

< 論文 >

# The Impact of Floating Exchange Rate Regime on the Egyptian Public Finance

自由変動為替相場制への移行のエジプト財政への影響

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## 要約

This paper studied the impact of shifting to the floating exchange regime on public finance in Egypt with attention to debt. The paper found that fiscal position measured by structural balance to GDP was rising during the period after transition to floating exchange rate system despite rising interest rates, rapidly tightening monetary policy against capital outflows and souring inflation. Then, the paper looked at the impact of regime change on structural balance to GDP. The regression derived from debt dynamics equation shows a positive and statistically significant relation by public debt on structural balance confirming the causality from debt to structural balance. In the second half of this paper, the stability of debt is analyzed. The analysis provides that the sensitivity of primary balance on debt is very large, compared with rate of inflation, nominal interest rates and therefore, debt is stable in Egypt.

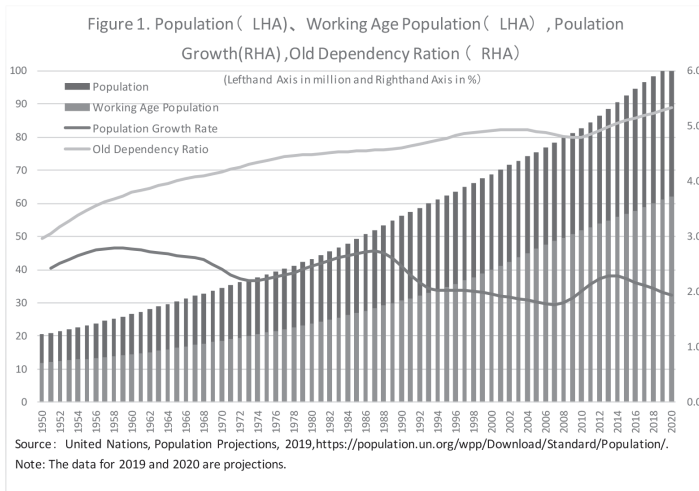
**キーワード：**エジプト、変動相場制、構造的財政収支、基礎的財政収支、石油収入、財政反応関数、Granger Causality Test、債務の安定性。

## 1. Introduction

The demonstration against the government which started in Tunisia, 2010 was quickly spread over the Middle Eastern countries. Egypt was no

exception. The President, Mubarak resigned in 2011. The government’s malfunction in the aftermath of the revolution resulted in a sudden fall in government revenue. Moreover, the emergence of the Islamic State, or IS in the region and the airplane crash accident put the Egyptian economy into deep troubles. The tourist arrival fell sharply and foreign direct investment flew out, which led to a shortage of international reserves. Consequently, the Egyptian government asked IMF for rescue. One of the requirements for the Extended Fund Facility, the rescue package, was shifting to floating exchange rate regime. Egypt introduced floating exchange rate system in November 2016. Upon the introduction of floating exchange rate system, the Egyptian pound (EL) depreciated from 8.7 EL/US\$ in October 2016 to 18.2 EL/US\$ in December 2016, which accompanied with rate of inflation hiking from 13.6% year-on-year in October 2016 to 23.3% in December, 2016 and hit the record high, 31.6% in September, 2017.

This paper will first analyze to what extent the fiscal policy mitigated the adverse impact of exchange regime shift on the economy and then,



to examine how the exchange regime shift affected the public finance in Egypt.

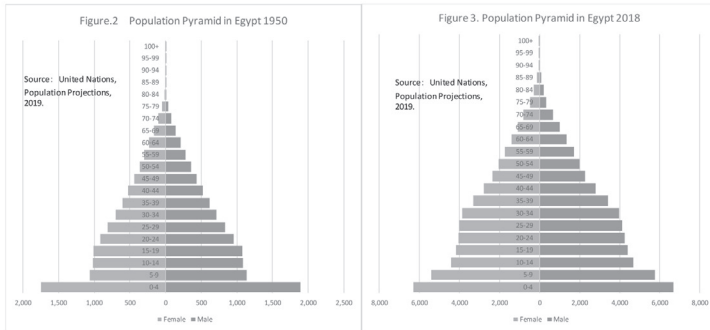
## 2 The Egyptian Economy

### 2.1 Population

The Egyptian population has been steadily growing from 20 million in 1950 to 100 million in 2018. The annual population growth rate gradually slowed from 2.8% in 1960 but still moderately high at 2.1% in 2018, which is 15<sup>th</sup> highest in the world in the same year. The demographic structure of Egypt is still young as shown in the population pyramid of Figure 2. The shape of population structure is becoming a bell shape in 2018 from a completely pyramid shape in 1950 but still developing and far from stationary. In fact, the fertility rate in Egypt is 3.37 in 2018, much lower than the world average of 2.4, which is shaping the demographic structure of Egypt. Due to the same reason, the old dependency rate is on upward trend but is still at 5.3% less the definition of aging society of 7%. The speed of population aging, annual change in the share of population over 65 years old in total population is very slow at less 1% while the corresponding figure for the world is 2.3%. On the other hand, the share of working age population shown in Figure 1 is high growing from 55.1% in 1991 to 61% in 2018.

This population structure indicates the country will have a sizable labor supply due to high population growth and fertility rate, which helps the economy grow fast in the production side. Secondly, the demand is expected to be solid for sometimes in future because young families who raise children tend to spend more than otherwise on one hand. On the other hand, the country tends to be in short of saving and likely to borrow

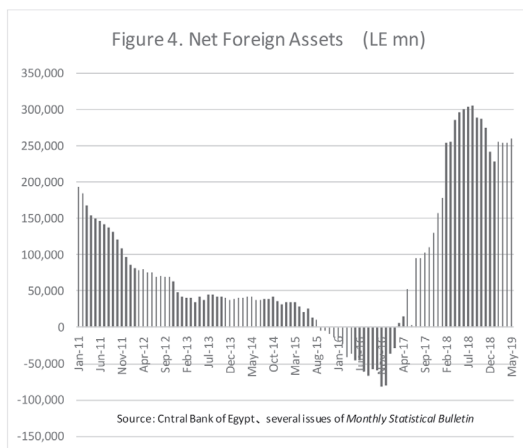
from abroad, making the financial account positive while current account in negative in BoP. Thirdly, the growth of government expenditure will be modest since the country still does not have a smaller share in dependency population. From the population projection by the U.N., Egypt is expected to receive demographic dividend from 2040 to 2045.



## 2.2 Recent Macroeconomic Development

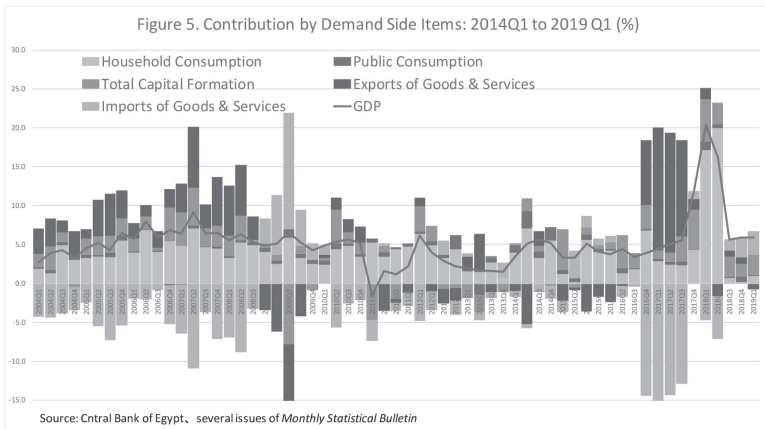
The turmoil subsequent to the Arab Spring, the emergence of the Islamic State, or IS in the region and the airplane crash accident and lower oil price<sup>i</sup> put the Egyptian economy into deep troubles. The tourist arrival fell sharply and foreign direct investment flew out, which, together with capital flight, led to a shortage of international reserves. The net foreign assets quickly fell from EL108 billion in November 2011 to negative in September 2015, which led the Egyptian government to resorting the rescue package, Extended Fund Facility or EFF<sup>ii</sup> for US\$ 12 billion, by IMF in November 2016. One of the requirements for the EFF was shifting to floating exchange rate regime. Egypt introduced floating exchange rate system in November 2016. Upon the introduction of floating exchange rate system, the Egyptian pound (EL) depreciated and the depreciation was accelerated from 8.7 EL/US\$ in October 2016 to 18.2 EL/US\$ in December

2016 with a tail wind of capital outflows from emerging markets and back to the US market triggered by tightening of monetary policy by Federal Reserve Board. A rapid depreciation of the Egyptian Pound led to hiking in inflation hiked. The rate of inflation rose from 13.6% year-on-year in October 2016 to 23.3% in December, 2016 and hit the record high, 31.6% in September, 2017. The rate inflation was accelerated by reducing fuel subsidy which started in 2013/14 toward 2018/19 and gradual rise in oil price from US\$ 45.3 per barrel in November to US\$ 76.7 per barrel in September 2016. However, as the international reserves bounced back due to additional international reserves from EFF, exchange rates were stabilized around EL 17 per US\$ and rates of inflation also fell to a single digit at around 7.5% in August 2019.



The impact of turmoil in exchange rates did not affect the real sector of the economy. The period average of quarterly GDP growth rates and standard deviation of the quarterly GDP growth rates for the pre-Arab Spring period from Q1 in 2004 to Q4 in 2010 are, 5.5% and 1.4%, respectively. The corresponding figures for the post Arab Spring period for Q1 in 2011

to Q3 in 2016 are 3.1% and 1.8%, lower in growth and high in fluctuation due to the turmoil subsequent to the Arab Spring. These figures under the floating exchange rate regime are 8.5% and 5.7%, respectively, showing much better economic performance while its fluctuation is also much high. In fact, while GDP growth rates fell from 4.5% year-on-year (y-o-y) in Q3, 2016 up on the regime change, growth rates gradually rose from 3.9% in Q4, 2016 to 5.6% in Q3, 2017 and then skyrocketed recording two digit growth rates for three consecutive quarters from Q1 to Q4 before it stabilizes at around 5.8%, still much higher than the pre Arab Spring era of 5.5% above. Different from financial indicators such as inflation and exchange rates, the regime shift did not affect the real sector but accelerated economic growth.

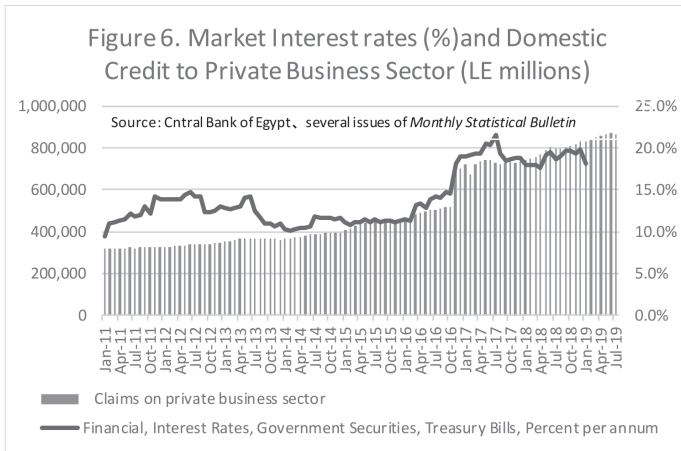


Looking at the structure of the economy on demand side, traditionally, the Egyptian economy is driven by exports as the Figure shows. Exports were the chief engine of the economic growth for the great moderation period before 2008. However, after the global financial crisis, exports lost its significance in view of contribution to GDP. Its contribution was

negative in the post Arab spring period. This picture changes up on the introduction of a floating exchange rate with exports shooting up 8.3% in contribution to GDP from previously negative contribution while imports also reacted as much as exports. There seems to be no fall in imports which is normally expected during a large depreciation in the Egyptian pound. From Q4 in 2016 to Q3 in 2017, contributions both in exports and imports are very high. Then, contributions by exports and imports became positive but not as significance as before. Instead, the household consumption took over as an engine of growth with noticeable two-digit contribution to GDP for two successive quarters, which also accompanied with a jump in GDP growth rates. This change in a growth driver and a sudden jump in GDP growth implies that substitution by domestic goods and service to imports, which enhanced domestic production, was on-going. In fact, growth in domestic credit to public enterprises and private sector recorded a two digit increases during 2017, which could have supported domestic production.

Another noticeable observation in the Egyptian economy in the post shift exchange regime lies in the rise in investment. The share of investment rose from 14.3% of GDP in 2015 to 15% in 2016 and reached 16.7% in 2018. This rise in investment was financed by a jump in bank lending to private business sector as shown in the Figure below. The Figure below shows a rise in domestic credit to private sectors from banking sector, which jumped from LE 520 billion in October, 2016 to LE 700 billion in November, 2016 while the market interest rates was raised high in monetary policy reaction against a rapidly depreciating exchange rates and large capital outflows subsequent to a regime shift to a floating exchange rate. A rapid growth of domestic credit to private business sector continues with average annual growth rate of 15.6% for the period from August 2018 to

July 2019, compared with the corresponding figure of 13.1% for the period from November 2015 to October 2016. A rise in investment in the phase of a rise in interest rates indicates a large demand for capital for a structural change pointed out above. From views from investment and domestic credit, there is no adverse impact of the exchange rate regime change on the Egyptian economy. It would be permissible to say that an exchange rate regime change sends a signal and stimulate private sector demand for capital, which led to a structural change of the economy. In this way, the adverse impact of the exchange rate regime change was kept minimum in Egypt.



Overall, the adverse impact on exchange regime change was as much as expected. After two years, exchange rates which once depreciated to LE 18 per dollar in early 2017, is stable around LE 17 per dollar. Rate of inflation hit the record high at 33% in July 2017. However, it also gradually calmed down and now is 7.5% as of July 2019, which is much lower than even before the regime change. Quarterly GDP growth rate in January-March 2019 marks 5.9%, which is much higher than 4.3%, the average for Q3,



2015 to Q2, 2016. In addition, current account balance was aggravated temporarily from -3.6% to GDP in 2015 to -6% in 2016 and 2017 but bounced back to -2.4% in 2018. In the next section, the paper will analyze the recent development in public finance and debt.

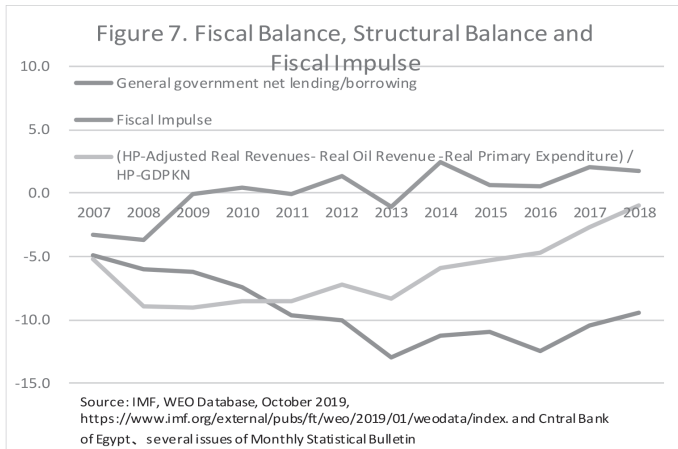
### 3. Public Finance

Total revenue excluding grant for 2018 was LE 821,134 million and 18% of GDP. This is relative high in considering the corresponding figure of 14.9%, the average of Lower Middle Income countries (LMI) . Tax revenue in % of GDP is 14.1%, higher than other LMI countries compared with the corresponding figure of 11.9 % for LMI countries. However, Egypt's tax collection capacity is ranked at 159 out of 190 in the *Doing Business Report 2019*, scored 52.73 point while the region average of 74.52. Egyptian grant and other revenue(% of revenue) is 23.4 % while the corresponding figure of LMI countries is about 20% and that for MENA excluding high income countries is 32% . One of the largest items in revenue is revenues from the Egyptian General Petroleum Corporation (EGPC) while it has gradually declined from about 30% of total revenue in 2011 to 13.9% in 2018. On the contrary, thanks to tax collection reform, tax revenue rose from 57% of total revenue in 2014 to 76.6% in 2018.

Total current expenditure for 2018 is LE 124,408 million and accounts for 28% of GDP, about twice as large as 16.3%, average of LMI countries. One of the notable features in Egyptian government expenditure is interest payment, 35.2% of total expenditures rising from 14.4% in 2010, much higher than 9.6%, average of LMI. Compensation of employee accounts for 19.3% in 2018, which rose from 22.3% in 2008 to 27.1% in 2015 in the post-Arab Spring era but fell rapidly. Due to fiscal consolidation as requested

by the IMF program, EFF, subsidies were significantly reduced from 29% of total expenditure in 2013 to 19.6% in 2018. On the other hand, social benefit was on the rise from 2% of total expenditure in 2013 to 6.3% in 2018 suggesting that the subsidies were replaced by social benefits which is targeted at the poor.

In order to analyze the fiscal policy stance excluding oil revenues and interest payment, which cannot be controlled by the government, structural fiscal balance<sup>iii</sup> and fiscal impulse<sup>iv</sup> based on structural balance was computed shown in the Figure below. Fiscal balance gradually deteriorates up on the Arab Spring in 2011 from -6.2% to GDP in 2009 to -9.6 in 2011 and further to -12.9% in 2013. While the balance slightly improves in 2017 to -11.3% and to -10.5% in 2015, it again falls to -12.5% in 2016 when the exchange rate regime changes. Therefore, the fiscal balance shows some adverse impact of the exchange rate regime change on public finance.



However, structural balance gives a different picture. The structural balance improves gradually from 2008 and continues to improve even

during the Arab Spring while it falls slightly in 2013 to -8.4% from -7.2% in 2012. Negative impact of the exchange rate regime change cannot be observed. The speed of improvement is even accelerated in the post regime change period for 2017-2018. The fiscal impulse also shows a steady improvement of fiscal stance. In fact, the fiscal impulse shows positive from 2010 to 2018 except for 2013. These observation on fiscal balance, structural balance and fiscal impulse suggests that the reasons for fiscal balance decline in the post-Arab Spring period lie in interest payment and oil revenues rather than fiscal policy management and exchange rate regime changes.

#### 4. Framework for Fiscal Analysis

This section will first present a framework for fiscal analysis and then analyze stability of public debt in Egypt.

$D_t$  = Debt Outstanding in year  $t$ ,  $i_t$  = nominal interest rate in year  $t$ ,  $R_t$  = government revenues in year  $t$ ,  $G_t$  = government spending in year  $t$ ,  $BAL_t$  = government balance in year  $t$ ,  $PB_t$  = primary balance in year  $t$ ,  $OT_t$  = Other capital flows in year  $t$ ,  $\pi_t$  = rate of inflation in year  $t$ ,  $r_t$  = real interest rates in year  $t$ ,  $\Delta D_t$  = a change in debt in year  $t$ .

Equation for debt dynamics:  $D_t = D_{t-1} + \Delta D_t$  (1)

Interest payment:  $I_t = i_t D_{t-1}$

Primary balance:  $PB_t = R_t - G_t$

Nominal GDP:  $P_t Y_t = (1 + g_t) (1 + \pi_t) P_{t-1} Y_{t-1}$

Primary balance is defined based on government revenues, government expenditures, a change in debt and other capital flows such as privatization proceeds as below

$$BAL_t = R_t - G_t + i_t D_{t-1} = -\Delta D_t + OT_t$$

$$G_t + i_t D_{t-1} - R_t + OT_t = -\Delta D_t$$

Incorporating primary balance,

$$-PB_t + i_t D_{t-1} + OT_t = \Delta D_t$$

Suppose ( $OT_t = 0$ ),

$$-PB_t + i_t D_{t-1} = D_t - D_{t-1}$$

$$D_t = (1 + i)D_{t-1} - PB_t$$

Taka ratios to GDP,

$$\frac{D_t}{P_t Y_t} = \frac{(1 + i)D_{t-1}}{P_t Y_t} - \frac{PB_t}{P_t Y_t}$$

Then,

$$\frac{D_t}{P_t Y_t} = \frac{(1 + r_t)D_{t-1}}{(1 + g_t)P_{t-1} Y_{t-1}} - \frac{PB_t}{P_t Y_t}$$

Define as  $d_t = \frac{D_t}{P_t Y_t}$ ,  $pb_t = \frac{PB_t}{P_t Y_t}$ ,

$$d_t = \frac{(1 + r_t)}{(1 + g_t)} d_{t-1} - pb_t \quad (2)^v$$

From (2),

$$d_t - d_{t-1} = \left[ \frac{(1 + r_t)}{(1 + g_t)} \right] d_{t-1} - d_{t-1} - pb_t$$

$$\Delta d_t = \left[ \frac{(r_t - g_t)}{(1 + g_t)} \right] d_{t-1} - pb_t \quad (3)$$

The equation (3) shows that when real interest rates are greater than real GDP growth rates, the debt automatically increases. The equation (3) also suggests that initial level of debt,  $d_{t-1}$ , also affect debt stability.  $\left[ \frac{(r_t - g_t)}{(1 + g_t)} \right]$  indicates that rapidly growing economies whose real GDP growth rates is high do not need to have high primary balance to stabilize the debt while mature economies whose real GDP growth rates are low need to have high

primary balance to stabilize the debt.

When  $\Delta d_t = 0$ ,

$$\left[ \frac{(r_t - g_t)}{(1 + g_t)} \right] d_{t-1} = pb_t^{*vi} \quad (4)$$

From (4), we can estimate primary balance as below

$$pb_t = \alpha + \beta X + \gamma d_{t-1} + \varepsilon_t \quad (5)$$

$X$  are control variables including GDP growth and real interest rates and the size of  $\gamma$  shows the sensitivity of fiscal adjustment to debt in  $t-1$ .

## 5. Regression Analysis

Table 1. Regression Outcomes

Dependent Variable	SBAL_HP2GDP					PEXP2GDP			
	M1	M2	M3	M4		M1	M2	M3	M4
C	-14.77 (-3.97)	-13.93 (-2)	-14.09 (-3.62)	-14.70 (-3.72)	C	-11.00 (-1.00)	-3.45 (-0.27)	2.06 (0.29)	8.83 (0.98)
GDEBT2GDP(-1)	0.17 (6.46)	0.16 (2.7)	0.15 (5.24)	0.16 (5.14)	OILREV2GDP	0.63 (4.12)	0.55 (3.3)	0.53 (3.44)	0.53 (1.70)
OILREV2GDP	-0.21 (-2.67)	-0.22 (-2.2)	-0.21 (-2.5)	-0.20 (-2.27)	UNEMP	1.23 (2.99)	1.11 (2.69)	1.04 (2.8)	0.98 (2.34)
IP2DEBT	-0.22 (-1.53)	-0.22 (-1.37)	-0.22 (-1.48)	-0.22 (-1.46)	PEXP2GDP(-1)	0.43 (1.75)	0.18 (0.54)		
SBAL_HP2GDP(-1)		0.02 (0.15)			INF	0.23 (1.81)	0.41 (1.99)	0.46 (2.64)	0.38 (2.08)
D1			0.53 (0.83)		D1		-3.86 (-1.12)	-5.13 (-2.15)	
Ex				0.03 (0.37)	ex				-0.47 (-1.54)
Adjusted R-squared	0.96	0.96	0.96	0.96		0.77	0.77	0.80	0.80
F-statistic	93.89	61.81	67.78	62.82		10.02	8.56	11.82	11.82
Akaike info criterion	1.76	1.93	1.84	1.91		3.39	3.36	3.24	3.24
Durbin-Watson stat	1.77	1.76	2.05	1.90					

Sample Period: 2007-218

SBAL\_HP2GDP=structural balance to Potential GDP, GDEBT2GDP=gross debt to GDP, OILREV2GDP= oil revenue to GDP

IP2DEBT= interest payment to GDP, PEXP2GDP = primary expenditure to GDP, INF= rate of inflation

D1= dummy for floating exchange rate regime with 1 for 2017 and 2018 and 0 for otherwise,

ex = exchange rate per US dollar, UNEMP= Unemployment rate

Source: IMF, WEO Database, October 2019, <https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index>. and Central Bank of Egypt, several issues of Monthly Statistical Bulletin

Note: t-values are in ().

In this paper, structural balance to potential GDP is used to estimate fiscal reaction function, equation (5) above in order to see the magnitude,  $\gamma$  in (5), of fiscal reaction against debt and analyze the impact of exchange rate regime changes over the fiscal stance and fiscal management. Additionally, the impact of gross public debt to GDP on primary expenditures is estimated because primary expenditures indicates fiscal management better than structural balance. The estimation outcomes are shown in Table 1. To start with structural balance to potential GDP, firstly, all the signs are consistent to the expectation. The sizes of coefficients are stable in different equations. The adjusted R-squared are all adequately high around 96%. The Durbin-Watson statistics takes around 1.7 to 2, implying no autocorrelation. The F-statistics are all high in both regressions for structural balance to potential GDP and primary expenditure to GDP. Therefore, the estimation outcomes are robust enough.

The regression outcomes for M1 to M4 shows that gross public debt to GDP is statistically significant and its sign is positive. This outcome suggests that fiscal stance improves against a rise in gross public debt to GDP with one-year lag and indicate that previous year gross public debt is one of the determinants in the fiscal policy formation by the Egyptian government. In terms of causality, theory does not suggest that an increase in the structural balance to GDP causes an increase in gross public debt to GDP because the relation apparently is opposite. Therefore, the causality for an increase in gross public debt to GDP leading to an improvement in structural balance to GDP is justified and as confirm fiscal discipline of the Egyptian fiscal management, reacting to the public debt<sup>vii</sup>.

Secondly, oil revenue to GDP has a negative sign, which indicates that

the Egyptian government increases its spending rather than it tries to improve fiscal position when the oil revenues increases. This is, to some extent, vulnerability and dependency of the Egyptian government to oil revenue. Thirdly, interest payment to GDP, which is effective interest rate of the public debt outstanding, is also statistically significant, implying that a rise in interest rates is adversely affecting fiscal stance of the Egyptian government. The lagged dependent variable is not found statistically significant, indicating that this year' s fiscal policy stance in Egypt reflects more on debt, interest payment and oil revenues and is independent on last year' s fiscal stance. The regression outcome found the dummy for exchange rate regime change and exchange rate are not statistically significant, implying no impact of the regime change on public finance.

Turing to the regression on primary expenditures to GDP, the signs are all consistent to expectation. The adjusted R-squared are high at around 77% to 80%. However, the size of the coefficients varies in different combination of the variables although they are not too different. Therefore, the regression outcomes can be fair but need some cautions in translation of the outcomes. The oil revenue to GDP is statistically significant, supporting the finding above. When oil revenues increase by 1%, the government tends to increase its spending by 0.5 to 0.6% and aggravate fiscal position. The impact of oil revenue on fiscal policy during 2007-2018 in the Egyptian government is considered large. Unemployment is also found statistically significant as social spending is one of the current expenditure items. The impact of unemployment is large since the regression outcome above shows that 1% increase in unemployment leads to a one percentage-point increase in primary spending in terms

of share to GDP. Unemployment is one of the determinants in fiscal policy formulation in Egypt. The regression also found that the primary spending increases as rate of inflation rise.

Moreover, slightly different from the regression above, the lagged dependent variable is found statistically significant, which shows some consistency in government policy or weak degree of autonomy in spending policy. However, since t-values for the lagged dependent variable is not high enough and it loses statistical significance when other variables such as dummy for exchange rate regime changes are added. While there are some evidences such as a large share of interest payment accounting for a third of total current expenditure, the regression does not show robust evidence on rigidity of primary expenditures.

Dummy for exchange rate regime change is statistically significant when the lagged dependent variable is removed, showing a turmoil stemming from the regime change had a collateral damage on the economy which increased government spending. The size of coefficient suggests that the primary spending during the post-exchange rate regime change is higher than before by 5 percentage points in terms of share to GDP. The regression outcomes do not show a statistically significant impact of exchange rate on primary spending with t-value, not high enough. In addition, its sign is negative, indicating that primary spending increased as the Egyptian Pound depreciates as opposed to expectation.

The regression outcomes did not confirm the impact of lagged and current gross public debt to GDP on primary spending. Therefore, Granger Causality Test was conducted in Table 2. The Granger Causality confirms the causal relation by gross public debt to GDP on primary spending.

Overall, the outcomes from two regression exercise suggest that the



impact of exchange rate regime change did not affect the fiscal position of the Egyptian government while its to some extent affected public spending for collateral damages accompanying with the regime changes.

Table 2. Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.
GDEBT2GDP does not Granger Cause PBAL2GDP	7.45	0.01
PBAL2GDP does not Granger Cause GDEBT2GDP	0.76	0.54

Sample: 1995 2018

Lags: 3

Source: IMF, WEO Database, October 2019,

<https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index>. and Central Bank of Egypt, several issues of Monthly Statistical Bulletin

## 6. Debt Stability

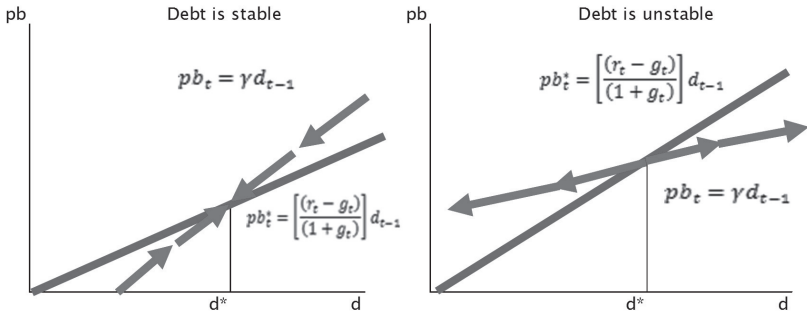
Now, the paper analyzes the stability of Egyptian public debt based on the theoretical exercise and regression outcomes above. The equation (4) is a demarcation line and shows the relation between debt(-1) and primary balance, both of which make debt stable, no increase and no decrease and is described in the blue line in the charts below. In the area above the demarcation line, the primary balance is larger than  $\left[\frac{(r_t - g_t)}{(1 + g_t)}\right]$ , the primary balance that stabilize the debt and that is why the debt falls. On the other hand, in the area below the demarcation line, the primary balance is smaller than  $\left[\frac{(r_t - g_t)}{(1 + g_t)}\right]$  the primary balance which stabilize the debt and that is why the debt rises.

The red line is based on the equation (5) show the relation between primary balance and debt when the equation (5) is expressed in two-dimensional space consisting of primary balance in a vertical axis and debt in a horizontal axis. The relation between primary balance and public debt in the equation (5) in a two-dimensional space is defined as:

$$pb_t = \gamma d_{t-1} \quad (6)$$

The equation (6), the red line, is a fiscal reaction function to public debt of the Egyptian government, estimated by the regression above. The large  $\gamma$  and steep slope indicates that the government is very reactive to public debt. The intersection of the reaction function and the demarcation line indicates that the change of debt is zero. This does not necessarily confirm that the debt is stable.

Figure 8. Debt Stability



When the slope of the reaction function, the red line, is greater than that of the blue line, this case is shown in the chart on the left-hand side. In this case, when debt is smaller than,  $d^*$ , the debt level at the intersection where the change of debt is zero, the debt increases because the primary balance in the area left to  $d^*$  is smaller than debt-stabilizing primary balance  $pb^*$ . On the other hand, when debt is larger than,  $d^*$ , which is in the area right to  $d^*$ , the debt falls because the primary balance derived from the fiscal reaction function is larger than the debt stabilizing primary balance,  $pb^*$ . Any deviation of debt to the left from  $d^*$  can be reacted by relaxing primary balance. Any deviation of debt to the right from  $d^*$  can be reacted by tightening primary balance. Therefore, this case suggests that the debt will revert to  $d^*$ .

On the other hand, in the case that the slope of the reaction function

is smaller than that of the blue line shown in the chart on the left-hand side, when debt is smaller than,  $d^*$ , the debt decreases because the primary balance in the area left to  $d^*$  is larger than debt-stabilizing primary balance  $pb^*$  while the debt rises when the debt level is greater than,  $d^*$  because the primary balance is smaller than debt-stabilizing primary balance. Therefore, this case suggests that the debt is unstable and implies that there is less fiscal autonomy to accommodate fiscal consolidation as well as recurrent expenses account for large amount. In this case,  $d^*$  is the debt limit and fiscal rules must be followed.

To analyze if the deb is stable or not,  $\left[\frac{(r_t - g_t)}{(1 + g_t)}\right]$  is computed. From the above regression, the size of  $\gamma$  is 0.16, the average of four coefficients from four regressions. The average real GDP growth rate is 4.4%. The average nominal effective interest rate for public debt during the same period is 8.5% while the average rate of inflation for the same period is 12.7%, making the average real interest rates is -4.2%.  $\gamma = 0.16$  is larger than  $\left[\frac{(r_t - g_t)}{(1 + g_t)}\right] = -0.082$ , which suggest that the Egyptian deb is stable. Even in considering the historical average rate of inflation nominal interest rates and GDP growth rate beyond 2007-2018, the size of  $\gamma$ , 0.16 is large enough, indicating the stability of debt will continue sometime. However, the concern about debt stability will rise when the size of  $\gamma$  declines while rate of inflation calms down and growth slows down.

## 7. Conclusion

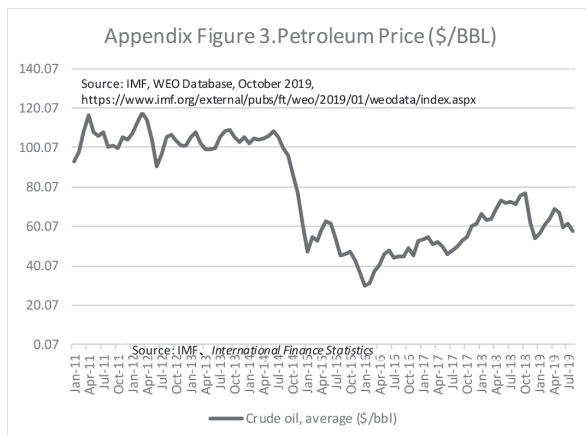
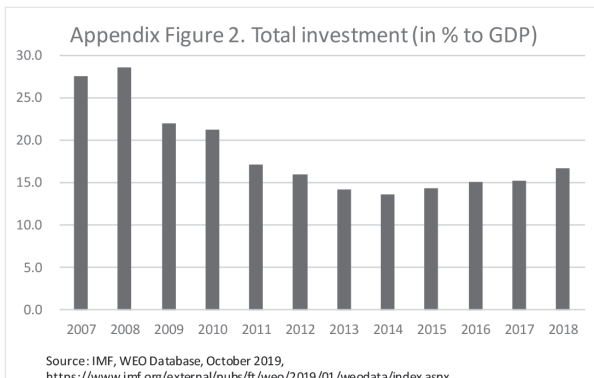
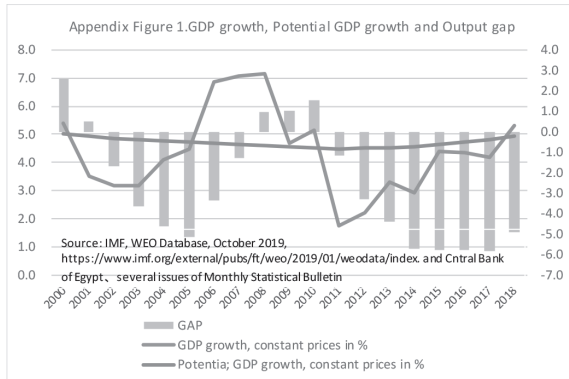
This paper studied the impact of exchange regime shift to float on public finance with special attention to debt. The paper found that fiscal position measured by structural balance to GDP was rising during the post-

regime change period despite a rise in interest rates, rapidly tightening monetary policy against capital outflows and souring inflation. Then, the paper looked at the impact of regime change on structural balance to GDP. The regression derived from debt dynamics equation found a positive and statistically significant relation by public debt on structural balance confirming the causality from debt to structural balance. The regression also found a spillover effect of oil revenue on structural balance which excludes oil revenues. This is also confirmed by the regression of oil revenue on primary spending and oil revenue relax government spending. However, dummy for regime change and exchange rates did not affect structural balance. The second regression on primary expenditure found some impact of regime change and exchange rate on primary expenditures to relative weak statistical significance. Regime change and exchange rates did not affect structural balance but primary expenditure, which suggests that an increase in primary expenditure was offset by overall revenue increase.

In the latter half of this paper, the stability of debt is analyzed. The analysis found that the sensitivity of primary balance on debt is very large, compared with rate of inflation, nominal interest rates and therefore, debt is stable in Egypt.

In conclusion, all the analysis above indicates the adverse impact of exchange rate regime change on public finance is not very significant. Some adverse impact on expenditure side was offset by a non-oil revenue increase. One possible reason for this conclusion lies in the fact that Egypt was under IMF' s Extended Fund Facility program during the post-regime change period, which contributed to containing fiscal spending.

Appendix



<sup>i</sup> Oil prices fell from US\$ 100 per barrel, August 2014 to US\$ 45.3 per barrel, November 2016.

<sup>ii</sup> Extended Fund Facility (EFF) is designed to assist a country facing medium-term balance of payments problems due to structural weaknesses. While EFF has a longer repayment period, the financial resources stay at the central bank and are not available for the government.

<sup>iii</sup> Structural balance is computed as below:

$100 \times \left[ \frac{(\text{Adjusted real revenue} - \text{Real oil revenue}) - (\text{Real expenditure} - \text{Real interest payment})}{\text{Adjusted real GDP}} \right]$ . Adjusted real GDP is derived by HP filter. Adjusted real revenue is computed as below

Real revenue  $\times \frac{\text{Adjusted real GDP}}{\text{Real GDP}}$ . Structural balance eliminates those variables which cannot be controlled by the government such as interest payments and oil revenues since interest payment is the consequence of past fiscal policy and oil revenues fluctuates due to oil price. It shows current fiscal policy stance by the government.

<sup>iv</sup> Structural fiscal impulse is computed as  $\text{Structural balance}_t - \text{Structural balance}_{t-1}$ .

<sup>v</sup> From  $d_t = \frac{(1+r_t)}{(1+g_t)} d_{t-1} - pb_t(2)$ , solving the difference equation  $d_t = \frac{(1+r_t)}{(1+g_t)} d_{t-1} - pb_t(2)$ , gives

$$d_t = \left[ d_0 - \frac{-pb_t}{1 - \frac{(1+r_t)}{(1+g_t)}} \right] \left[ \frac{(1+r_t)}{(1+g_t)} \right]^t - pb_t \quad (2)'$$

$\frac{(1+r_t)}{(1+g_t)}$  indicates whether the debt is explosive or stable.

<sup>vi</sup>  $pb_t^*$  is primary balance which make a change in debt zero and corresponds to  $d^*$  on horizontal axis.

<sup>vii</sup> Granger Causality Test is conducted between structural balance to GDP and gross public debt to GDP and confirmed causal and unilateral relation by gross public debt to GDP on structural balance to GDP, supporting the discussion in this section.

## 参考文献

### 英文

- Ahmed Qadry M. Bahloul, 2018, *The Potential Impact of the Floating Exchange Rate Policy on the Egyptian Trade Balance, Agricultural Trade and Food Trade*, Zagazig University, Egypt.
- Belke, Angsar and Thorsten Polleit, 2009, *Monetary Economics in Globalized Financial Market*, New York, Springer
- Burger, Philippe Ian Stuart, Charl Jooste, and Alfredo Cuevas, *Fiscal sustainability and the fiscal reaction function for South Africa*, IMF Working Paper, WP1169, Washington, D.C. March 2011
- International Monetary Fund, 2015 *Arab Republic of Egypt : Staff Report for the 2014 Article IV Consultation*, Washington D.C., International Monetary Fund.
- International Monetary Fund, 2017, Arab Republic of Egypt : *First Review Under the Extended Arrangement Under the Extended Fund Facility and Requests for Waivers for Nonobservance and Applicability of Performance Criteria-Press Release; Staff Report; and Statement by the Executive Director for the Arab Republic of Egypt*, Washington D.C., International Monetary Fund.
- International Monetary Fund, 2017, Arab Republic of Egypt : *2017 Article IV Consultation, Second Review Under the Extended Arrangement Under the Extended Fund Facility, and Request for Modification of Performance Criteria-Press Release; Staff Report; and Statement by the Executive Director for the Arab Republic of Egypt*, Washington D.C., International Monetary Fund.
- International Monetary Fund, 2017, Arab Republic of Egypt : *Third Review Under the Extended Arrangement Under the Extended Fund Facility, and Requests for a Waiver of Nonobservance of a Performance Criterion and for Modification of a Performance Criterion-Press Release; Staff Report; and Statement by the Executive Director for the Arab Republic of Egypt*, Washington D.C., International Monetary Fund.

Mishkin, Fredric, 2016, *The Economics of Money, Banking and Financial Market*, New York, Pearson.

## 和文

岡室美恵子・染矢将和（2019）「変動為替移行の財政への影響」mimeo, 名古屋大学.

岡室美恵子・染矢将和（2019）「エジプト経済：為替自由化の影響」共著 『千葉経済論叢』第60号, 千葉経済大学.

岡室美恵子・染矢将和（2017）「低石油価格下におけるイラク財政運営：財政反応関数の推計と債務に関するリスク分析」共著 『千葉経済論叢』第56号 pp.1 -20, 千葉経済大学.

九門康之「成長軌道に復帰してきたエジプト経済の現状と課題」Newsletter No.19, 国際通貨研究所, 2018年.

ジェトロカイロ事務所, 海外調査部 中東アフリカ課「政変後のエジプト経済・政治状況」JETRO, 2012年.

鈴木繁「通貨の大幅減価がマクロ経済に与える影響—ナイジェリアとエジプトの比較分析（変動相場制への移行）」経営論集第27巻第1号, 2017年.