2019

The impact of increasing public debt on real interest rate in Egypt (from 1982 to 2017)

Dr. Mostafa H. Elsayed
Economic Department, HIMIT
Kafr El Sheikh

The impact of increasing public debt on real interest rate in Egypt (from 1982 to 2017)

Dr. Mostafa H. Elsayed

ملخص

يهدف البحث الى دراسة ديناميكية استجابة سعر الفائدة الحقيقي للتغيرات المتزايدة في الدين العام في مصر حيث يوجد بعض التدخل من قبل الحكومة في تحديد سعر الفائدة, وقد تم تحليل سلسلة بيانات خاصة بالاقتصاد المصري (من العام 1982 وحتى 2017) باستخدام نموذج تصحيح الخطأ واختبارات التكامل المشترك للتوصل الى نتيجة مفادها ان زيادة الدين العام المحلي بما يعادل 1 مليار دولار يؤدي الى ارتفاع سعر الفائدة الحقيقي بمقدار يتراوح بين 1 و 1.1 نقطة اساس, ومن الملاحظ ان هذا التأثير اقل من مثيله بالدول المتقدمة وقد يفسر هذا الاختلاف الى انخفاض كفاءة راس المال في مصر عن الدول المتقدمة, هذه النتائج من شأنها ان تسهم في مساعدة السلطات النقدية والمالية على فهم العلاقة بين سعر الفائدة والدين العام وتنبي السياسات الملائمة.

Abstract

The paper aims to study the dynamic interaction between public debt and real interest rate, or real interest rate responsiveness to changes in domestic public debt; this could be by giving an answer to a debatable question, does the increase in government debt affect real interest rates in Egyptian economy, where government intervenes in interest rate determination? Using a set of Egyptian data (from 1982 to 2017), and a simple econometric model, the paper adds to empirical evidence that an increase in domestic government debt equivalent to $1 billion would likely increase the real interest rate by about 1 to 1.1 basis points. Some existing studies in HDCs estimate effects above this range. This reduction in interest rate effects of public debt could be according to the decrease in the efficiency of physical capital in Egypt. The value of this finding is that it helps policymakers to understand the mutual independence between interest rate and public debt.

Keywords: Public debt, interest rate, marginal product of capital, Ricardian equivalence

Introduction

The years after revolution of 25th January has been a period of remarkable fiscal activities in Egypt: expanding expenditure on infrastructure, changes in income and value added tax, and financial liberalization programs. These measures have occurred against a backdrop of economic trends associated with the political disturbances, which suggest accelerated increases in government spending programs. The 2017-2018 predicted budget deficits indicate that government debt will exceed 100 percent of GDP and rise rapidly under the alternative fiscal scenarios, a situation that suggests an unsustainable path of fiscal policy. At the same time, interest rates rose to unprecedented levels to reach about 20% for some types of time deposits.

The draft of the fiscal year 2018-2019 budget approved in March 2018, aimed to reduce the budget deficit in order to reduce the large public debt burden. At the same time, public investment is expected to rise remarkably, and government spending on goods and services had to increase to help poor people who were affected by high rates of inflation. According to this draft, the budget set a fiscal deficit target of 8.4% of GDP for fiscal year 2018-2019, after the government recently reduced its fiscal year 2017-2018 deficit to 9.7%.

The budget gets revenues rising 22.0% year-on-year, and a 15.5% increase in expenditure. Revenue generation will increase by reinforcing the economy (the budget sets on a predicted 5.8% GDP growth). Public investment is set to rise to EGP 149 billion in 2018-2019, up from the EGP 125 billion planned in the fiscal year 2017-2018. However, investment spending still represents a small share of the overall budget and is dwarfed by outlays for public debt services which budgeted more than 38% of

government spending. In light of this fiscal momentum, the public debt continues to grow due to the accumulation of the budget deficit.

Did this public debt accumulation crowd out private investment? Did this expansion in public debt lead to a significant rise in interest rate? This paper attempts to analyze the connection between the public debt and interest rate, discussing the conceptual and applied debate, and quantifies the extent of public debt impact on interest rate in a neoclassical equilibrium model for the Egyptian economy.

According to the conceptual base of economic thought (see Chen et al (2017) pp257-278 and Lee et al (2015) pp119-126) , the effect of government debt is primarily determined by the form of fiscal or monetary policy shock that causes a debt expansion. Higher government debt can crowd out or crowd in private investment; it crowds in investment if the debt is caused by a reduction in tax rates or by an increase in creative government investment that motivates private investment, because both raise the net return to capital. Over a longer run, debt services financing may play an important role in the negative investment response following a debt expansion. However public debt crowds out investment if the debt is caused by an expansion in government spending or by an increase in infertile government investment that cannot motivate private investment, because both raise the demand for loanable fund which in turn increase real interest rate. Another side of debate is; if the government borrows on the capital market, it competes with other borrowers. So, public debt does always crowd out other debtors. But the question is: does public debt crowd out debtors who are essential for the welfare and economic development of society, that is public debt may 'absorb' the excess of capital supply over capital demand at a zero real rate of interest, or it may 'absorb' the excess of capital supply over essential

capital demand for the welfare and economic development at a zero real rate of interest.

Coenen et al (2012) pp22-68, Drautzburg and Uhlig (2013), Uhlig (2010) pp30-34 and Elmendorf and Mankiw (1999) argued that, After World War II, economists worried about the impact of government debt, and a conventional view has appeared, suggesting that government borrowing is expansionary in the short run but contractionary in the long run, the view based on Keynesian theory claims that when prices and wages are sticky, the higher the debt (that is caused by tax cuts or increase in government spending that adds to aggregate demand) the higher the income and output will be. However, in the long run, if private saving and foreign investment inflows do not increase enough to fully offset government borrowing, interest rates rise over time. Consequently, investment is crowded out, and capital accumulation and output eventually decline, opposing the short-run expansion.

Building on this view, many studies such as Laubach (2009) pp858-885 estimated the relationship between government debt and interest rates. A positive relationship between the two variables was viewed as evidence of crowding out, at the same time a fragile relationship between the two variables, was viewed as evidence of no crowding out effect, so Traum and Yang (2015) pp24-45 argued that, generally literature surveys conclude a lack of consensus among the findings. Accordingly this paper is divided into three parts, the first one included the literature review about the two opposite point of view, the second part included a simple model developed to measure the effect of increasing public debt on the real interest rate in Egyptian economy, and the final part represents the main conclusion of the study.

Study problem

This paper addresses a timely significant question for policymakers: How much larger long run real interest rates have been affected when the government has run large deficits or large debt?

According to the CB Egypt's external debt reached $96.612 billion at the end of the May 2019, which represents about LE1.6 trillion, Domestic debt at the same time increased to LE4.108 trillion. However, the percentage of public debt to GDP in Egypt was decreased to about 97%, down from about 108% a year earlier. The growing public debt in Egypt has been a serious issue that received more attention in last years, because no country likes to bear the burden of being indebted, public debt also can constrain capabilities and objectives of any government because It gives less fiscal policy options. Besides, there are other matters that should be kept in mind, such as the impact of increasing public debt on the interest rate. So, the problem of the study is to answer the following question:

What is the sensitiveness or responsiveness of real interest rate to the increase in public debt?

Study methodology

A standard benchmark for understanding the probable effect of changes in public debt on interest rates is a purposed model based on the aggregate Cobb-Douglas production function in which government debt crowds out physical capital, this model has a long run real interest rate determined by the marginal product of capital (MPK), which would increase if capital (K) were decreased, or crowded out, by increasing public debt (D).

So, the methodology used both deductive and inductive method (the so-called econometric approach), the study begins with the deductive method to form the theoretical basis on which the mathematical model is built, whose

parameters are estimated using the appropriate econometric method and data published by CB from 1982 to 2017.

In other words, the paper followed the following steps:

1- Using economic theory to construct mathematical relations between real interest rate, public debt and other related variables.
2- Deduct the reduced form equations.
3- Using available data about public debt and other related variables to obtain some results about the effect of public debt on long run real interest rate.

Study hypothesis

The study seeks to validate the following hypothesis

- There is a positive association between the increase in public debt and increase in real interest rate In the Egyptian economy, in other words; real interest rate is sensitive to the increase in domestic public debt.

1-Literature review

1-1 **Variable included in empirical studies:**

As Traum and Yang (2015) PP24-45 and Laubach (2009) pp858-885 argued; While the effects of government debt on the economy can work through many different channels, the most concerned may be about government borrowing and potential interest rate effect. That is, higher interest rates caused by growing domestic government debt can decrease investment (and capital accumulation in long run), interest-sensitive consumption expenditures, and decrease the value of assets held by households, that reduces consumption expenditures through wealth effect. The magnitude of these potential adverse consequences depends on the degree to which government debt actually raises interest rates.

According to theoretical framework (which describes the effect of government debt on interest rates) there are several implications for empirical analysis of those effects. First, the *level* of the interest rate is determined by the level of MPK (marginal product of capital) which in turn is determined by the level of the capital stock, and thus is adversely affected by the *level* of government debt, so it is easy to conclude that, the *change* in interest rate is affected by the government budget deficit, which is equal to the *increase* in government debt.

Practical estimations of the influence on interest rates differ significantly depending on ways the deficit or debt is used, and the specification of the implied economic model (see Coenen et al (2012) pp22-68, Drautzburg and Uhlig (2013), Uhlig (2010) pp30-34); in other words, if we think about a model that suggests that deficits affect the level of the interest rate, then we may use Keynesian *IS-LM* framework where deficits increase the interest rate not only because debt may crowd out capital but also because deficits encourage aggregate demand and raise output and may cause balance of payment deficit, so there are many factors and channels of influences to be included in a simple economic model.

Second, there are many factors, other than government debt which can affect directly the determination of interest rates in credit markets. For instance, in a growing economy, the Central Bank will purchase some government debt (through open market operation) to expand the money supply and counterbalance the output expansion to keep prices relatively constant. So, government debt held by the Central Bank does not have a crowd out effect on private capital formation, but as noted by Engen and Hubbard, (2005) many empirical studies of government debt and interest rates ignore Central Bank purchases of government debt.

Other important endogenous factors are involved in the supply and demand for loanable funds in credit markets, as the private-sector debt acquired by durable consumption, which could also crowd out capital formation. Typically, Engen and Hubbard, (2005) argued that, private-sector debt or borrowing and private-sector saving are not included in empirical studies of government debt. Also, increases in government debt can be offset by increases in foreign-sector lending as the open economy is a part of the global capital market, so empirical analyses of government debt and interest rates should take into account foreign-sector lending and purchases of treasury securities.

Finally, there are many factors, other than government debt, which can affect indirectly the determination of interest rates, in other words the interest rate is also affected by macroeconomic factors other than capital that influence output; for instance, labor and total factor productivity. Therefore, empirical analyses of the effect of government debt on interest rates should pay some attention regarding any macroeconomic factor that can affect the performance of the economy.

1-2 **How does public debt affect the economy:**

In the short run any increase in public debt means an increase in budget deficit which in turn raises the aggregate demand, and according to orthodox analysis, the economy is Keynesian in the short run, so increase in aggregate demand raises national income (see Coenen et al (2012) pp22-68, Drautzburg and Uhlig (2013), Uhlig (2010) pp30-34). In other words, because of sticky wages and prices, shifts in aggregate demand affect the utilization of the factors of production. Also, orthodox analysis claimed that the economy is classical in the long run. The sticky wages and prices, which make demand matter in the short run, are less significant in the long run. So,

fiscal policy in the long run affects national income only if it can make changes in factors of production.

However, Feldstein and Bacchetta (1991) argued that, in long Run, increase in public debt negatively affects domestic savings and consequently reducing investment. To make that clear, it is crucial to focus on the following national accounting identity.

$$S + (T - G) \equiv I + NFI$$

The left side of this identity shows national saving as the sum of private (S) and public saving (T-G), and the right side shows the uses of these saved funds for investment at home (I) and abroad (NFI). So, it is clear that reduced domestic investment will result in a slighter domestic capital stock, which in turn indicates lower domestic output and income. With conventional analysis, the less the capital available, the more the marginal product of capital, which raises the return earned by each unit of capital and thereby increases interest rate. On the other hand, labor productivity would be lower, and then the average real wage and total labor income would be lower.

The less democratic country with a large debt it is likely to face high interest rate, and the monetary authority may be stressed to reduce this rate through expansionary monetary policy (see Lanzavecchia, et al (2015) pp135-146); this policy may reduce interest rates in the short run, but in the long run, it will leave real interest rate unchanged and thereby inflation and nominal interest rate higher. In less democratic countries, if the fiscal authority can force the Central Bank to finance the deficit with seigniorage - when a country faces difficulties in financing budget deficit through additional borrowing, as a result, the country will raise revenue through seigniorage - hence, as Sargent and Wallace (1981) pp1-17 argued that, inflation is a fiscal phenomenon rather than a monetary one.

As Feldstein (1995) pp589-599 argued, government debt may alter the political process that determines fiscal policy, that is, when additional government spending is not covered by additional tax, the ability of government to borrow will reduce the discipline of the budget process, as policymakers and the public will generally worry less about whether the additional spending is appropriate or not. On the other hand, the existence of large government debt may reduce the fiscal policy flexibility, that is, if larger debts are perceived to be costly, then a country will be constrained from responding to sounds for greater spending or lower taxes. As Elmendorf and Mankiw (1998) noted, this constraint on future policymakers is, in fact, one of the explanations sometimes given for why governments choose to accumulate large debts.

Elmendorf and Mankiw (1998) noted also that, there is a way in which government debt could affect the economy, by making it more vulnerable to a crisis of international confidence. they noted that international investors have worried about high debt levels "since King Edward III of England defaulted on his debt to Italian bankers in 1335". A possible effect of government debt is the risk of weakened political independence or international headship of a country like Egypt. This problem is more likely to arise when government borrow from abroad after it drains the domestic sources, and the country experiences a large capital inflow from abroad.

1-3 **Review of Previous Studies**

While this study does not evaluate empirical papers that focusing have been written on the connection between public debt and interest rates, it will offer a simple review of some of the existing literature, focusing on more recent papers.

In their studies about the concept of Ricardian equivalence “the hypothesis that; when the government stimulates the economy by increasing

debt-financed government spending, aggregate demand remains unchanged", different approaches have been implemented, Forni et al (2009) pp559-585, Leeper et al (2010) pp304-321 and Zubairy (2009) implemented Bayesian estimation of models that include feedback rules for tax rates from output and debt. Leeper et al (2010) pp304-321 considered the importance of different degrees of distortionary tax responses to debt. Coenen et al (2012) pp22-68 examined fiscal multipliers and the importance of different fiscal instruments across seven dynamic general equilibrium macro models. Drautzburg and Uhlig (2013) and Uhlig (2010) pp30-34 focus on how future distortionary tax finance the program of the American Recovery and Reinvestment Act affects the overall impact of the program. Accordingly, there was not a clear consensus on whether there is a statistically and economically significant conclusion. Moreover, several different surveys over the past years have evaluated and focused on the empirical literature regarding the relationship between government debt and interest rates, for example: Barth et al (1984) pp79-95, Bernheim (1989) pp55-72, Barro (1989) pp178-235, Barth et al (1991) pp71-141, Seater (1993) pp142-190, Elmendorf and Mankiw (1999), and Gale and Orszag (2003) pp463-485. Despite the volume of work, no common consensus emerged.

In their studies about the concept of Ricardian equivalence[(1)], Bernheim (1989) pp55-72, Seater (1993) pp142-190 and Barro (1989) pp178-235 itemized some problems with examining the relationship between public debt, budget deficits and interest rates, Bernheim concludes that, it is easy to cite many studies that argue that the Ricardian equivalence hypothesis should be rejected, which means that there is a likely positive relationship between government debt and interest rates. However, Seater (1993) pp142-190 found

[(1)] The hypothesis that when the government stimulates the economy by increasing debt-financed government spending, aggregate demand remains unchanged.

many studies that support the Ricardian equivalence hypothesis, which implies that government debt has no effect on interest rates, at the same point; Barro concludes that the empirical results on interest rates support the Ricardian point of view.

Elmendorf and Mankiw (1999) discussed empirically the connection between federal government debt and interest rates, they stated that it is not very informative that literature has supported the Ricardian view "that budget deficits have no effect on interest rates", also Gale and Orszag (2002) in their survey of the economic effects of central government debt recognized that the evidence from the literature is diversified and conclude that, surveys of the empirical literature on government debt and interest rates refer to differentiated results reported in different studies, explanations and calculations. Many studies analyzed the direct effects of government debt on interest rates, Barro and Sala-i-Martin (1990) estimated the effects that economic policy variables have on real world interest rates across main developed economies. They used a structural model where the world interest rate is determined by investment demand and saving supply, and they concluded that current government debt does not play a vital role in real interest rates determination. Cohen and Follette (2003) in their analysis found no evidence of a significant relationship between current debt or deficits and current interest rates, the same finding that Barro and Sala-i-Martin (1990) found. Kitchen (2002) studied the effects of the standardized budget deficit (government budget deficit which adjusts the actual deficit for business-cycle effects) on the difference between the three-month Treasury yield and longer-term Treasury rates; he found that a 1% increase in budget deficit relative to GDP rises the difference between the ten year Treasury rate and the three-month Treasury rate by 42 basis points. Laubach (2003) estimated the effect of five-year-ahead forecasts by government debt or deficits on real ten-year

Treasury yield. He found that a 1% increase in the expected government deficit (relative to GDP) increases the forward-looking ten-year Treasury rate by 28 basis points. Evans and Marshall (2007) pp1986-2003 used a VAR model to examine the determinants of the variability in the Treasury yield curve and found that macroeconomic shocks responsible for most of the variability in Treasury yields, however fiscal policy shocks do not significantly explain Treasury yield variability.

1-4 Empirical Analysis of the public Debt and Interest Rates

Some empirical evidences on the possible effects of public debt on interest rates are examined by estimating the following reduced-form equation:

$$i_t = \alpha + \beta D_t + \gamma X_t + \varepsilon_t$$

Where it is the interest rate, dt is the public debt, and X is a vector of other variables that may influence interest rates according to the economic theory, which may include the following variables:

1. The level of money supply
2. The growth of money supply
3. GDP.
4. The growth rate of real GDP.
5. The fluctuation of business cycle.
6. A measure of risk aversion.
7. The fluctuation of exchange rate.
8. The fluctuation of interest rate.
9. Central Bank purchases of the Treasury securities.

The specification of the reduced-form equation between interest rate and the public debt can take different forms. As noted earlier, the hypothesis that public debt may crowd out private capital formation and thus increase real interest rates is based on a simple economic model which implies that:

1. The real interest rate is related to the *level* of public debt, *D,*
2. Or, the *change* in the real interest rate is related to the *change* in government debt, which is equal to the government borrowing, or budget deficit.
3. Or, the level of the real interest rate *is related to* government borrowing or the budget deficit.

As Engen and Hubbard (2005) noted, a number of studies have used the third specification and its results, to compare the results with those that employ the previous two specifications, even though it is not consistent with a simple crowding-out model. Economic theory recommends that; the total accumulation of government debt is most significant for explaining the level of the interest rate, not just the one-period budget deficit.

Previous studies have also varied in using whether forward-looking or current measures of interest rates and government debt in their analysis, provide estimates for three types of specifications:

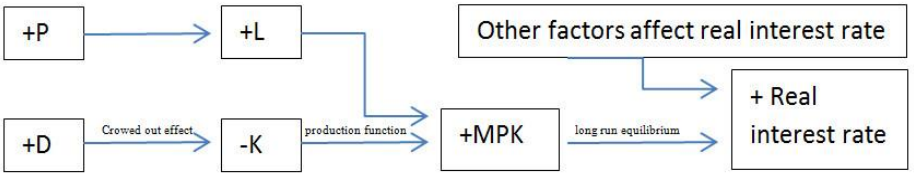
1. The effect of an expected, government debt on a forward-looking measure of real interest rate;
2. The effect of an expected, government debt on a current measure of real interest rate.
3. The effect of a current measure of government debt on a current measure of real interest rate.

Fiscal policies other than government debt, may also affect real interest rates. Studies of Ramey and Shapiro (1998) pp145-194 and Evans and Marshall (2007) pp1986-2003 regarding the effect of defense expenditure on interest rate, found that exogenous defense spending shocks -measured as a dummy variable- tend to increase interest rates. This result is consistent with the theoretical implication of an exogenous increase in government consumption expenditure in a neoclassical model.

While conducting monetary policy, the Central Bank regularly purchases Treasury securities as the economy grows to increase monetary base and money supply, which may reduce the impact of government debt on the real interest rate. Thus, a variable measuring the purchase of Treasury securities by the Central Bank should be included in the regression equation.

2- The simple model

An ordinary approach for understanding the potential effect of an increase in government debt on interest rates is a usual model based on an aggregate production function for the economy in which government debt crowds out physical capital.



As it well known in economic theory:

1- Other thing being equal; an increase in population (P) over time will lead to a proportionate increase in labor force (L); which in turn will reduce real wages and increase employment.

2- An increase in public debt (D) will contract (and so the increase in capital stock) through the crowding out effect.

3- Both previous effects will increase the marginal productivity of capital (MPK); which in turn positively affect long run real interest rate

That is, the model has an interest rate (r) determined in the long run by the marginal product of capital *(MPK)*, which is adversely associated by capital *(K)*, or crowded out, by government debt (D):

First: we have to calculate capital accumulation:

$$K_t = K_{t-1} + I_t - dep_t \text{--------- (1)}$$

Where:

K is the capital stock

I is the investment expenditure

dep is the depreciation

So,

$$K_t = K_0 + \sum_{i=1}^{t}(I_t - dep_t) \text{ --------- (2)}$$

Where:

$$K_0 = Y_0 \times \kappa_0$$

K_0 Is the capital stock at the base year, which calculated as the product of capital output ratio κ multiplied by the GDP (Y) , the capital output ratio is calculated as the product of the change in GDP divided by net investment (The equation was applied to the period from 1969 to 1981, and the capital output ratio in this period was 7.8, and therefore the capital stock of 1982 was calculated as the product of the multiplication of this factor by the GDP in the same year, noting that all values are at 2005 prices), that is:

$$\kappa_0 = \frac{\sum_{t=-n}^{t=0} \Delta Y_t}{\sum_{t=-n}^{t=0}(I_t)}$$

Or otherwise the capital stock is calculated by knowing the approximate depreciation rate δ, so that the capital stock is amount to:

$$K_0 = \sum_{t=0}^{t=\frac{1}{\delta}} dep_t$$

Second: we have to illustrate Output function:

$$Y_t = L_t \times APL_t \text{ --------- (3)}$$

$$APL_t = f\left(L_t, \left(\frac{K_t}{L_t}\right), Tec_t\right) \text{ --------- (4)}$$

Where:

APL: the average product of labor

L: the labor units

TEC: the technical progress which in turn is determined by:

$Tec_t = f(\delta_t, K_t, T)$

$\delta_t =$ depreciation rate.

K: is the amount of capital which reflects the spillover effect.

So we can simply conclude that technical progress is a function of time, and the output function could be illustrated as:

$$\boldsymbol{Y_t = AL_t^{\propto 21}\left(\frac{K_t}{L_t}\right)^{\alpha 22} e^{\propto 23 T}} \text{--------- (5)}$$

Where:

A: is the coefficient multifactor productivity

$\propto_{21}$: return to scale [(2)]

$\propto_{21} - \propto_{22}$: output elasticity of labor

$\propto_{22}$: output elasticity of capital [(3)]

$\propto_{23}$: the coefficient of technical progress

So:

The marginal product of capital is:

$$\frac{\partial Y}{\partial K} = \boldsymbol{MPK = \alpha_{22}\, AL^{\alpha 21 - \alpha 22} K^{\alpha 22 - 1}(1 + \propto_{23})^t} \quad \text{--------- (6)}$$

Third: we can calculate the long run equilibrium interest rate and the theoretical change in real interest rate as follow:

In a competitive market MPK = interest rate

So

$$r = MPK = = \alpha_{22}\, AL^{\alpha 21 - \alpha 22} K^{\alpha 22 - 1}(1 + \propto_{23})^t$$

$$\frac{\Delta r}{\Delta D} = \frac{\Delta r}{\Delta K} \times \frac{\Delta K}{\Delta D}$$

In the case of full crowd out

[(2)] this could be concluded if the function transformed into the form $Y_t = L_t^{\propto 21 - \propto 22} K^{\propto 22} e^{\propto 23 T}$

[(3)] The use of the amount of capital per worker will avoid the function multicolinearity problem.

$$\frac{\Delta K}{\Delta D} = -1$$

$$\frac{\partial r}{\partial D} = (\alpha_{22} - 1)\, \alpha_{22}\, AL^{\alpha 21-\alpha 22} K^{\alpha 22-2} (1+\propto_{23})^{t} \times -1$$

We assume that the percentage of the crowding out effect is equal to the complementary percentage of claims on household sector/domestic credit, which will be denoted by h, so:

$$\frac{\partial r}{\partial D} = (\alpha_{22} - 1)\, \alpha_{22}\, AL^{\alpha 21-\alpha 22} K^{\alpha 22-2} (1+\propto_{23})^{t} \times -h \text{ -----(7)}$$

In the case of partial crowd out, if the Central Bank uses the new issued money to buy government securities, then:

New issued money = money base X GDP growth rate =MB * g = ΔMB

$$\frac{\Delta K}{\Delta D} = -1 \times \frac{\Delta D - \Delta MB}{\Delta D}$$

$$\frac{\partial r}{\partial D} = (\alpha_{22} - 1)\, \alpha_{22}\, L^{\alpha 21-\alpha 22} K^{\alpha 22-2} (1+\propto_{23})^{t} \times \frac{\Delta D - \Delta MB}{\Delta D} \text{ -------(8)}$$

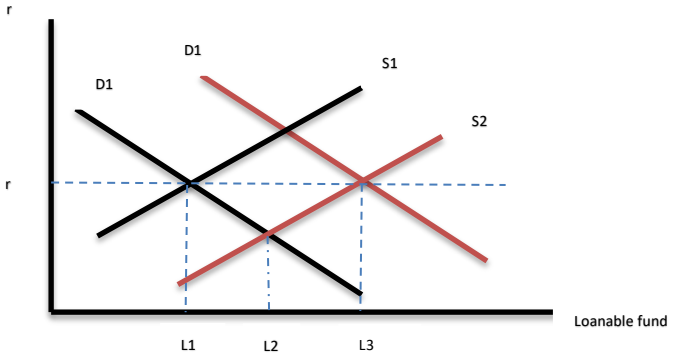
But if we consider the change in money base as government revenue, then we can simply neglect this effect and consider the crowd out effect equals to 1. In the conceptual framework (which is usually used to illustrate the possible effects of government debt on interest rate) there are many implications for empirical analysis of those effects.

First, the *level* of interest rate is determined by the marginal productivity of capital which in turn is determined by the comparative level of the capital stock, and thus the *increase in* government debt or budget deficit (the *change* in the interest rate is affected by the *change* in government debt, which is essentially equal to government budget deficit - crowding out the demand for investment-) will have some effects on interest rate. Empirical estimates of the effect on interest rates differ significantly depending on

whether it used the budget deficit or the government debt, and depending on the different specifications of the economic model; For instance, some empirical work uses Keynesian *IS-LM* framework, where the deficit is regressed on the level of the interest rate, depends on the hypothesis that deficits affect the level of the interest rate not only because public debt crowds out capital but also because budget deficits motivate aggregate demand which raises output and demand for money. However, As Bernheim (1987) 263-304 discussed, the increase in interest rates in the short run as a result of stimulating aggregate demand, is quite different than an increase in long-run interest rates as a result of crowding out private capital. So, it requires many assumptions about many elasticities to differentiate the short-term effect and the long-term effect of increase in public debt on interest rates.

Second, there are many factors other than government debt that can influence the determination of interest rates in money and capital markets. For example, the Central Bank purchases of government securities to expand the money supply to balance the output expansion and keep prices relatively constant. If this is the case, it seems that, government debt held by the monetary authority does not crowd out private investment (at the prevailing interest rate), But it is worth to be noted that, the Central Bank purchases of government securities may crowd out private investment by the concept of opportunity cost, that is, by looking at the following figure:

Figure 1: Demand and supply of loanable fund



1- If the Central Bank wants to keep interest rate constant, then it increases supply of loanable fund (the new Central Bank issue) and demand for loanable fund (the Central Bank's purchase of government bonds) also increase (increased from L1 to L3 each) in a way that keeps the interest rate unchanged.
2- If the Central Bank does not purchase government securities (demand for loanable fund does not increase), the investment funds will be increased from L1 to L2 due to the lower interest rate. That is, even in the case of the new money issue there is a crowding out effect, but it is not tangible because the interest rate remains unchanged.

So, in credit markets more econometric problems will be faced such as other potentially endogenous factors involved in the supply and demand of loanable funds. In addition to public debt there is the household debt acquired to increase consumption which also can crowd out investment. So, as Eric and Hubbard (2005) pointed out those measures of private-sector debt or borrowing are not included in empirical studies of government debt.

Besides, some neoclassical models imply Ricardian equivalence, because of the fact that public saves more to pay for expected tax increases that will be used to pay off the debt. This concept developed by David Ricardo and revised by Robert Barro. In other words, the increase in

government debt (holding government consumption outlays and marginal tax rates constant) is offset by increase in private saving, and thus the capital stock does not get affected by government debt and the interest rate does not rise. However, as Eric and Hubbard (2005) pointed the private saving is usually not included in empirical studies of government debt and the interest rate. Also, they pointed that, in a globalized economy that is a part of the global capital market, increases in government debt can be offset by increases in external lending, the issue that many empirical studies do not include.

Finally, besides capital accumulation, the interest rate is also affected by other general macroeconomic variable; in the simple model here, includes labor, TFP, technical progress and household borrowing, Thus, there is some accounting for general macroeconomic factors that can influence the effect of government debt on interest rates. If we assume Ricardian equivalence or open international capital markets (in which private domestic saving increases or foreign saving flows in to finance domestic government borrowing) then, increase in public debt does not crowd out capital ($dK/dD = 0$) and thus increase in public debt has no effect on the interest rate. For the alternative crowding-out assumption the presented model can provide a reasonable calculation of the potential effect on interest rates from the change in the public domestic debt, so the crowding out effect is as much as the ratio of investment loans to total loans (consumer loans + investment loans), or equal to the fraction of investment borrowing to overall borrowing, so that $-1 < dK/dD < 0$, which in Egypt is approximately about 0.9 as shown in the following table (1).

3- Estimation and results [4]

To estimate the proposed production function, the stability of the time series of the logarithm of gross domestic income, the logarithm of the number of workers and the logarithm of the working share of capital were first tested using the Augmented Dickey-Fuller test, which shows that the series were not stable at their first level, except for the share of capital.

In this case, the Cointegration Tests are to be carried out. In case of passing the test, the error correction mechanism is performed to ensure that there is a relationship between the variables and to avoid the spurious regression. This is done by regression of the variables at their first level using OLS. The results were as follows:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.793374	6.239055	0.928566	0.3620
$\propto_{21}$	0.783870	0.317470	2.469113	0.0207
$\propto_{22}$	0.566785	0.160631	3.528500	0.0016
$\propto_{23}$	0.026314	0.007565	3.478561	0.0019

R-squared	0.997295	Mean dependent var	24.86115
Adjusted R-squared	0.996971	S.D. dependent var	0.372828
S.E. of regression	0.020520	Akaike info criterion	-4.807421
Sum squared resid	0.010526	Schwarz criterion	-4.618828
Log likelihood	73.70760	Hannan-Quinn criter.	-4.748356
F-statistic	3072.809	Durbin-Watson stat	0.536777
Prob(F-statistic)	0.000000		

(4)

- The value of physical capital and output are in 2005 dollars,
- The value of the marginal product of the capital and therefore the value of the interest are in real terms.
- Thus, the effect of the public debt in real interest rate are linked to the change in capital or debt in 2005 dollar.
- The period of analysis was chosen from 1982 until before the January 25th Revolution because of its relative political and economic stability.
- The period after 2010 will be included in the analysis to derive the effect of the change in debt on the interest rate, after conversion to 2005 US dollars

The value of the Durbin-Watson statistic = 0.536, which is less than the value of the R-squared, which suggests the possibility of a spurious regression resulting from the instability of time series, and then have to conduct tests of cointegration.

The Johansen Cointegration test found that the maximum values of the trace statistics and maximum eigenvalue is greater than the critical value at 5%. Therefore, the null hypothesis is rejected, and the alternative is accepted, that shows that there is a single long-term equilibrium equation between the variables and the error correction mechanism is then performed. The unit root of the random error was also tested, which should be stable if there is a long-term integrative relationship between the variables. The value of the test was 0.019 that recognizes the stability of the time series of random error, and hence the existence of a long-term equilibrium relationship between the variables.

Error correction mechanism showed that the speed of response of the dependent variable to the independent variables is 0.7522 per year. So, the full response period is = 1 / 0.7522 = 1.33 years.

By studying the recent data of Egyptian domestic credit, we can notice that *h* is approximately equal 0.9, so by substituting eq (5) into (7):

$$\frac{\partial r}{\partial D} = (0.566 - 1) \times 0.566 \times 330\, L^{0.7838-0.566} K^{0.566-2} (1 + 0.0263)^t \times 0.9$$

$$\frac{\partial r}{\partial D} = 81.174\, L^{0.2178} K^{-1.434} (1.0263)^t \times h \text{ ------(9)}$$

Eq (9) reflects the main deductions of the paper; that the effect of increase public debt on real the long run real interest rate depends upon the following:

1. It is positively associated with the labor input; that is other things being equal, the more the labor input; the more the effect of increase public debt on real interest rate.

2. It is negatively associated with the capital input; that is other things being equal, the more the capital input; the less the effect of increase public debt on real interest rate.
3. Time factor (t) represents an approximation to the technological advancement, so eq (9) shows that the effect of increase public debt on real interest rate is positively associated with time period (and hence the more the technological advancement; the more the MPK).
4. The effect of increase public debt on real the long run real interest rate is positively associated with the percentage of household credit to total credit.
5. In 2017 h=0.901 t=36 K=$610.517 billion (to avoid some measurement problems, K has baan valued in dollar term) and L=25.3 million by substituting in eq (9) $\frac{\partial r}{\partial D}$ = -0.0105% which means that; other things being equal, an increase in public debt by 1 billion $ will lead to an increase in MPK (and hence real interest rate) by about 1.05 base point.

Conclusion

This paper is intentionally constricted in its scope; the focus is only on the interest rate effects of public debt. The effect of public debt and budget deficits on interest rates have been the focus of many of the recent and previous policy discussions in HDCs, concerning the effects of public borrowing on investment, capital accumulation and economic activity.

Besides, the recent reemergence of large budget deficits in Egyptian economy has motivated attention on a conservative question:

Does the increase in government debt affect interest rates? The answer based on the previous studies is mixed. Some studies found no statistically significant relationship, some studies recommended a minor increase in the

real interest rate when government debt increases, and others estimated large effects.

Comparing results across studies is complicated because there are many differences in

1- economic models' specifications,
2- Econometric methods,
3- Definitions of government debt and interest rates,
4- The use of budget deficit or public debt,
5- Sources of data.

By using a set of Egyptian data and a simple model, the paper added to empirical evidence on the effect of increasing government debt on interest rates. However, the researcher trusts that other effects of changes in public debt on economic factors, other than interest rates, are vital issues for analysis. This paper has not investigated the degree by which government borrowing could be offset by private domestic saving or inflows of foreign saving. These factors interact with government borrowing in ways that may have comparable effects on interest rates but dissimilar effects on macroeconomic variables.

The paper began by deriving theoretically the effect of increasing government debt on the real interest rate and concluded that the bulk of empirical studies recommended that an increase in government debt by 1% of GDP, other things being equal, is expected to increase the long-term real interest rate by around three basis points, while some studies' results were not statistically significant. Also, other studies estimated smaller effects and other studies estimated larger effects, it is remarked that, larger estimates related to the models used budget deficits as opposed to public debt and used interest rate as opposed to changes in interest rates.

This paper presented the empirical analysis in two parts. First, it built a simple model linking interest rates and government debt and other essential

macroeconomic variables. Second, by using the appropriate econometric methods, the model has been estimated.

Using Egyptian economy's data from 1982 to 2010 (the time period before 25th January revolution at which there was a relative political stability) and a simple economic framework, the paper concluded that an increase in government debt equivalent to $1billion would likely increase the real interest rate by about 1 to 1.1 basis points. While some existing studies in HDCs estimated effects above this range. This reduction in interest rate effects of public debt could be according to the decrease in physical capital efficiency in Egypt.

Appendix

Appendix 1: statistical tables

Table 1: Domestic Credit

	2012	2013	2014	2015	2016	2017
In million Egyptian pounds	June	June	June	June	June	Feb.
Domestic Credit (a+b)	1072566.0	1343140.4	1625141.0	1978210.8	2460114.7	2985206.8
Net claims on government	578654.4	802539.2	1045186.4	1291426.6	1654910.0	1933727.5
Claims on public business sector	40619.6	42866.0	45416.7	63217.7	93072.9	141572.0
Claims on private business sector	340865.0	369814.0	389274.9	448276.0	504258.0	676753.8
Claims on household sector	112427.0	127921.1	145263.0	175290.0	207873.9	233153.5
Claims on household sector/Domestic Credit	**10.733%**	**9.704%**	**9.062%**	**9.028%**	**8.588%**	**8.010%**
Claims on private business sector/Domestic Credit	**89.27%**	**90.30%**	**90.94%**	**90.97%**	**91.41%**	**91.99%**
(a) Domestic credit in local currency	1019124.7	1261509.2	1477223.0	1756646.0	2109503.8	2261842.1
Net claims on government	638492.1	851425.0	1034568.9	1251096.2	1500936.3	1537669.5
Claims on public business sector	31784.0	33872.9	35424.0	43989.1	65409.9	94018.4
Claims on private business sector	239111.0	250706.4	263977.6	289572.9	338687.6	402954.0
Claims on household sector	109737.7	125504.9	143252.0	171988.4	204470.4	227200.8
(b) Domestic credit in foreign currencies	53441.0	81631.2	147918.0	221565.0	350611.0	723364.7
Net claims on government	-59837.7	-48885.8	10617.0	40331.0	153973.6	396058.0
Claims on public business sector	8835.7	8993.1	9993.2	19228.6	27663.5	47553.6
Claims on private business sector	101754.0	119107.6	125297.3	158703.0	165570.4	273800.3
Claims on household sector	2689.0	2416.2	2011.1	3301.7	3403.5	5952.7

Source: The Central Bank of Egypt data base 2018.

Table 2: Gross Domestic Debt

-	2008	2009	2010	2011	2012	2013	2014	2015
Gross Domestic Debt (1+2+3-4)	658307	755,297	888,715	1,044,898	1,238,137	1,527,378	1,816,582	2,116,343
1- Net Domestic Debt of Government (A+B+C+D+E+F)	478811	562,327	663,818	808,113	990,529	1,261,141	1,538,459	1,871,332
A- Balances of Bonds & Bills	568960	681,838	779,232	916,976	1,078,162	1,269,289	1,478,846	1,722,165
Treasury Bonds :	422521	442758	513111	560873	669554	786024	944176	1125969
Treasury Bills :	146439	239,080	266,121	356,103	408,608	483,265	534,670	596,196
LE	146439	239,080	266,121	356,103	373,398	425,847	471,521	531,543
US$	0	0	0	0	35,210	46,914	51,166	53,307
Euro	0	0	0	0	0	10,504	11,983	11,346
B- Borrowing from other entities	0	0	0	2,000	13,036	25,348	15,686	5,640
C - Credit Facilities from the Social Insurance Funds	2343	2,343	2,343	2,343	1,725	1,225	1,225	450
D - The Masri Dollar certificate**	0	0	0	0	193	1,421	2,256	2,207
E- Net Government Balances with the Banking System	-92492	-121,854	-117,757	-113,206	-102,587	-36,142	40,446	140,870
F- Government Borrowing from NIB ***	0	0	0	0	0	0	0	0
2- Borrowing of Economic Authorities (Net)	50123	52,255	67,771	66,290	63,112	63,256	58,360	11,064
Net Balances of Economic Authorities with the Banking System	-1156	2,193	16,302	14,149	10,457	11,943	6,331	-41,524
Borrowing of Economic Authorities from NIB ****	51279	50,062	51,469	52,141	52,655	51,313	52,029	52,588
3- NIB Debt (Net)	189180	200,754	222,259	238,179	251,028	266,595	280,946	293,900
NIB Debt	193071	205,560	227,769	240,851	253,679	268,388	282,674	295,337
Deposits of the NIB with the banking system (-)	3891	4,806	5,510	2,672	2,651	1,793	1,728	1,437
4- NIB Intradebt	59807	60,039	65,133	67,684	66,532	63,614	61,183	59,953
Government debt to the NIB (investments in government securities)	8528	9,977	13,664	15,543	13,877	12,301	9,154	7,365
Government Borrowing from NIB	0	0	0	0	0	0	0	0
Loans of economic authorities to NIB	51279	50,062	51,469	52,141	52,655	51,313	52,029	52,588

Source: The Central Bank of Egypt data base.

Table 3: Discount Rate

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Discount Rate	9.00	9.00	8.50	8.50	9.50	10.25	8.75	9.25	12.25
Less than three-month deposits	6.50	6.50	6.30	6.60	7.70	8.00	6.70	6.80	7.50
Loans less than one year	12.00	12.10	11.10	11.00	11.90	12.60	11.30	11.60	13.40
Other Saving Vessels :									
Investment certificates (simple interest)	10.00	10.00	9.50	9.50	11.50	12.50	9.75	10.25	12.75
Investment cert. (compound interest)	9.50	9.50	9.00	9.00	11.00	12.00	9.25	9.75	10.75
Post office saving deposits	9.50	9.25	9.00	9.00	9.00	9.00	8.50	8.00	8.00

Source: The Central Bank of Egypt data base.

Table 4: Money growth in Egyptian economy

years	Broad money growth (annual %)	Broad money to total reserves ratio	Broad money (% of GDP)	Broad money (current LCU)
2000	11.58132166	5.558053389	76.74189944	2.60999E+11
2001	13.21525123	5.914560071	82.37828269	2.95491E+11
2002	12.63037204	5.482002643	87.8365004	3.32813E+11
2003	21.27975962	5.489782575	96.6788503	4.03634E+11
2004	16.23925111	4.969610269	96.67862586	4.69181E+11
2005	11.48935434	3.985891682	97.13784245	5.23087E+11
2006	15.00211258	4.024933144	97.38731171	6.01561E+11
2007	19.11424882	3.896674875	96.20641406	7.16545E+11
2008	10.48289527	4.192719994	88.40425157	7.9166E+11
2009	9.472592098	4.503293911	83.1559012	8.66651E+11
2010	12.41851334	4.773150315	80.74556173	9.74276E+11
2011	6.664885736	9.597564788	75.79391193	1.03921E+12
2012	12.34730479	12.42727056	69.71545906	1.16752E+12
2013	18.89071658	13.02106873	74.61183576	1.38808E+12
2014	15.76638521	15.44179212	75.44264838	1.60693E+12
2015	18.60496444	16.3603846	77.98587789	1.9059E+12
2016	39.50914199	13.96468985	98.17599122	2.6589E+12

Source: world Bank data base

Appendix 2: statistical results

Unit root test:

Null Hypothesis: LNGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.393495	0.9790
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNL has a unit root
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.197149	0.2126
Test critical values:	1% level	-3.769597	
	5% level	-3.004861	
	10% level	-2.642242	

Null Hypothesis: LNKL has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.123137	0.0376
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

Cointegration test:

Trend assumption: Linear deterministic trend
Series: LNGDP LNL LNKL
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.566409	30.94014	29.79707	0.0368
At most 1	0.249816	8.377500	15.49471	0.4259
At most 2	0.022583	0.616725	3.841466	0.4323

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.566409	22.56264	21.13162	0.0313
At most 1	0.249816	7.760775	14.26460	0.4035
At most 2	0.022583	0.616725	3.841466	0.4323

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Error correction model:

Dependent Variable: D(LNGDP)
Method: Least Squares
Sample (adjusted): 1983 2010
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.011065	0.014563	-0.759784	0.4548
D(α_{21})	2.312036	0.579209	3.991710	0.0005
D(α_{22})	1.727473	0.472479	3.656186	0.0012
U(-1)	-0.752209	0.227768	-3.302527	0.0030

R-squared	0.399441	Mean dependent var	0.046237
Adjusted R-squared	0.324371	S.D. dependent var	0.015376
S.E. of regression	0.012638	Akaike info criterion	-5.772599
Sum squared resid	0.003833	Schwarz criterion	-5.582284
Log likelihood	84.81639	Hannan-Quinn criter.	-5.714418
F-statistic	5.320926	Durbin-Watson stat	1.570440
Prob(F-statistic)	0.005915		

References

1) Barro, Robert J. (1989). The neoclassical approach to fiscal policy. In Modern Business Cycle Theory. Cambridge, MA: Harvard University Press,.
2) Barro, Robert J., and Xavier Sala-i-Martin. (1990). World real interest rates. In NBER Macroeconomics Annual, O. J. Blanchard and S. Fischer, (eds.). Cambridge, MA: MIT Press, and NBER working paper no W3317.
3) Barth, James R., George Iden, and Frank S. Russek. (1984). Do federal deficits really matter? Contemporary Policy Issues 3(1, Fall).
4) Barth, James R., George Iden, Frank S. Russek, and Mark Wohar. (1991). The effects of federal budget deficits on interest rates and the composition of domestic output. In the Great Fiscal Experiment, Rudolph G. Penner (ed.). Washington, DC: The Urban Institute Press, pp.
5) Bernheim, B. Douglas. (1987). Ricardian equivalence: An evaluation of theory and evidence. In NBER Macroeconomics Annual, Stanley Fischer (ed.). Cambridge: MIT Press,.
6) Bernheim, B. Douglas. (1989). A neoclassical perspective on budget deficits. Journal of Economic Perspectives 3(2, Spring).
7) Chen, C., Yao, S., Hu, P., & Lin, Y. (2017). Optimal government investment and public debt in an economic growth model. China Economic Review, 45.
8) Coenen, G., Erceg, C. J., Freedman, C., Furceri, D., Kumhof, M., Lalonde, R., Laxton, D., Lind, J., Mourougane, A., Muir, D., Mursula, S., de Resende, C., Roberts, J., Roeger, W., Snudden, S., Trabandt, M., and in't Veld., J. (2012). \Effects of fiscal stimulus in structural models." American Economic Journal: Macroeconomics, 4(1).

9) Cohen, Darrel, and Glenn Follette. (2003). Forecasting exogenous fiscal variables in the United States. Board of Governors of the Federal Reserve System. Finance and Economics Discussion Series 2003-59. November.
10) Drautzburg, T., and Uhlig, H. (2013). Fiscal stimulus and distortionary taxation." Federal Reserve Bank of Philadelphia Working Paper.
11) Elmendorf DW, Mankiw NG. 1999. Government debt. In Taylor JB, Woodford M (eds.) Handbook of Macroeconomics, volume 1C. Amsterdam: Elsevier Science.
12) Elmendorf, Douglas W., and N. Gregory Mankiw. (1999). Government debt. In Handbook of Macroeconomics, John B. Taylor and Michael Woodford (eds.). Amsterdam: Elsevier Science, Chapter 25.
13) Engen, Eric M., and R. Glenn Hubbard, (2004) "Federal Government Debt and Interest Rates", in Mark Gertler and Kenneth Rogoff, : NBER Macroeconomics Annual 2004, MIT Press, April 2005.
14) Engen, Eric M., and R. Glenn Hubbard (2005)," Federal Government Debt and Interest Rates", in Mark Gertler and Kenneth Rogoff, NBER Macroeconomics Annual 2004, Volume 19, available at: http://www.nber.org/chapters/c6669.
15) Evans, Charles L., and David Marshall. (2007). "Economic determinants of the nominal Treasury yield curve" *Journal of Monetary Economics* 54.7.
16) Feldstein, Martin and Douglas W. Elmendorf, (1990) "Government Debt, Government Spending, and Private Sector Behavior Revisited: Comment," American Economic Review 80 (June 1990).
17) Feldstein, Martin and Philippe Bacchetta, (1991) "National Saving and International Investment," in National Saving and Economic Performance, B. Douglas Bernheim and John B. Shoven, eds., Chicago: University of Chicago Press (1991).

18) Feldstein, Martin, "How Big Should Government Be?," National Tax Association Proceedings (1996).
19) Feldstein, Martin, "Overview Panelist," Budget Deficits and Debt: Issues and Options, Federal Reserve Bank of Kansas City (1995).
20) Forni, L., Monteforte, L., and Sessa, L. (2009). \The general equilibrium effects of fiscal policy: Estimates from the Euro Area." Journal of Public Economics, 93.
21) Gale, William G., and Peter Orszag. (2002). The economic effects of long-term fiscal discipline. Urban Institute Brookings Institution Tax Policy Center. Discussion Paper. December.
22) Gale, William G., and Peter Orszag. (2003). Economic effects of sustained budget deficits. National Tax Journal 56(3, September).
23) Gregory Mankiw. Douglas W. Elmendorf. "Government Debt" in Handbook of Macroeconomics. Harvard university press. (1998).
24) Kitchen, John. (2002). A note on interest rates and structural budget deficits. U.S. Congress, House of Representatives, Budget Committee. Mimeo. October.
25) Lanzavecchia, A., Pavarani, E., & Tagliavini, G. (2015). How Euro shrinks Democracy: insights from the Greek crisis. Journal of Governance and Regulation, 4(4).
26) Laubach T. 2009. New evidence on the interest rate effects of budget deficits and debt. Journal of European Economic Association 7.
27) Laubach, Thomas. (2003). New evidence on the interest rate effects of budget deficits and debt. Board of Governors of the Federal Reserve System. Finance and Economics Discussion Series 2003-12. May.
28) Lee, S. P., & Ng, Y. L. (2015). Public debt and economic growth in Malaysia. Asian Economic and Financial Review, 5(1).

29) Leeper, E., Plante, M., and Traum, N. (2010). \Dynamics of fiscal financing in the United States." Journal of Econometrics, 156.

30) Leeper, E., Richter, A., and Walker, T. (2012). \Quantitative effects of fiscal foresight." American Economic Journal: Economic Policy, 4(2).

31) Leeper, E., Traum, N., and Walker, T. (2011). \Clearing up the fiscal multiplier morass." NBER Working Paper 17444.

32) Nora Traum And Shu-Chun S. Yang, When Does Government Debt Crowd Out Investment?, on line at: http://www4.ncsu.edu/~njtraum/CrowdingOut.pdf

33) Ramey, Valerie A., and Matthew D. Shapiro. (1998). Costly capital reallocation and the effects of government spending. Carnegie Rochester Conference Series on Public Policy (48, June).

34) Sargent, Thomas J. and Neil Wallace, "Some Unpleasant Monetarist Arithmetic," Quarterly Review, Federal Reserve Bank of Minneapolis (Fall 1981).

35) Seater, John J. (1993). Ricardian equivalence. Journal of Economic Literature (31, March).

36) Traum, N., & Yang, S. C. S. (2015). When does government debt crowd out investment?. Journal of Applied Econometrics, 30(1).

37) Uhlig, H. (2010). Some fiscal calculus." The American Economic Review, 100(2),.

(1) Zubairy, S. (2010). “Explaining the effects of government spending shocks." Mimeo, Duke University. Zubairy, S. (2013). On fiscal multipliers: Estimates from a medium scale DSGE model." International Economic Review, at: https://www.banqueducanada.ca/wpcontent/uploads/2011/05/irf_estimation.pdf.