

2019

# **Could Egyptian government use inflation to erode public debt?**

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## ملخص

تجاوز الدين العام في مصر 100% من الناتج المحلي الإجمالي في عام 2019، في حين بلغ معدل التضخم 9.4% تقريباً، وفي بعض الحالات الخاصة، قد يساعد التضخم متوسط الارتفاع (رغم اثاره السلبية) على خفض القيمة الحقيقية للدين العام وبالتالي خفض نسبة الدين إلى الناتج المحلي الإجمالي، وهذه السياسة تشبه تلك المتبعة في نهاية الحرب العالمية الثانية في بعض البلدان المتقدمة. وبالتالي تقدم هذه الورقة إطاراً تحليلياً لتحديد أثر التضخم على الدين العام الاسمي. وبناءً عليه، تم استنتاج انه مع بقاء العوامل الاخرى على حالها (على سبيل المثال معدلات الضرائب ومعدل الانفاق الحكومي الى الناتج المحلي الاجمالي ومعدل الفائدة وسعر الصرف)، يمكن للحكومة خفض نسبة الدين العام الى الناتج المحلي الاجمالي عن معدلها الحالي من خلال معدل تضخم معتدل يزيد عن 12.28% على المدى القصير (حالة انعدام اثر فيشر)، و7.35% على المدى الطويل حالة تحقق اثر فيشر)، ومع ذلك ، فإن أقصى مستوى متراكم لاستخدام التضخم يساوي 125.6% تقريباً، وهي النسبة التي يتساوى بعدها اثر التضخم على تخفيض القيمة الحقيقية للدين العام الداخلي مع اثره على ارتفاع قيمة الدين العام الخارجي.

## Abstract

Egypt's public debt exceeds 100% of GDP in 2018. In some cases, inflation (in some special cases) may help reduce the real value of public debt and thus reduce debt to GDP ratio. This policy is similar to that used at the end of World War II in some HDCs. This paper therefore provides an analytical framework for determining the impact of inflation on nominal public debt. Accordingly, Other things being equal, to reduce the current rates of public debt to GDP, an inflation rate more than 12.28% and of 7.35% per annum should be attained in the short run (no Fisher effect) and long run (full Fisher effect) respectively, and the maximum cumulative level to use inflation policy to erode the real value of public debt is about 125.6%, the level at which the ratio of external public debt is equal to the ratio of domestic public debt, so that in the long run any decrease in real value of domestic public debt will be equivalent to the increase in external debt.

**Keywords:** Public debt, inflation rate, economic growth, seigniorage.

## **1-Introduction:**

Governments borrow if current spending is not completely covered by current revenues. This borrowing constitutes the annual net new debt, which does not include borrowing meant for debt rescheduling or the rolling-over of loans from previous fiscal years. The net new debt plus the loans for debt rescheduling together form gross new borrowing. But there is a part of thought considers public debt as an evil, their point of view originates from the advice of the less you are in debt, the better for you. This philosophy is accurate for a household who expects to pay down all his debt. The philosophy also holds true to some extent for the government; a low debt level is better than a high debt level, but keep in mind that, government usually doesn't pay its debt back rather it reschedules it and pays annually the required interest payment. On the other hand, the budget deficit is an important tool in economic policy by which government can achieve some economic goals.

Less democratic nations with a large public debt is likely to face high interest rate, and the monetary authority may be stressed to reduce this rate through expansionary monetary policy; this policy may reduce interest rates in the short run, but in the long run, real interest rate will stay unchanged and inflation and nominal interest rate will reach higher levels. In less democratic countries also, if the fiscal authority can force the Central Bank to finance the budget 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, 1981) argues, inflation is a fiscal phenomenon rather than a monetary one.

This paper discusses a simple framework about how inflation can be used to reduce public indebtedness.

### **Study problem:**

According to the CB data both inflation and public debt have increased dramatically after 25th Jan revolution, 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 inflation rate reaches 9.37% in June 2019 down from 14.38% 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:

How could the government use inflation as a tool to reduce domestic public debt?

### **Study hypothesis:**

**The study seeks to validate the following hypothesis:**

- Could government use inflation as a tool to reduce the real value of domestic public debt?

### **Study methodology:**

The methodology used both mathematical deductive and inductive method, the study begins with the mathematical deductive method to form the mathematical model and by using data published by CB, one could determine the appropriate level of inflation that helps to reduce the real value of domestic public debt. In other words, the paper followed the following steps:

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

## **2-Literature review:**

### **2-1 When should the public debt be reduced?**

Public debt is one of the key macroeconomic variables, for all types of countries. However, there is a consensus that high debt-to-GDP ratios are disagreeable (see, Neck and Sturm 2008; Kumar and Woo 2010; Cecchetti et al. 2010). That is, many recent economic crises have been caused by extreme levels of public debt (see Das et al. 2010). This exceptional importance has generated a wide-ranging literature on public debt and its management. So, some countries put debt ceilings in terms of percentage of GDP or in monetary units. For instance, the public debt of USA (measured in monetary, not in debt-to-GDP ratio) is subject to a definite level or ceiling that must be altered by the Congress. This ceiling has been changed whenever it was required (usually it was extremely difficult to reach an agreement to change this ceiling). Under the No Budget, No Pay Act of 2013, On May 19, the debt ceiling was raised to approximately \$16.699 trillion to accommodate the borrowing done during the suspension period (see Austin, 2015).

As a result, the USA debt was downgraded by S&P from AAA to AA+ for the first time in history. The debt ratings of some countries such as Italy, Spain, Greece, France and Portugal, have been downgraded as well.

Moreover, the Maastricht treaty 1992 set a percentage of 60% as ceiling for the debt-to-GDP ratio for countries to be members in European

Economic Community. So, public debt ceiling could be defined as the maximum absolute or percentage level of public debt at which fiscal interventions are not required, if the public debt exceeds that level, the government should intervene to reduce it, one way to do so is by generating fiscal surpluses by increasing taxes, decreasing government spending or both. The logic for the determined debt ceilings mentioned above come from empirical data, according to Herndon et al. (2013) and Chowdhury and Islam (2010), the 60% of Maastricht Treaty was the average of the debt ratio in Euro countries.

However, when addressing the limit of public debt, the maximum level of public debt is considered, it is the level at which government can pay the obligatory interest. So, the debt limit will be as the upper limit of interest payment will stand, and when recognizing that public debt always renewed and doesn't paid down, then we will conclude that the interest payment of the public debt ( that paid periodically) is the something being matters.

Table 1 shows some debt related macroeconomic ratios for some selected countries, the first column shows that, however Japan has a large public debt (about 250% of GDP), it has a negative interest rate and then negative interest payment. Nevertheless, comparing this situation to what it is in Egypt, the result is that, Egypt has a lower debt ratio (about 92% of GDP) but it has much larger percentage of interest payments about (17.3% of GDP).

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**Table 1: Some macroeconomic ratios for selected economies 2017**

countries	Japan	Italy	USA	Spain	Euro area	India	Brazil	Mexico	S Koria	Turkey	Indonesia	Egypt
public debt/GDP	250.40%	132.60%	106.10%	99.40%	89.20%	69.50%	69.49%	47.90%	38.60%	28.30%	27.90%	92.30%
interest rate	-0.10%	0.00%	1.50%	0.00%	0.00%	6.00%	7.50%	7.00%	1.50%	8.00%	4.25%	18.75%
inflation rate	0.60%	0.90%	2.20%	1.20%	1.40%	4.88%	2.80%	6.63%	1.50%	11.92%	2.61%	26.00%
real interest rate	-0.70%	-0.90%	-0.70%	-1.20%	-1.40%	1.12%	4.70%	0.37%	0.00%	-3.92%	1.64%	-7.25%
interest payment/GDP	-0.25%	0.00%	1.59%	0.00%	0.00%	4.17%	5.21%	3.35%	0.58%	2.26%	1.19%	17.31%
real interest payment/GDP	-1.75%	-1.19%	-0.74%	-1.19%	-1.25%	0.78%	3.27%	0.18%	0.00%	-1.11%	0.46%	-6.69%
budget deficit/GDP	-4.50%	-2.40%	-3.50%	-4.50%	-1.50%	-3.50%	-8.90%	-2.60%	-2.40%	-1.10%	-2.46%	-9.80%
government spending/GDP	39.47%	49.60%	34.00%	42.40%	47.70%				32.30%			30.80%
government revenue/GDP	34.97%	47.20%	30.50%	37.90%	46.20%				29.90%			21.00%
debt growth rate	1.80%	1.81%	3.30%	4.53%	1.68%	5.04%	12.81%	5.43%	6.22%	3.89%	8.82%	10.62%
growth rate current account	2.10%	1.70%	2.30%	3.10%	2.60%	6.30%	1.40%	1.50%	3.80%	11.10%	5.06%	4.90%
	3.70%	2.60%	-2.60%	2.20%	3.30%	-0.70%	-1.30%	-2.70%	7.00%	-3.80%	-1.80%	-5.90%

**Source:** world Bank data base 2018.

Central Bank data showed that Egypt's internal debt jumped from LE 1044 billion in 2011 to LE 2619 billion in 2016, an increase of LE 1575 billion, equivalent to an increase of 150.8%. In comparison to the debts registered during 2018, internal debt jumped from LE 1044 billion in 2011 to LE 3888 billion by the beginning of 2019, an increase of LE 2844 billion, an increase of 272.4%. So, the average annual increase in the public internal debt since the January revolution so far is about 34%, equivalent to about LE 355.5 billion annually.

On the other side, Egypt's external debt increased to about \$ 96.6 billion at the end of 2018, compared with \$ 82.8 billion at the end of 2017. The Central Bank of Egypt reported that the external debt increased by about 13.8 billion dollars in 2018, an increase of 16.5% of the total external debt in 2017. A record rise in Egypt's external and internal debt levels since the January 2011 revolution to date is directly attributable to the decline in the country's revenues from tourism which is one of the most important sources of foreign exchange to Egypt. In comparison with the debt recorded at the end of 2018, Egypt's external debt jumped from \$ 34.9 billion in 2011 to \$ 96.6

billion at the end of 2018, an increase of \$ 61.7 billion, an increase of 176.8%. The average annual increase in the total external debt of Egypt since the January 2011 revolution until the end of last year is about 22.1% with an average annual increase of about \$7.7 billion dollars.

So, if a country wants to reduce its indebtedness ratios, how can public debt/GDP ratio be reduced?

**There are four scenarios:**

- First scenario, the denominator (GDP) could be growing rapidly to reduce the ratio. This scenario requires an increase in economic factors such as labor, natural resources, physical and human capital that determine economic growth.
- Second scenario, inflation can rise, which wear down the real value of public debt and the effective debt/GDP ratio. In such a case if foreign creditors hold a weighty share of the domestic public debt, then they will share the burden of inflation with domestic creditors.
- Third scenario, the government can sell some of its assets or part of the public sector through the privatization program to redeem some of the debt.
- Fourth scenario, the government can decrease public spending or increase taxes and use revenue to redeem some of its debt.

Accordingly, there are three main variables that control the indebtedness ratios, GDP growth rate, inflation rate and public debt growth rate, so in the next section the connections between the three variables will be discussed.

## **2-2 Review of Assorted Empirical Studies**

Previous studies could be divided into three categories; the *first* category represents the studies that are concerned with the relation between



public debt and economic growth, the *second* category contains the studies that examine indirectly the connection between inflation and public debt through the effect of public debt on macroeconomic variable such as investment and interest rate. However, the *third* category contains the studies that analyze directly the causality relationship or the mutual interdependence between inflation and public debt.

### **2-2-1 public Debt and economic growth:**

The connection between debt and growth is suggested by Barro (1979) pp940-971, that is, taxes will need to be upraised to attain debt sustainability, so the distortionary impact of taxes is likely to lower potential output in the future. The other way to ensure debt sustainability is to reduce government spending, which can be contractionary.

Many studies examined the impact of domestic debt on economic growth, such as Ahmed et al (2010) pp256-263, Checherita and Rother (2010), Adofu and Abula (2010) pp22-26, Maana et al (2008)), applied OLS and observed that the stock of domestic debt positively affects economic growth, however debt servicing is negatively associated with economic growth.

Herath (2016) pp52-71 examines the connection between public debt and economic growth, and analyzes the ideal level of public borrowing and the effect of national borrowing on the size of the public sector. He examines the mathematical relationships between debt with growth and size of the public sector, and he analyzes the empirical studies of national debt in developed and developing countries and the size of the public sector. He found that, high levels of debt deal with high growth to developed countries and expand the public sector in both HDCs and LDCs.

## **2-2-2 Debt, interest and investment:**

Obi and Nurudeen (2009) pp306-316 studied the effect of fiscal deficits and public debt on interest rates in Nigeria using VAR approach that is; interest rate is affected by the fiscal deficit and public debt. The authors found that fiscal deficits and public debt have a positive effect on interest rates.

Cadenillas & Aguilar (2015) develop a debt control model to study the ideal government debt ceiling. They consider that, debt generates a cost for the country, and this cost is a convex function of debt ratio. Then, the objective of the government is to minimize the expected total cost at the optimal debt ceiling.

Rohrs (2015) pp1282-1312 analyzes the public debt in a dynamic economic model with overlapping generations. He found that, the elasticity of substitution between public and private consumption determines the level of public debt and may explain the differences of debt across countries.

zadeh et al (2013) pp31-40 estimate the effect of disaggregated government spending (government consumption, government investment and budget deficit) on private investment in both HDCs and LDCs. They indicate that the responsiveness of private investment to government investment expenditure is positive in both groups, nevertheless this crowed in effect is greater in HDCs than LDCs. Similarly, the responsiveness of private investment to government consumption expenditure is significantly negative in both groups; however, this crowding out effect is greater in HDCs. Also, the budget deficit has a crowding out effect on private investment in HDCs, while it has a crowd in effect in LDCs, and this effect is marginal in both groups.

Kollamparambil and Nicolaou (2011) pp98-108 analyze using a VAR model the relationship between public and private investment in South Africa.

They found that public investment doesn't crowd in or out" private investment, but it has an indirect impact on private investment spending through the accelerator effect.

Funashima and Ohtsukay (2017) suggest fiscal spillovers model to investigate crowding-out and in effects of government expenditure on the private sector in Japan. They proved that there exist autocorrelations in the private economic variables, which increase the crowding-out effects of government consumption. However, the crowding-out of public investment spending is shown to be insignificant.

This finding is related to the study of Miyazaki (2016), who studied the crowding out and in effects of public investment on private investment by using a regional panel in Japan. This study is similarly related to Bruckner and Tuladhar (2014) pp1279-1316, and Miyazaki (2017) pp795-799, who use the regional data to study the effects of fiscal policy on the regional economy in Japan. He estimated the changes in regional public investment and showed that these changes were deepening the regional business cycle fluctuations.

However, Bruckner and Tuladhar (2014) pp1279-1316 estimated the local government spending multipliers which defer significantly between regions.

Cloyne (2014) argued that the magnitude and sign of the government expenditure multiplier depends on how this expenditure is financed and how households respond to expected tax increases. So, he examined a New Keynesian model with distortionary labor and capital taxes. He evaluated if the model could explain the evidence for the United States data and examined the transmission mechanism, for planning accurate policy rules. He found that the model can explain the positive empirical response of key variables including output, consumption and the real wage.

He found also that the role of the wealth effect on labor supply is insignificant, and the tax rates rise following a spending shock is small compared with the debt rising, so the deficit financed spending is therefore expansionary due to sticky prices rather than wealth effect.

### **2-2-3 the mutual interdependence between inflation and public debt:**

Some recent papers (see Krause and Moyen (2016) pp142-172, Lopes da Veiga et al (2016) pp294-322, Akitoby et al (2017) pp28-50, Di Bartolomeo et al (2015), Aizenman and Marion (2011) pp31-40, and Menna and Tirelli (2017) pp79-94) discuss the effects of a higher inflation target on the burden of real public debt, suggested that a moderate inflation rate can have a noticeable effect on real public debt.

The relationship between huge public debt and inflation is evident, that is, government can obtain domestic public debt from many sources, such as commercial banks, insurance companies, the Central Bank, and other financial institutions. Borrowing from the Central Bank carries a risk of inflation according to additional aggregate demand caused by additional money supply. Inflation is the continuous rise in the general price level of goods and services. As the price level increases in an economy, the purchasing power of money decreases by equivalent amount. Inflation could be used as a macroeconomic indicator that providing some important insights about the economy. A low and stable inflation rate is appropriate for a promotion environment for economic growth. On the other hand, public debt is used by the governments in both HDCs and LDCs to finance internal and external gaps. The efficient utilization of debt will probably enhance productive capacity and economic growth through development of infrastructure and related projects. Nevertheless, if the debt is not efficiently

and effectively used, it makes many complications in the economy. So, when government borrows from the Central Bank, it is the same as printing new money. It is an inflationary approach that usually not recommended. Moreover, if the government cannot service the debt, the money stock may increase disproportionately to the increase in GDP, involving inflationary issuing of money.

On the other hand, inflation leads to higher prices for government purchases of goods and services, especially the cost of subsidized goods and services provided by the government. At the same time, rising inflation means high interest rates, which means higher debt servicing and higher government spending, which in turn increases the government's demand for loans, and so on.

When a commercial bank lends government, there are two points of concern. Firstly, how commercial banks get funds to lend the government. Secondly, how will banks' processes be affected by lending the government? If a bank lends the government by purchasing government securities, the required cash outflow needed for lending government may be attained by two ways: the new government securities replace the old ones and the aggregate volume of the bank's assets and liabilities remains unchanged. So, this channel wouldn't be inflationary. But, if the commercial banks obtain funds through new deposits to invest in government securities, then the acquisition of additional deposits will increase money supply and if there isn't an equivalent increase in GDP this channel would be inflationary.

As a matter of fact, unexpected inflation can reduce the real interest of servicing the debt. So, the efficiency of this process is sensitive to the maturity structure of the debt. That is, the longer the term of nominal government debt is, the more the vulnerability to inflation will be, however shorter-term public debt is less vulnerable to inflation. This is simply because,

any government that tries to reduce the real value of short-term debt by increasing inflation rate, will pay much higher interest rates. Also, the way in which public debt was built up can be vital. For example, Reinhart and Rogoff (2010) stated that, war debts are less tricky for future economic growth and inflation than debts that have accumulated in peace time, because the postwar economic growth tends to be high “by way of war allocation of manpower and resources will shift to the civilian economy”. Besides, a peacetime debt explosion frequently reflects unstable economic dynamics that can continue for very long periods.

Bildirici and Ersin (2007) examined the connection between domestic public debt and inflation for high inflation countries and found that the more the domestic debt growth is, the more the inflation and the more the cost of debt will be.

Kannan and Singh (2009) applied 2SLS technique to study the dynamic interaction between fiscal deficits and public debt with macroeconomic variables (inflation, interest rate, trade gap and real GDP). They found that fiscal deficits and public debt have a negative effect on the previous macroeconomic variables in the intermediate to long run.

Fujiki (2001) stated that, the hyperinflation in Austria and Germany in the interwar period had helped them to reduce their external debt. Both countries were required to pay compensations exceeding their economic ability. However, hyperinflation had driven them into chaos; it also helped them to reduce their external debt to a repayable level. These experiences do not prove that huge debts have no other solutions apart from hyperinflation. In Czechoslovakia, in the same period, it adopted rigorous fiscal and monetary policies to avoid hyperinflation.

Ahmed et al, (2012) investigate the impact of public debt on inflation in Pakistan in the period 1972 to 2009. They conclude that domestic debt and

domestic debt servicing increase inflation in Pakistan. The effect of domestic debt volume and servicing on price level is found positive and statistically significant. Banks and other financial institutions obtain treasury bills and receive a high return on them; this will increase income, aggregate demand and price level.

Wijnbergen & Budina (2001) pp293-309 analyze the dependability between budget deficits and inflation and assess Poland's domestic and foreign debt policies and the impact of the Brady agreement of debt reduction on the relationship between fiscal deficits and inflation. They also evaluate the impact of seigniorage revenue and low inflation strategy. They found that, such policies have a direct impact on inflation targets.

Da Veiga et al (2014) analyze the impact of public debt on economic growth and inflation in 52 African countries between 1950 and 2012. They found that, the limits of public debt affect economic growth negatively, from a given level of debt. They found also that, the relationship between economic growth and public debt is an inverted U shape, that is, the highest rates of growth are attained where public debt reaches 60% of GDP and inflation rate of 8.2%. But when debt to GDP ratio reaching between 60-90%, the rate of economic growth drops by up to 1.32 % and continues reaching by 1.64 % when the ratio exceeds 90%.

Aizenman & Marion (2013) pp31-40 design an analytical framework for the impact of large nominal debt on the temptation to inflate. The framework suggests that when economic growth is slowed down, additional inflation would significantly decrease the debt ratio, even with shortening of debt maturities.

Reinhart and Rogoff (2010) studied economic growth and inflation at different levels of public debt, the analysis was based on 44 countries covering a wide range of political systems, institutions, exchange rate

policies, historic and geographic conditions. They found that, the relationship between public debt and growth rate is insignificant for public debt/GDP ratios below 90%. Exceeding 90 percent, relationship between public debt and growth rate is significant, and the two variables are negatively associated. However, when external debt reaches 60 % of GDP, growth rate will decline at increasing rate. They found also that, there is no simultaneous link between inflation and public debt levels for the HDCs as a group; however United States has experienced higher inflation rates when debt/GDP ratio was high. But the relationship was different in LDCs, where inflation rises sharply as debt increases.

#### **2-2-4 Evidence from Emerging Market Countries**

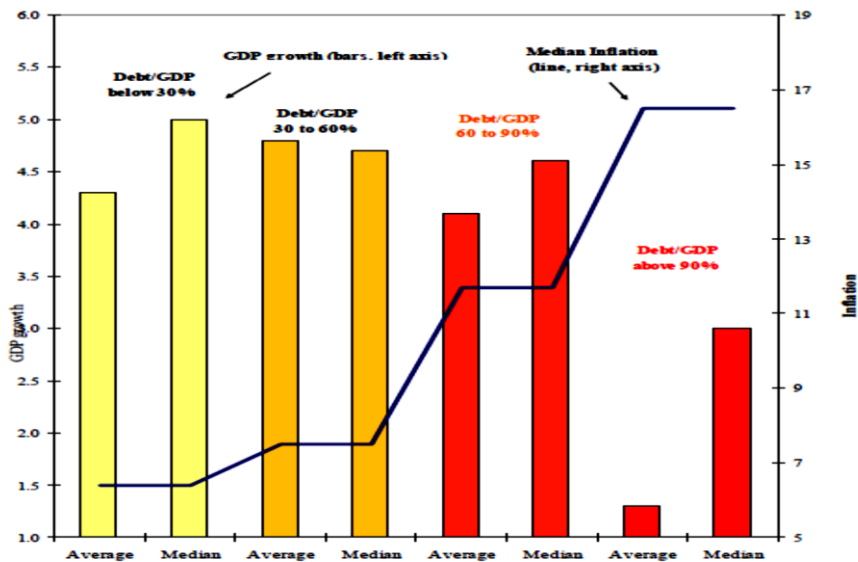
Studies that concerned of the relationship between public debt, inflation and economic growth in Egypt are very rare, so, evidence from some emerging market countries could be used as indicator for this relation.

Reinhart and Rogoff (2010) studied the debt ratio , growth rate and inflation rate of 24 LDCs economies (countries included are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Ghana, India, Indonesia, Kenya, Korea, Malaysia, Mexico, Nigeria, Peru, Philippines, Singapore, South Africa, Sri Lanka, Thailand, Turkey, Uruguay, and Venezuela.) for the periods 1946-2009 and 1900-2009, the results illustrated in Figure 1 and Table 1.

They found that, median and average GDP growth was around 4-4.5% for levels of debt/GDP below 90%, nevertheless median growth was about 2.9% for high debt (above 90%); the decrease in growth rate was almost the half. Similar to HDCs economies, they found that, in LDCs economies the higher the debt levels, the higher the levels of inflation. Inflation rate increase more than double (from about 7% to 16%) as debt rises from the low (less or equal to 30%) to above 90%.



**Figure 1. Public Debt, Growth, and Inflation:  
Selected Emerging Markets, 1946-2009**



**Source:** Reinhart, C. and Rogoff, K. (2010), “Growth In A Time Of Debt”, Working Paper 15639, National Bureau Of Economic Research, <http://www.nber.org/papers/w15639>.

**Table 2. A Historical review of Growth rate as the Level of Government Debt Varies:**

**Selected Emerging Economies, 1900-2009 (annual percent change)**

Country	Period	Central (Federal) government debt/ GDP			
		Below 30 percent	30 to 60 percent	60 to 90 percent	90 percent and above
Argentina	1900-2009	4.3	2.7	3.6	0.5
Bolivia	1950-2009	0.7	5.2	3.7	3.9
Brazil	1980-2009	3.2	2.3	2.6	2.3
Chile	1900-2009	4.0	1.0	7.5	-4.5
Colombia	1923-2009	4.3	3.0	n.a.	n.a.
Costa Rica	1950-2009	6.9	5.0	3.4	3.0
Ecuador	1939-2009	5.3	5.0	3.2.	1.5
El Salvador	1939-2009	3.6	2.6	n.a.	n.a.
Ghana	1952-2009	n.a.	4.6	4.7	1.9
India	1950-2009	4.2.	4.9	n.a.	n.a.
Indonesia	1972-2009	6.6	6.3	-0.1	3.1
Kenya	1963-2009	6.3	4.2	2.3	1.2
Malaysia	1955-2009	2.0	6.2	6.9	5.5
Mexico	1917-2009	4.1	3.4	1.2.	-0.7
Nigeria	1990-2009	5.4	10.6	11.2	2.6.
Peru	1917-2009	4.3	2.9	2.7	n.a.
Philippines	1950-2009	5.0	3.8	5.1	n.a.
Singapore	1969-2009	n.a.	9.5	8.2	4.0.
South Africa	1950-2009	2.0	3.5	n.a.	n.a.
Sri Lanka	1950-2009	3.3	3.7	4.2	5.0
Thailand	1950-2009	6.1	6.6	n.a.	n.a.
Turkey	1933-2009	5.4	3.7	3.2	-6.4
Uruguay	1935-2009	2.1	3.1	3.2	0.0
Venezuela	1921-2009	6.5	4.1	3.2	-6.5
Average		4.3	4.1	4.2	1.0
Median		4.5	4.4	4.5	2.9
Number of observations = 1,397		686	450	148	113

Source: *ibid.*

Christian and Weizsacker (2015) pp42-61 stated that, the neo Austrian capital theory implied that: in capital market equilibrium without public debt, the average period of production will be equivalent to the average waiting period of households. And he observed that, in the 21<sup>st</sup> century the OECD and China have capital market equilibrium without public debt, the case that implies a negative real interest rate. While price stability needs a non-negative real interest rate, so, positive public debt is required for price stability under

circumstances of prosperity. Hence a balanced view of public debt is vital and to reduce public debt is not usually the paramount policy.

### **2-2-5 What rate of Inflation is harmful to economic Growth?**

From one side government can raise inflation as a policy to erode the large public indebtedness ratio, however from the other side, the high rates of inflation will negatively affect the economic growth rate, so the final result is large indebtedness ratio again, if this is the case, government should know approximately the edge or threshold at which inflation affects economic growth negatively.

Khan & Senhadji (2001) studied the connection between inflation and GDP growth separately for LDCs and HDCs countries. They examined the presence of “threshold or edge” effects among inflation and growth rate, they used data set containing 140 countries data. The authors found that the presence of an edge or a threshold at which inflation exerts a negative effect on growth rate. Inflation rates below this edge level have no effect on growth, while inflation rates exceeding this edge have a substantial negative effect on growth rate. The authors’ found that the edge is lower for HD countries (about 1-3%) than it is for LD countries (11-12%). the estimated relationship does not provide the detailed channel through which inflation rate affects growth rate, though, where investment and employment are controlled for, the effect is primarily through productivity. This suggests that the negative effect may be understated. The outcomes of this paper provided evidence for supporting the opinion of low inflation for sustainable growth.

Ghosh and Phillips (1998) argued that if an association occurs among inflation rate and growth rate, it is not to be a simple one. The relationship may be nonlinear; and the correlation between inflation or disinflation and growth rate may be dissimilar. Ghosh and Phillips argued also, that in a multivariate case, the association becomes more problematical. The

attachment of other factors of growth reduces the apparent effect on growth, that is, some of the other determinants may be function as inflation. The authors used data set of 145 countries data. They found that, there is a negative association between inflation and growth that is statistically significant. The authors also developed a serial decision technique in order to verify that inflation is not only a statistically significant determinant but also one of the most central elements of growth. At very low rates of inflation (3% a year or lower), inflation and growth are positively associated. Otherwise, inflation and growth are negatively associated, but the relationship is curved, so that the decline in growth accompanied with an increase from 30% to 40% inflation is much larger than that accompanied with 40% to 50% inflation. The authors found a threshold or edge at 2.5%, and above this level there is a significant negative effect.

Christoffersen and Doyle (1998) addressed some topics on panel data studies of growth process. They focused on the role of export growth and structural reforms and tried to discover the relationship between GDP and inflation as well as the impact of disinflation. According to authors, even given the external shocks, structural reform and disinflation can stimulate growth. Moreover, they found that there is no evidence that disinflation acquires significant output costs, even at moderate inflation. Losses appear only when inflation is stabilized in the presence of inflexible exchange rate. The authors recommended that, for countries currently below the estimated inflation-output threshold, no evidence is found that output will be increased by raising inflation. Thus, such countries have to aim to stay in their low rates of inflation.

Sarel (1995) examined the possibility of non-linear effects on growth rate; he found evidence of a structural break in the equation that relates growth to inflation. The study conducted to confirm the view that inflation has a

negative effect on growth. He found that there is a significant evidence of a structural break. The break is estimated to happen when the inflation rate is 8%, so this percentage represents the edge or threshold at which inflation exerts a negative effect on growth rate. The author also found that, below that rate, inflation hasn't any effect on growth or it may have a little positive effect. When the inflation rate is more than 8%, the effect of inflation on growth rates is negative, significant and very powerful. The study also confirmed that when this structural break is taken into account, the estimated effect of inflation on growth will rise three times. The outcomes suggested that the presence of a structural break recommends keeping inflation below this level.

Bruno and Easterly (1995) examined the determinants of economic growth and proposed a nonparametric description of high inflation crises as "periods when inflation rate exceeds 40 percent". The author used data series contained inflation rate of 26 countries that had inflation crises at some point in 1961- 1992 period. The authors found a negative association between inflation rate and growth. However, they found that, the effects of low to moderate inflation rates on growth are much unclear. That is, causality remained problematical; in other words, the costs of inflation only become significant at the relatively high inflation rates. However, at lower inflation rates, inflation and growth may be together troubled by various shocks of demand and supply and hence shows no constant model. They found also recoveries of growth following the reduction of high inflation rate. The authors concluded that, if the inflation crisis does not affect the long-run average rates of inflation, it will not change the long-run average rates of growth, if there was sufficient time to recover from the crisis. So, Inflation crises have a temporary effect on output but not a permanent effect on growth.

Barro (1995) attempted to find from empirical study the effects of inflation on growth. He considered the effect of inflation and of other factors such as fertility, education and other factors on growth. Once the effects of other factors are removed, then the residual growth is plotted against inflation. The author used data set that covers over 100 countries; the results show that, the effects of an increase in inflation by 10% are a reduction in real per capita growth rate by 0.2-0.3%, and a decrease in the investment to GDP ratio by 0.4-0.6%.

Fischer (1993) established a framework to recognize channels of effect of macroeconomic policy on growth. He recognized growth's responsiveness to inflation, large budget deficits and foreign exchange markets, and examined the causal association and the channels through which it functioned. He used data set of 93 countries. He found that, inflation rate is significantly associated with growth rate. The simple panel regressions confirm the relationships between inflation and growth; he found also that, inflation affects growth by falling investment, and by decreasing the rate of productivity progression. The analysis showed that, while low inflation and small deficits were not essential for high levels of growth, high inflation rates were not consistent with sustained growth rates.

According to the previous studies, there is a consensus that the maximum inflation rate for a developing country is about 8-10%

#### **2-2-6 Without seigniorage, how to deal with large public debt:**

Turkish experience could be used as a pioneer guide to deal with Egyptian large public debt, the Turkish experience in public debt reduction shows what are needed to bring levels of outsized debt to levels at that encourage economic growth. Turkey reduced public debt/GDP ratio from about 80% in 2001 to less than 40% in 2009 and 28.3% in 2017. A number of elements helped to achieve this huge reduction.

- (1) Relatively high economic growth rate.
- (2) A primary budget balances.
- (3) Exchange rate appreciation.
- (4) Improve the management of public debt.
- (5) Interest rates reduction.
- (6) The use of some of the revenues from privatization process and taxation reform to repay country's liabilities.

**First.** One of the most important elements was the stimulation of growth stimulated by economic reforms, increasing the size and type of trade with the European Union, the good use of global prosperity, and working on enhancements in the investment climate (by establishment of the Investment Advisory Council, comprising business officials, representatives of international organizations and multinational corporations, that cooperate with the government on legislation). That is, growth rate between 2002 and 2010 was about 5% to 11.1% in 2017, so, the economic performance powered by a set of appropriate economic allowed Turkey to grow out of debt. **Second.** Turkey made primary fiscal surpluses between 2002 and 2006 3% of GDP. **Third.** it allowed more independence to the Central Bank for better monetary policies, to increasing the confidence in the local currency, which lead to appreciation of local currency after 2002. Between 1999 and 2007, the real exchange rate evaluated by euro gained about 30 % (Macovei 2009). However, the Central Bank independency since 2001 succeeded in reducing inflation from about 50% in 2000 to about 8% in 2004 to 2017. As the main part of the public debt was in foreign currencies, the strengthening of local currency helped to reduce country's indebtedness. **Fourth.** the government enhanced the management of public debt by optimizing the cost of borrowing, extended maturities of debt and borrowing in local currency at fixed interest rates. **Fifth.** the appropriate monetary and exchange rate policies, the better

managing of public debt, and the longer maturity periods lead to reduce the interest rate which in return reduced the debt services. Sixth, the privatization earnings used to repay debt, the changes in taxation, restraints on public employment, and rationalization of public investment, all contributed to reduce public debt.

### 3-Simple framework:

The researcher has proposed a simple deductive mathematical framework as presented in appendix (1) by which some useful mathematical associates could be concluded.

#### Assuming that:

<i>Total public debt</i>	$TD$
<i>Domestic debt</i>	$DD$
<i>Foreign debt in foreign currency</i>	$FD_{\$}$
<i>Foreign debt in domestic currency</i>	$FD_{\text{E}}$
<i>Domestic debt growth rate</i>	$K_D$
<i>Foreign debt growth rate</i>	$K_f$
<i>Domestic inflation rate</i>	$\pi_D$
<i>Foreign inflation rate</i>	$\pi_f$
<i>GDP growth rate</i>	$g$
<i>Exchange rate</i>	$E$
<i>GDP</i>	$Y$
<i>Money supply growth rate</i>	$g_{MS}$
<i>Tax revenue</i>	$T$
<i>Government spending</i>	$G$
<i>Net government spending (without interest payment)</i>	$\bar{G}$
<i>interest payment</i>	$R$
<i>Tax rate (or government revenue as % of GDP )</i>	$\tau$
<i>Net Government spending (% of GDP)</i>	$Gr$
<i>interest payment (% of GDP)</i>	$Rr$
<i>Total debt (% of GDP)</i>	$td$
<i>Nominal interest rate</i>	$i$
<i>Real interest rate</i>	$ir$



- 1- In economy without foreign debt, the minimum inflation rate to keep public debt to GDP ratio constant could be simply concluded as following:

$$\pi_D = \frac{Gr_{t-1} + (i - g_t) \times td_{t-1} - \tau \times (g_t + 1)}{\tau + td_{t-1}} \text{-----} (1)$$

- 2- in the long run, when interest rate and inflation rate are correlated the required inflation rate (in closed economy without foreign debt) to keep public debt/GDP ratio constant is:

$$\pi_D = \frac{Gr_{t-1} + (ir - g_t)td_{t-1} - \tau \times (g_t + 1)}{\tau} \text{-----}(2)$$

- 3- However, in an open economy with foreign debt, the minimum inflation rate to keep constant or to reduce the public debt to GDP ratio, could be simply concluded as follows:

$$\frac{dd_t}{fd_t} = 1 - \frac{\pi_f}{\pi_D} + \pi_D - \pi_f \text{-----}(3)$$

- 4- the total effect of inflation rate on public debt is:

$$\Delta TD_t = -DD_t \left( \frac{\pi_D}{1 + \pi_D} \right) + FD_{\$t} \times E_t \times (\pi_D - \pi_f) \text{-----}(4)$$

- 5- The maximum level of inflation that could be used to reduce public debt/GDP ratio is that rate at which:

$$\Delta TD_t = -DD_t \left( \frac{\pi_D}{1 + \pi_D} \right) + FD_{\$t} \times E_t \times (\pi_D - \pi_f) = 0 \text{-----}(5)$$

- 6- The change in public debt structure could be calculated as:

$$\frac{DD_n}{FD_{\$n}} = \frac{(1 + K_D)^n \times DD_0}{(1 + K_f)^n \times FD_{\$0} \times E_0 \times (1 + \pi_D - \pi_f)^n} \text{-----}(6)$$

- 7- Accordingly, the exchange rate that will equalize domestic public debt with the foreign one could be calculated as:

$$E_0 = \frac{(1 + K_D)^n \times DD_0}{(1 + K_f)^n \times FD_{\$0} \times (1 + \pi_D - \pi_f)^n} \text{-----}(7)$$

#### **4-Conclusions:**

- 1) There are three main variables that control the indebtedness ratios, GDP growth rate, inflation rate and public debt growth rate, so, government can raise inflation as a policy to erode the large public indebtedness ratio, however, it seems that there is a consensus that the maximum harmless inflation rate for a developing country is about 8-10% as noted in most of related studies.
- 2) In recent years Egyptian government has increased the money supply to historical levels to finance budget deficit, so, inflation has increased to a high level, which helped to wear down the real value of public debt and reduce the debt/GDP ratio.
- 3) By studying the Egyptian economy data published in the World Bank database, the Egyptian Ministry of Finance and the Central Bank of Egypt (data in appendix 2), the following data can be obtained:
  - Net government spending (% of GDP) = 24.9% in 2017.
  - Nominal interest rate = 17%.
  - Real interest rate = 3.7% (as an average for the period 1978-2016).
  - The target growth rate is 5%.
  - Foreign inflation rate is 2% (as an average for USA inflation rate in the period 2007-2017 as the Egyptian pound is associated with US dollar).So, by using the previous mathematical framework, the following results could be simply obtained:
  - a) Other things being equal, to keep the current rates of both government spending to GDP and public debt to GDP, an inflation rate of 12.28% and of 7.35% per annum should be attained in the short run (no Fisher effect) and long run (full Fisher effect) respectively.

- b) To reduce public debt to GDP ratio, an inflation rate of more than 12.28% and of 7.35% per annum should be attained in the short run and long run respectively.
- c) The maximum cumulative level to use inflation policy to erode the real value of public debt is about 125.6%, the level at which the ratio of external public debt is equal to the ratio of domestic public debt, so that in the long run (in which purchasing power parity takes place; assuming that the foreign inflation rate is about 2%) any decrease in real value of domestic public debt will be equivalent to the increase in external debt.
- 4) The effectiveness of inflation policy in reducing public debt ratio depends on the following factors:
  - a) How long the debt maturity is, that is, the longer the debt maturity the more effectiveness the inflation policy is.
  - b) The extent of foreign acquisition of public debt instrument, if foreign creditors hold a weighty share of the domestic public debt, then they will share the burden of inflation with domestic creditors.
  - c) The percentage of external debt to total public debt, which is negatively associated to the effectiveness of inflation policy.
  - d) The ability of exchange rate to withstand the depreciation caused by inflation.
  - e) The ability of growth rate to resist the negative effects of inflation.

**Policy recommendations:**

It's useful for policymakers to know about the mechanism by which inflation could be used as a tool to erode a part of large public debt.

- 1) Using hyperinflation is not recommended, but (if necessary) government could use moderate inflation rate carefully to erode some of large public debt, a level of inflation at which economic growth is not affected harmfully.
- 2) A result to take from the simulation of the simple model is that other things being equal; eroding public debt through inflation could be done by using a moderate inflation rate of more than 12.28% & 7.35% in the short run and long run respectively could reduce the debt/GDP ratio.
- 3) However moderate inflation may help reduce today's debt burden, it is a much less powerful tool for handling long-term debt burden.
- 4) The greater share of the local public debt is held by foreign creditors and the longer the maturity of the debt, the greater the effect of inflation as a tool to erode large public debt
- 5) At the same time, the cost of inflation should be taken into account, because Inflation could generate a high level of uncertainty, which affect negatively most economic variables and reducing the attractiveness of using inflation to erode the debt.

**Appendix (1)**

1- In economy without foreign debt, the minimum inflation rate to keep public debt to GDP ratio constant could be simply concluded as following:

$$\Delta TD_t + \Delta T_t = G_{t-1} - T_{t-1}$$

To keep public debt to GDP ratio constant

$$\Delta TD_t = (\pi_D + g_t)TD_{t-1}$$

So,

$$(\pi_D + g_t)TD_{t-1} + \tau \times \Delta Y_t = \bar{G}_{t-1} + R_{t-1} - \tau \times Y_{t-1}$$

$$(\pi_D + g_t) \frac{TD_{t-1}}{Y_{t-1}} + \tau \times \frac{\Delta Y_t}{Y_{t-1}} = \frac{\bar{G}_{t-1}}{Y_{t-1}} + \frac{R_{t-1}}{Y_{t-1}} - \tau$$

$$(\pi_D + g_t)td_{t-1} + \tau \times (\pi_D + g_t + 1) = Gr_{t-1} + Rr_{t-1}$$

$$(\pi_D + g_t)td_{t-1} + \tau \times (\pi_D + g_t + 1) = Gr_{t-1} + i \times td_{t-1}$$

$$\pi_D td_{t-1} + \tau \times (\pi_D + g_t + 1) = Gr_{t-1} + i \times td_{t-1} - g_t td_{t-1}$$

$$\pi_D td_{t-1} + \tau \times (\pi_D) = Gr_{t-1} + i \times td_{t-1} - g_t td_{t-1} - \tau \times (g_t + 1)$$

So, in the short term where interest rate is not linked to inflation rate (no Fisher effect), the required inflation rate (in closed economy without foreign debt) to keep public debt/GDP ratio constant is:

$$\pi_D = \frac{Gr_{t-1} + (i - g_t) \times td_{t-1} - \tau \times (g_t + 1)}{\tau + td_{t-1}} \text{----- (1)}$$

However, in the long run, when interest rate and inflation rate are correlated (full Fisher effect)

$$(\pi_D + g_t)td_{t-1} + \tau \times (\pi_D + g_t + 1) = Gr_{t-1} + (ir + \pi_D) \times td_{t-1}$$

$$\begin{aligned} (\pi_D)td_{t-1} + \tau \times (\pi_D + g_t + 1) - \pi_D \times td_{t-1} \\ = Gr_{t-1} + (ir - g_t) \times td_{t-1} \end{aligned}$$

$$\pi_D(\tau) = Gr_{t-1} + (ir - g_t)td_{t-1} - \tau \times (g_t + 1)$$

So, the required inflation rate (in closed economy without foreign debt) to keep public debt/GDP ratio constant is:

$$\pi_D = \frac{Gr_{t-1} + (ir - g_t)td_{t-1} - \tau \times (g_t + 1)}{\tau} \text{-----(2)}$$

2- However, in an open economy with foreign debt, the minimum inflation rate to keep constant or to reduce the public debt to GDP ratio, could be simply concluded as follows:

$$TD_t = DD_t + FD_{\text{£}t}$$

$$DD_n = (1 + K_D)^n \times DD_0$$

$$Y_n = (1 + \pi_D + g)^n \times Y_0$$

$$\frac{DD_n}{Y_n} = \frac{(1 + K_D)^n}{(1 + \pi_D + g)^n} \times \frac{DD_0}{Y_0}$$

$$FD_{\text{£}t} = FD_{\text{\$}t} \times E_t$$

$$E_n = (1 + \pi_D - \pi_f)^n \times E_0$$

$$FD_{\text{\$}n} = (1 + K_f)^n \times FD_{\text{\$}0}$$

$$\frac{FD_{\text{£}n}}{Y_n} = \frac{(1 + K_f)^n}{(1 + \pi_D + g)^n} \times \frac{FD_{\text{\$}0}}{Y_0} \times E_0 \times (1 + \pi_D - \pi_f)^n$$

Assuming that,

$$g_{MS} = \pi_D + g_t$$

$$\frac{FD_{\text{£}n}}{Y_n} = \frac{(1 + K_f)^n \times (1 + \pi_D - \pi_f)^n}{(1 + g_{MS})^n} \times \frac{FD_{\text{\$}0} \times E_0}{Y_0}$$

So for external debt to keep the ratio  $\frac{FD_{\text{£}n}}{Y_n}$  constant

$$g_{MS} \geq \pi_D - \pi_f + K_f + \pi K_f$$

If we ignore  $\pi K_f$

$$\pi_D + g_t \geq -\pi_f + K_f$$

$$\text{So } g_t \geq K_f - \pi_f$$

Similarly, for the domestic debt to keep the ratio  $\frac{DD_n}{Y_n}$  constant

$$g_t \geq K_D - \pi_D$$

So, the maximum level of inflation that could be used to reduce public debt/GDP ratio is that rate at which

$$\Delta DD_t = \Delta FD_{\epsilon t}$$

$$DD_t \left(1 - \frac{1}{1 + \pi_D}\right) = FD_{\epsilon t} \times \Delta E_t \%$$

$$DD_t \left(1 - \frac{1}{1 + \pi_D}\right) = FD_{\epsilon t} \times (\pi_D - \pi_f)$$

$$DD_t \left(\frac{\pi_D}{1 + \pi_D}\right) = FD_{\epsilon t} \times (\pi_D - \pi_f)$$

$$\frac{DD_t}{Y_t} \left(\frac{\pi_D}{1 + \pi_D}\right) = \frac{FD_{\epsilon t}}{Y_t} \times (\pi_D - \pi_f)$$

$$dd_t \left(\frac{\pi_D}{1 + \pi_D}\right) = fd_t \times (\pi_D - \pi_f)$$

$$\frac{dd_t}{fd_t} = (\pi_D - \pi_f) \times \left(\frac{1 + \pi_D}{\pi_D}\right)$$

$$\frac{dd_t}{fd_t} = \left(\frac{\pi_D^2 - \pi_D \pi_f}{\pi_D}\right) \times \left(\frac{1 + \pi_D}{\pi_D}\right)$$

$$\frac{dd_t}{fd_t} = \left(\frac{\pi_D^2 - \pi_D \pi_f + \pi_D^3 - \pi_D^2 \pi_f}{\pi_D^2}\right)$$

So

$$\frac{dd_t}{fd_t} = 1 - \frac{\pi_f}{\pi_D} + \pi_D - \pi_f \text{ -----(3)}$$

3- the total effect of inflation rate on public debt is:

$$\Delta TD_t = -\Delta DD_t + \Delta FD_{\epsilon t}$$

$$\Delta TD_t = -DD_t \left(\frac{\pi_D}{1 + \pi_D}\right) + FD_{\epsilon t} \times (\pi_D - \pi_f)$$

$$\Delta TD_t = -DD_t \left( \frac{\pi_D}{1+\pi_D} \right) + FD_{\$t} \times E_t \times (\pi_D - \pi_f) \text{ -----(4)}$$

The maximum level of inflation that could be used to reduce public debt/GDP ratio is that rate at which:

$$\Delta TD_t = -DD_t \left( \frac{\pi_D}{1+\pi_D} \right) + FD_{\$t} \times E_t \times (\pi_D - \pi_f) = 0 \text{ -----(5)}$$

4- The change in public debt structure could be calculated as:

$$\frac{DD_n}{FD_{\$n}} = \frac{(1+K_D)^n \times DD_0}{(1+K_f)^n \times FD_{\$0} \times E_0 \times (1+\pi_D - \pi_f)^n} \text{ -----(6)}$$

5- Accordingly, the exchange rate that will equalize domestic public debt with the foreign one could be calculated as:

$$1 = \frac{(1+K_D)^n \times DD_0}{(1+K_f)^n \times FD_{\$0} \times E_0 \times (1+\pi_D - \pi_f)^n}$$

$$(1 + K_D)^n \times DD_0 = (1 + K_f)^n \times FD_{\$0} \times E_0 \times (1 + \pi_D - \pi_f)^n$$

$$E_0 = \frac{(1+K_D)^n \times DD_0}{(1+K_f)^n \times FD_{\$0} \times (1+\pi_D - \pi_f)^n} \text{ -----(7)}$$



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