
	(0.00199)	(0.17295)	(0.72135)	(0.57920)	(0.51047)	(1.17733)
	[0.68274]	[4.45612]	[1.42413]	[0.65077]	[0.66985]	[0.67176]
OUTGAP(-1)	0.000215	0.107516	-0.062652	0.233178	0.032018	0.089791
	(0.00069)	(0.06027)	(0.25137)	(0.20184)	(0.17789)	(0.41027)
	[0.31001]	[1.78394]	[-0.24924]	[1.15529]	[0.17999]	[0.21886]
OUTGAP(-2)	-0.001195	0.157717	-0.130712	0.375789	0.100615	0.362857
	(0.00063)	(0.05455)	(0.22751)	(0.18267)	(0.16100)	(0.37132)
	[-1.90289]	[2.89138]	[-0.57454]	[2.05715]	[0.62494]	[0.97721]
OUTGAP(-3)	5.43E-06	0.097481	-0.040098	0.072351	0.046038	-0.177020
	(0.00060)	(0.05237)	(0.21842)	(0.17538)	(0.15457)	(0.35649)
	[0.00901]	[1.86142]	[-0.18358]	[0.41253]	[0.29784]	[-0.49656]
OUTGAP(-4)	-0.000651	0.245965	0.503720	0.284331	0.029176	-0.039799
	(0.00047)	(0.04059)	(0.16931)	(0.13595)	(0.11982)	(0.27634)
	[-1.39272]	[6.05912]	[2.97511]	[2.09149]	[0.24350]	[-0.14402]
EXCH(-1)	-0.000487	-0.036157	-0.120292	0.594337	0.261288	1.013540
	(0.00068)	(0.05927)	(0.24720)	(0.19849)	(0.17494)	(0.40346)
	[-0.71398]	[-0.61005]	[-0.48661]	[2.99433]	[1.49362]	[2.51211]
EXCH(-2)	0.000159	-0.078477	0.093810	-0.142967	-0.052639	-0.242004
	(0.00081)	(0.07068)	(0.29480)	(0.23670)	(0.20862)	(0.48114)
	[0.19476]	[-1.11032]	[0.31822]	[-0.60400]	[-0.25232]	[-0.50298]
EXCH(-3)	-0.000781	-0.106615	-0.177326	0.023846	0.194670	0.483234
	(0.00080)	(0.06980)	(0.29113)	(0.23376)	(0.20602)	(0.47516)
	[-0.97106]	[-1.52739]	[-0.60909]	[0.10201]	[0.94489]	[1.01699]
EXCH(-4)	0.001021	-0.103824	-0.098857	-0.124739	0.116664	-0.850208
	(0.00076)	(0.06637)	(0.27681)	(0.22226)	(0.19589)	(0.45178)
	[1.33595]	[-1.56437]	[-0.35713]	[-0.56123]	[0.59556]	[-1.88189]
T_BILL(-1)	0.000481	0.120192	0.281164	0.219761	0.985880	-0.346031
	(0.00077)	(0.06718)	(0.28021)	(0.22499)	(0.19829)	(0.45733)
	[0.62143]	[1.78901]	[1.00340]	[0.97675]	[4.97180]	[-0.75663]

T_BILL(-2)	-0.000824	-0.040102	-0.303611	0.129587	-0.600327	-0.015547
	(0.00099)	(0.08559)	(0.35699)	(0.28664)	(0.25263)	(0.58264)
	[-0.83645]	[-0.46853]	[-0.85048]	[0.45209]	[-2.37635]	[-0.02668]
T_BILL(-3)	0.000351	0.130467	0.118392	0.086279	0.327775	-0.568998
	(0.00092)	(0.08031)	(0.33495)	(0.26895)	(0.23703)	(0.54668)
	[0.38006]	[1.62456]	[0.35346]	[0.32080]	[1.38282]	[-1.04082]
T_BILL(-4)	0.000734	0.162863	0.154303	0.061480	-0.368467	0.174919
	(0.00078)	(0.06738)	(0.28102)	(0.22564)	(0.19887)	(0.45866)
	[0.94624]	[2.41718]	[0.54908]	[0.27247]	[-1.85283]	[0.38137]
INF(-1)	0.000240	-0.024230	-0.005900	0.023928	0.064432	0.771844
	(0.00031)	(0.02650)	(0.11053)	(0.08875)	(0.07822)	(0.18040)
	[0.78712]	[-0.91428]	[-0.05338]	[0.26960]	[0.82372]	[4.27842]
INF(-2)	0.000618	-0.011239	0.023187	-0.038068	-0.063629	-0.240684
	(0.00039)	(0.03388)	(0.14131)	(0.11347)	(0.10000)	(0.23064)
	[1.58279]	[-0.33171]	[0.16409]	[-0.33550]	[-0.63628]	[-1.04356]
INF(-3)	-0.000717	0.014361	0.068560	-0.045977	-0.087844	0.057760
	(0.00039)	(0.03418)	(0.14257)	(0.11447)	(0.10089)	(0.23268)
	[-1.82191]	[0.42014]	[0.48090]	[-0.40164]	[-0.87070]	[0.24823]
INF(-4)	1.48E-06	-0.016032	-0.002187	0.097186	0.099687	0.088217
	(0.00028)	(0.02407)	(0.10037)	(0.08059)	(0.07103)	(0.16382)
	[0.00534]	[-0.66617]	[-0.02179]	[1.20587]	[1.40343]	[0.53849]
C	-0.011048	6.337412	-2.965355	2.618655	21.70268	24.23422
	(0.03317)	(2.88013)	(12.0126)	(9.64532)	(8.50084)	(19.6058)
	[-0.33310]	[2.20039]	[-0.24685]	[0.27149]	[2.55300]	[1.23607]

Appendix M: Vector Error Correction Estimates

Vector Error Correction Estimates	
Date: 03/21/21 Time: 15:03	
Sample (adjusted): 9/01/2006 6/01/2020	
Included observations: 56 after adjustments	
Standard errors in ( ) & t-statistics in [ ]	
Cointegrating Eq:	**CointEq1**
LPRIM_BAL(-1)	1.000000
LPD_GDP(-1)	-0.152751
	(0.03460)
	[-4.41430]

LOUTGAP(-1)	-0.170746					
	(0.02535)					
	[-6.73678]					
LEXCH(-1)	0.050570					
	(0.02317)					
	[2.18263]					
LT_BILL(-1)	-0.071241					
	(0.02290)					
	[-3.11142]					
LINF(-1)	0.014878					
	(0.00436)					
	[3.41017]					
C	-3.078369					
Error Correction:	**D(LPRIM_BAL)**	**D(LPD_GDP)**	**D(LOUTGAP)**	**D(LEXCH)**	**D(LT_BILL)**	**D(LINF)**
CointEq1	-0.011571	-2.739345	-0.515953	-2.812146	0.071825	-1.400781
	(0.00607)	(0.48265)	(1.97978)	(1.63493)	(1.50920)	(3.65192)
	[-1.90552]	[-5.67569]	[-0.26061]	[-1.72005]	[0.04759]	[-0.38357]
D(LPRIM_BAL(-1))	2.426365	-14.76925	34.32504	-14.63201	-21.96338	-101.1969
	(0.10636)	(8.45383)	(34.6771)	(28.6367)	(26.4345)	(63.9656)
	[22.8134]	[-1.74705]	[0.98985]	[-0.51095]	[-0.83086]	[-1.58205]
D(LPRIM_BAL(-2))	-2.278369	19.35670	-33.28892	20.27482	25.14819	137.0691
	(0.17202)	(13.6733)	(56.0870)	(46.3173)	(42.7555)	(103.459)
	[-13.2446]	[1.41566]	[-0.59352]	[0.43774]	[0.58819]	[1.32487]

D(LPRIM_BAL(-3))	0.817568	-8.762084	4.043596	-9.769724	-5.435693	-62.44693
	(0.09120)	(7.24872)	(29.7338)	(24.5545)	(22.6662)	(54.8472)
	[8.96500]	[-1.20878]	[0.13599]	[-0.39788]	[-0.23981]	[-1.13856]
D(LPD_GDP(-1))	-0.004154	-1.011166	-0.558911	-0.733197	-0.261934	-0.771688
	(0.00260)	(0.20646)	(0.84690)	(0.69938)	(0.64560)	(1.56220)
	[-1.59916]	[-4.89755]	[-0.65995]	[-1.04835]	[-0.40572]	[-0.49398]
D(LPD_GDP(-2))	-0.001523	-0.911638	-1.036047	-0.754729	0.194646	-1.686542
	(0.00261)	(0.20732)	(0.85040)	(0.70227)	(0.64827)	(1.56866)
	[-0.58374]	[-4.39729]	[-1.21830]	[-1.07469]	[0.30025]	[-1.07515]
D(LPD_GDP(-3))	-0.002511	-0.692258	-0.973470	-0.032608	-0.401559	-0.074877
	(0.00217)	(0.17255)	(0.70780)	(0.58451)	(0.53956)	(1.30561)
	[-1.15654]	[-4.01189]	[-1.37535]	[-0.05579]	[-0.74424]	[-0.05735]
D(LOUTGAP(-1))	-0.000853	-0.400723	-0.928646	-0.381867	0.036001	-0.191461
	(0.00075)	(0.05925)	(0.24303)	(0.20070)	(0.18526)	(0.44829)
	[-1.14448]	[-6.76356]	[-3.82114]	[-1.90271]	[0.19432]	[-0.42709]

D(LOUTGAP(-2))	-0.001109	-0.276754	-0.855800	-0.127649	0.058255	0.162935
	(0.00051)	(0.04018)	(0.16481)	(0.13610)	(0.12563)	(0.30400)
	[-2.19320]	[-6.88827]	[-5.19277]	[-0.93791]	[0.46369]	[0.53597]
D(LOUTGAP(-3))	-0.000145	-0.210950	-0.705288	-0.158027	0.013604	-0.057733
	(0.00037)	(0.02979)	(0.12222)	(0.10093)	(0.09317)	(0.22544)
	[-0.38726]	[-7.08004]	[-5.77079]	[-1.56574]	[0.14602]	[-0.25609]
D(LEXCH(-1))	0.000131	0.128608	-0.038546	-0.025171	0.188407	1.132766
	(0.00069)	(0.05479)	(0.22473)	(0.18559)	(0.17131)	(0.41454)
	[0.19015]	[2.34744]	[-0.17152]	[-0.13563]	[1.09978]	[2.73259]
D(LEXCH(-2))	0.000537	0.092038	0.161073	-0.071661	-0.018137	0.442514
	(0.00077)	(0.06129)	(0.25142)	(0.20763)	(0.19166)	(0.46378)
	[0.69638]	[1.50158]	[0.64064]	[-0.34514]	[-0.09463]	[0.95415]
D(LEXCH(-3))	-0.000260	0.011682	0.018357	0.020610	0.088746	0.818849
	(0.00072)	(0.05758)	(0.23618)	(0.19504)	(0.18004)	(0.43567)
	[-0.35837]	[0.20289]	[0.07772]	[0.10567]	[0.49291]	[1.87953]

D(LT_BILL(-1))	9.67E-05	-0.149697	0.189831	-0.089365	0.244033	-0.549029
	(0.00084)	(0.06668)	(0.27352)	(0.22588)	(0.20851)	(0.50454)
	[0.11530]	[-2.24498]	[0.69403]	[-0.39564]	[1.17039]	[-1.08818]
D(LT_BILL(-2))	-0.001521	-0.172075	-0.207204	0.008033	-0.293906	-0.280153
	(0.00079)	(0.06259)	(0.25674)	(0.21202)	(0.19572)	(0.47359)
	[-1.93140]	[-2.74919]	[-0.80704]	[0.03789]	[-1.50168]	[-0.59155]
D(LT_BILL(-3))	-0.000358	-0.109734	-0.077691	0.057843	0.137302	-0.840869
	(0.00071)	(0.05672)	(0.23267)	(0.19215)	(0.17737)	(0.42919)
	[-0.50159]	[-1.93456]	[-0.33390]	[0.30104]	[0.77410]	[-1.95919]
D(LINF(-1))	0.000349	-0.005320	-0.034764	0.067269	0.100816	0.218075
	(0.00026)	(0.02046)	(0.08392)	(0.06930)	(0.06397)	(0.15480)
	[1.35715]	[-0.26001]	[-0.41424]	[0.97063]	[1.57586]	[1.40871]
D(LINF(-2))	0.000734	0.008052	0.008625	0.027609	0.007274	-0.116044
	(0.00028)	(0.02208)	(0.09058)	(0.07481)	(0.06905)	(0.16709)
	[2.64204]	[0.36461]	[0.09521]	[0.36908]	[0.10533]	[-0.69449]

D(LINF(-3))	-2.24E-05	0.019914	0.093922	-0.042396	-0.043405	-0.077811
	(0.00028)	(0.02217)	(0.09096)	(0.07511)	(0.06934)	(0.16778)
	[-0.08031]	[0.89808]	[1.03262]	[-0.56444]	[-0.62600]	[-0.46378]
C	7.42E-05	0.012759	0.000540	0.026858	0.004081	-0.005693
	(6.0E-05)	(0.00478)	(0.01962)	(0.01620)	(0.01496)	(0.03620)
	[1.23358]	[2.66713]	[0.02749]	[1.65739]	[0.27284]	[-0.15727]

Appendix N: VAR Granger Causality

VAR Granger Causality/Block Exogeneity Wald Tests			
Date: 03/21/21 Time: 13:51			
Sample: 9/01/2005 6/01/2020			
Included observations: 56			
Dependent variable: PRIM_BAL			
Excluded	**Chi-sq**	**df**	**Prob.**
PD_GDP	2.496398	4	0.6453
OUTGAP	4.844815	4	0.3036
EXCH	2.841720	4	0.5847
T_BILL	2.261759	4	0.6877
INF	10.57494	4	0.0318
All	43.06674	20	0.0020
Dependent variable: PD_GDP			
Excluded	**Chi-sq**	**df**	**Prob.**
PRIM_BAL	17.90520	4	0.0013
OUTGAP	39.09221	4	0.0000
EXCH	12.42917	4	0.0144
T_BILL	16.22735	4	0.0027
INF	3.668937	4	0.4527
All	143.5933	20	0.0000
Dependent variable: OUTGAP			
Excluded	**Chi-sq**	**df**	**Prob.**
PRIM_BAL	2.712994	4	0.6069

PD_GDP	3.016881	4	0.5550
EXCH	0.964937	4	0.9151
T_BILL	1.560802	4	0.8158
INF	1.909472	4	0.7524
All	22.44959	20	0.3166
Dependent variable: EXCH			
Excluded	**Chi-sq**	**df**	**Prob.**
PRIM_BAL	2.000360	4	0.7357
PD_GDP	11.62922	4	0.0203
OUTGAP	6.346446	4	0.1747
T_BILL	3.777887	4	0.4369
INF	1.935896	4	0.7475
All	20.69582	20	0.4152
Dependent variable: T_BILL			
Excluded	**Chi-sq**	**df**	**Prob.**
PRIM_BAL	5.716097	4	0.2214
PD_GDP	2.864434	4	0.5808
OUTGAP	0.428986	4	0.9800
EXCH	4.381619	4	0.3568
INF	3.275278	4	0.5129
All	31.41776	20	0.0499
Dependent variable: INF			
Excluded	**Chi-sq**	**df**	**Prob.**
PRIM_BAL	4.545511	4	0.3372
PD_GDP	2.706543	4	0.6081
OUTGAP	1.946996	4	0.7455
EXCH	11.21073	4	0.0243
T_BILL	3.202844	4	0.5245
All	29.05883	20	0.0866

Appendix O: IMF Workbook

Egypt Public Sector Debt Sustainability Analysis (DSA) - Baseline Scenario

(in percent of GDP unless otherwise indicated)

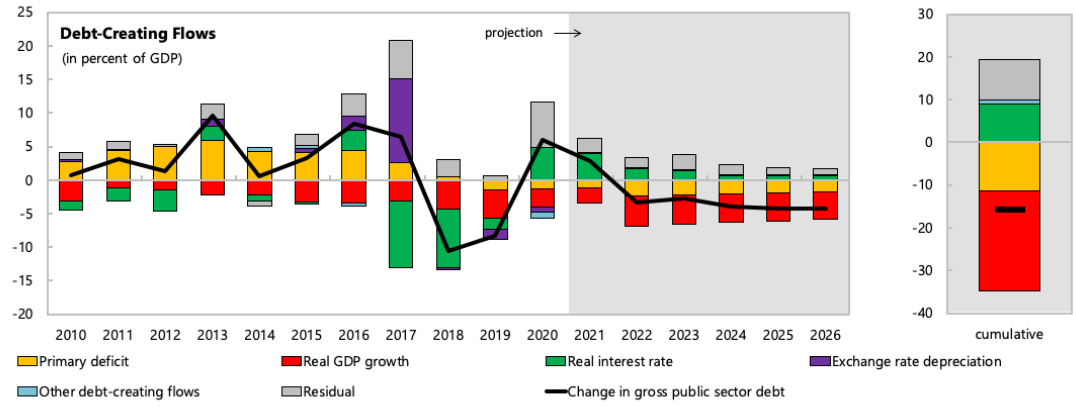
Debt, Economic and Market Indicators [1/]

	Actual			Projections					
	2010-2018 [2/]	2019	2020	2021	2022	2023	2024	2025	2026
Nominal gross public debt	85.1	84.2	90.2	93.0	89.6	86.9	83.0	78.7	74.5
Public gross financing needs	30.7	36.5	38.0	36.9	35.8	34.4	29.5	29.4	28.8
Real GDP growth (in percent)	3.7	5.6	3.6	2.8	5.5	5.5	5.6	6.0	5.8
Inflation (GDP deflator, in percent)	12.8	13.6	5.6	5.3	7.6	7.8	7.8	7.6	7.5
Nominal GDP growth (in percent)	17.0	19.9	9.4	8.2	13.5	13.6	13.8	13.8	13.8
Effective interest rate (in percent) [4/]	10.0	12.3	12.2	10.2	10.1	10.0	9.1	9.0	8.8

As of November 17, 2020		
Sovereign Spreads		
Bond Spread (bp) 3/		580
5Y CDS (bp)		410
Ratings	Foreign	Local
Moody's	B2	B2
S&Ps	B	B
Fitch	B+	B+

Contribution to Changes in Public Debt

	Actual			Projections							
	2010-2018	2019	2020	2021	2022	2023	2024	2025	2026	cumulative	debt-stabilizing primary balance [9/]
Change in gross public sector debt	2.6	-8.3	6.0	2.8	-3.4	-2.7	-3.9	-4.3	-4.2	-15.7	
Identified debt-creating flows	0.7	-8.8	-0.7	0.7	-5.0	-4.9	-5.5	-5.3	-5.2	-25.1	
Primary deficit	3.8	-1.4	-1.3	-1.1	-2.3	-2.2	-2.0	-1.9	-1.8	-11.3	-3.3
Primary (noninterest) revenue and grants	21.4	20.1	19.1	20.5	20.7	21.0	21.3	21.6	21.6	126.7	
Primary (noninterest) expenditure	25.2	18.8	17.8	19.4	18.4	18.8	19.2	19.7	19.8	115.3	
Automatic debt dynamics [5/]	-3.3	-7.5	1.4	1.6	-2.8	-2.9	-3.6	-3.5	-3.5	-14.6	
Interest rate/growth differential [6/]	-5.0	-5.9	2.1	1.6	-2.8	-2.9	-3.6	-3.5	-3.5	-14.6	
Of which: real interest rate	-2.4	-1.6	4.9	3.9	1.7	1.4	0.7	0.7	0.6	9.0	
Of which: real GDP growth	-2.7	-4.3	-2.7	-2.3	-4.5	-4.3	-4.3	-4.2	-4.0	-23.6	
Exchange rate depreciation [7/]	1.8	-1.6	-0.7	...	...	...	...	...	...	...	
Other identified debt-creating flows	0.1	0.0	-0.9	0.2	0.1	0.1	0.1	0.1	0.1	0.9	
Please specify (1) (e.g., privatization receipts)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GG: Net Lending	0.1	0.0	-0.9	0.2	0.1	0.1	0.1	0.1	0.1	0.9	
Residual, including asset changes [8/]	1.9	0.6	6.7	2.1	1.6	2.2	1.5	1.0	1.0	9.4	



Source: IMF staff.

1/ Public sector is defined as general government.

2/ Based on available data.

3/ EMBIG (bp).

4/ Defined as interest payments divided by debt stock (excluding guarantees) at the end of previous year.

5/ Derived as [r - π(1+g) - g + ae(1+r)]/(1+g+π+gπ) times previous period debt ratio, with r = effective nominal interest rate; π = growth rate of GDP deflator; g = real GDP growth rate; a = share of foreign-currency denominated debt; and e = nominal exchange rate depreciation (measured by increase in local currency value of U.S. dollar).

6/ The real interest rate contribution is derived from the numerator in footnote 5 as r - π (1+g) and the real growth contribution as -g.

7/ The exchange rate contribution is derived from the numerator in footnote 5 as ae(1+r).

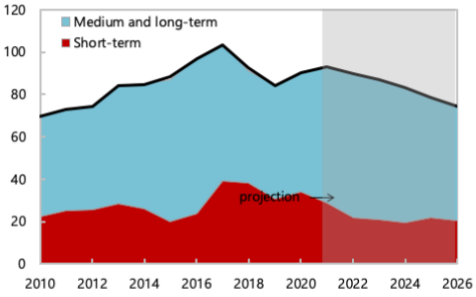
8/ Includes asset changes and interest revenues (if any). For projections, includes exchange rate changes during the projection period.

9/ Assumes that key variables (real GDP growth, real interest rate, and other identified debt-creating flows) remain at the level of the last projection year.

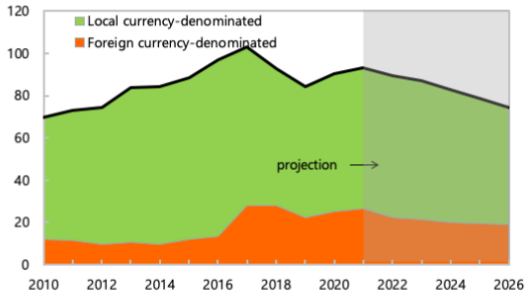
Egypt Public DSA - Composition of Public Debt and Alternative Scenarios

Composition of Public Debt

By Maturity
(in percent of GDP)

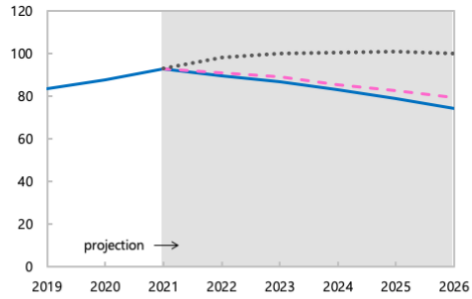


By Currency
(in percent of GDP)

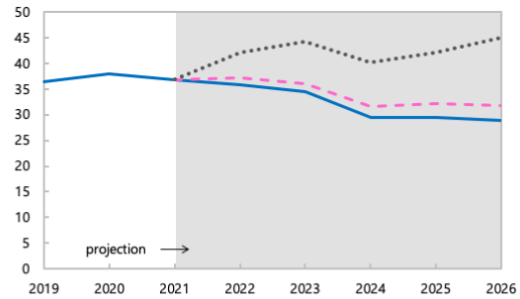


Alternative Scenarios

Gross Nominal Public Debt [1/]
(in percent of GDP)



Public Gross Financing Needs
(in percent of GDP)



Underlying Assumptions
(in percent)

Baseline Scenario	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary Balance	1.1	2.3	2.2	2.0	1.9	1.8
Effective interest rate	10.2	10.1	10.0	9.1	9.0	8.8
Constant Primary Balance Scenario						
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary Balance	1.1	1.1	1.1	1.1	1.1	1.1
Effective interest rate	10.2	10.1	9.9	9.1	9.0	8.7

Historical Scenario	2021	2022	2023	2024	2025	2026
Real GDP growth	2.8	3.7	3.7	3.7	3.7	3.7
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary Balance	1.1	-2.9	-2.9	-2.9	-2.9	-2.9
Effective interest rate	10.2	10.1	8.8	7.4	7.0	6.5

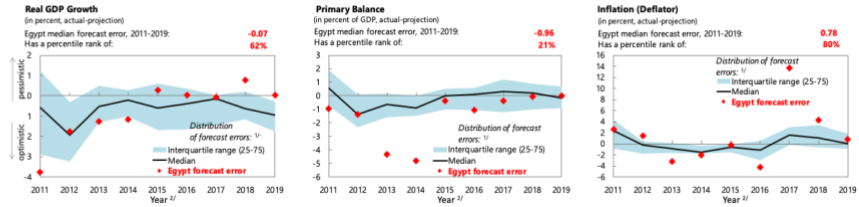
Source: IMF staff.

Egypt Public DSA - Realism of Baseline Assumptions

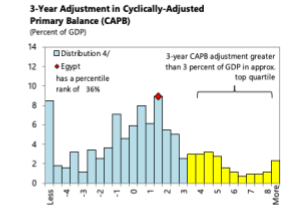
Forecast Track Record comparator group:

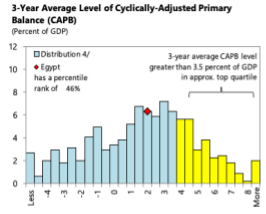
program countries

Forecast Track Record, versus program countries

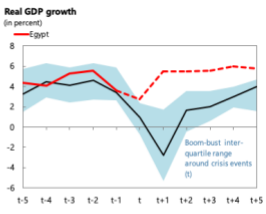


Assessing the Realism of Projected Fiscal Adjustment





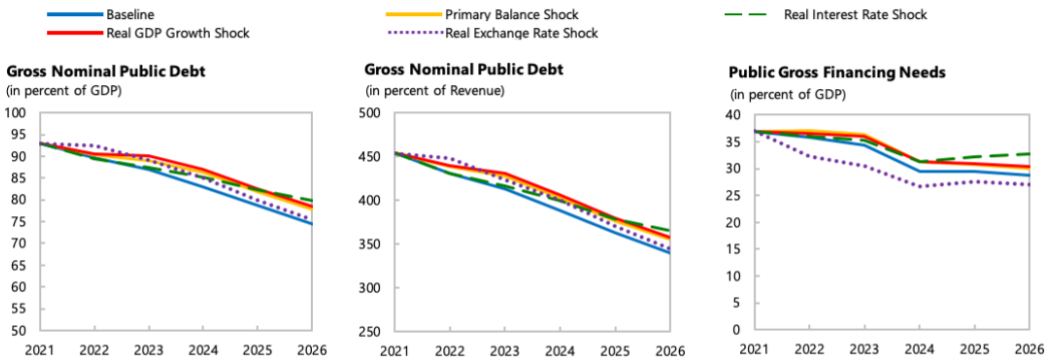
Boom-Bust Analysis 3/



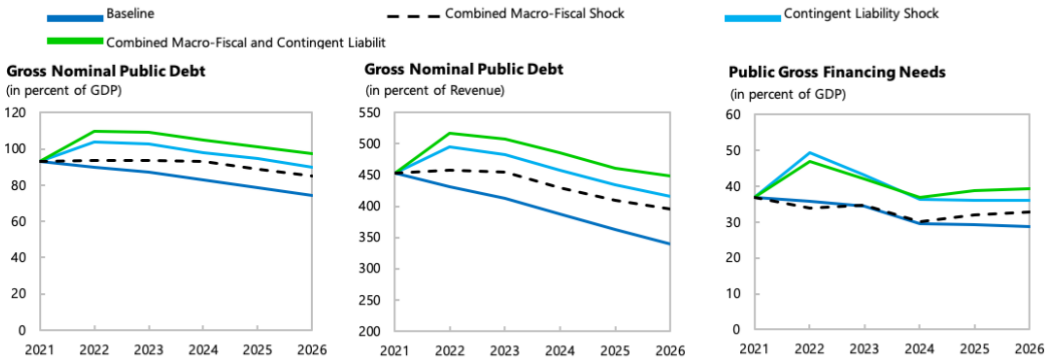
Source : IMF Staff.
1/ Plotted distribution includes program countries, percentile rank refers to all countries.
2/ Projections made in the spring WEO vintage of the preceding year.
3/ Egypt has had a positive output gap for 3 consecutive years, 2018-2020. For Egypt, t corresponds to 2021; for the distribution, t corresponds to the first year of the crisis.
4/ Data cover annual observations from 1990 to 2011 for advanced and emerging economies with debt greater than 60 percent of GDP. Percent of sample on vertical axis.

Egypt Public DSA - Stress Tests

Macro-Fiscal Stress Tests



Additional Stress Tests



Underlying Assumptions

(in percent)

	2021	2022	2023	2024	2025	2026
Primary Balance Shock						
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary balance	1.1	1.0	0.8	2.0	1.9	2.4
Effective interest rate	10.2	10.1	10.0	9.2	9.1	8.8
Real Interest Rate Shock						
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	7.6	7.8	7.8	7.6	7.5
Primary balance	1.1	2.3	2.2	2.0	1.9	2.4
Effective interest rate	10.2	10.1	11.0	10.9	11.1	10.9
Combined Shock						
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	42.3	7.8	7.8	7.6	7.5
Primary balance	1.1	1.0	0.8	2.0	1.9	2.4
Effective interest rate	10.2	11.4	9.4	9.6	9.9	9.9
Combined Macro-Fiscal and Contingent Liability Shock						
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	42.3	7.8	7.8	7.6	7.5
Primary balance	1.1	-12.0	0.8	2.0	1.9	1.8
Effective interest rate	10.2	11.4	9.4	9.9	10.1	10.0

	2021	2022	2023	2024	2025	2026
Real GDP Growth Shock						
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	7.2	7.4	7.8	7.6	7.5
Primary balance	1.1	2.0	1.6	2.0	1.9	2.4
Effective interest rate	10.2	10.1	10.0	9.1	9.1	8.8
Real Exchange Rate Shock						
Real GDP growth	2.8	5.5	5.5	5.6	6.0	5.8
Inflation	5.3	42.3	7.8	7.8	7.6	7.5
Primary balance	1.1	2.3	2.2	2.0	1.9	2.4
Effective interest rate	10.2	11.4	8.5	8.0	8.1	7.9
Contingent Liability Shock						
Real GDP growth	2.8	4.3	4.2	5.6	6.0	5.8
Inflation	5.3	7.2	7.4	7.8	7.6	7.5
Primary balance	1.1	-10.7	2.2	2.0	1.9	2.4
Effective interest rate	10.2	10.1	9.7	9.2	9.1	8.8

Source: IMF staff.

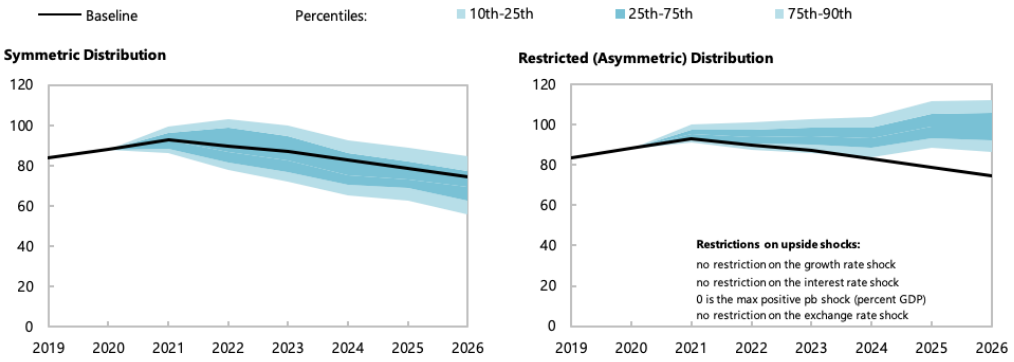
Egypt Public DSA Risk Assessment

Heat Map

Debt level 1/	Real GDP Growth Shock	Primary Balance Shock	Real Interest Rate Shock	Exchange Rate Shock	Contingent Liability shock
Gross financing needs 2/	Real GDP Growth Shock	Primary Balance Shock	Real Interest Rate Shock	Exchange Rate Shock	Contingent Liability Shock
Debt profile 3/	Market Perception	External Financing Requirements	Change in the Share of Short-Term Debt	Public Debt Held by Non-Residents	Foreign Currency Debt

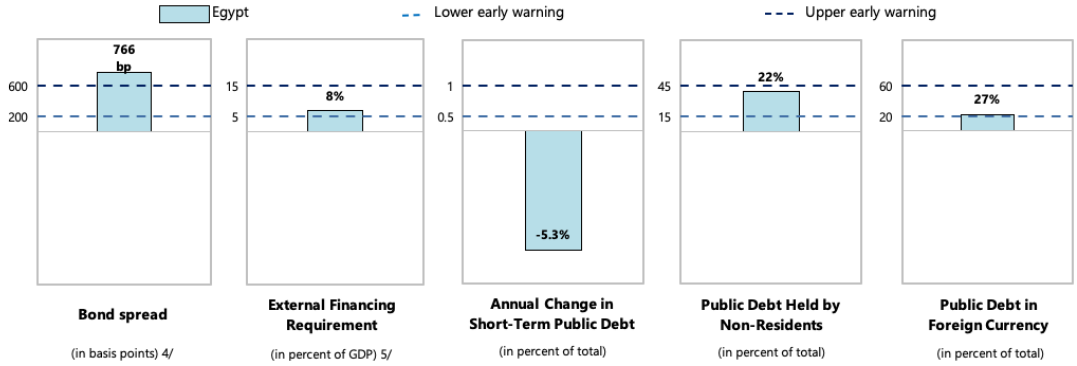
Evolution of Predictive Densities of Gross Nominal Public Debt

(in percent of GDP)



Debt Profile Vulnerabilities

(Indicators vis-à-vis risk assessment benchmarks, in 2020)



Source: IMF staff.

1/ The cell is highlighted in green if debt burden benchmark of 70% is not exceeded under the specific shock or baseline, yellow if exceeded under specific shock but not baseline, red if benchmark is exceeded under baseline, white if stress test is not relevant.

2/ The cell is highlighted in green if gross financing needs benchmark of 15% is not exceeded under the specific shock or baseline, yellow if exceeded under specific shock but not baseline, red if benchmark is exceeded under baseline, white if stress test is not relevant.

3/ The cell is highlighted in green if country value is less than the lower risk-assessment benchmark, red if country value exceeds the upper risk-assessment benchmark, yellow if country value is between the lower and upper risk-assessment benchmarks. If data are unavailable or indicator is not relevant, cell is white.
Lower and upper risk-assessment benchmarks are:

200 and 600 basis points for bond spreads; 5 and 15 percent of GDP for external financing requirement; 0.5 and 1 percent for change in the share of short-term debt; 15 and 45 percent for the public debt held by non-residents; and 20 and 60 percent for the share of foreign-currency denominated debt.

4/ EMBIG (bp), an average over the last 3 months, 19-Aug-20 through 17-Nov-20.

5/ External financing requirement is defined as the sum of current account deficit, amortization of medium and long-term total external debt, and short-term total external debt at the end of previous period.

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