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Fiscal fatigue, public debt limits and fiscal space in some MENA countries

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Abstract

In the light of the evolution of public debt in some emerging countries during recent years, we have tried to assess debt limits, i.e the threshold from which debt starts to follow an explosive path, according to Ganiko, Melgarejo & Montoro (2016) model. This model was largely inspired from Gosh, Kim Mendoza, Ostry et Qureshi (2013). We have assessed the determinants of the public debt dynamics, the government primary balance as well as the effective cost of debt for 27 emerging countries during the 2000- 2017 period. Results show the existence of a fiscal fatigue, namely the loss of control of the debt accumulation using fiscal adjustments when debt increases. The debt ratio is an important determinant of the effective cost of public debt, since the level of debt increases EMBI Global spreads. Finally, debt limits range between 160 and 220% of GDP for our sample giving evidence of positive fiscal spaces for the four MENA countries used in this paper.

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1- Introduction

The Sovereign Debt crisis that recently hit European countries has led to a great resurgence of interest in debt sustainability issues, either external or public. The highly rapid accumulation of public debt, especially in the context of financial instability and low growth has increased the need for a deeper assessment of government debt viability. This crisis has also high lightened the importance of market reactions when assessing debt sustainability. In addition, one has to notice that debt issues are even more complex and uncertain for emerging countries.

Paret (2016) has indeed high lightened three main features one should take into account: (i) First, the exchange risk (« Original Sin »), highly determined by the fraction of public debt denominated in foreign currencies. This risk increases with inflows sudden stops and mimicry; (ii) Second, the low level of credibility of economic policies because of the lack of commitment from government's and monetary authorities; (iii) finally, these economies are extremely volatile, regarding growth, interest and inflation rates for instance. The last feature turns to be exaggerated by the first two points, since local depreciations can lead to larger crises and poor economic policies.

In this paper, I have tried to assess debt limits for some MENA countries, i.e the thresholds from which debt starts to follow an explosive path. Our methodology is based on Ganiko, Melgarejo & Montoro (2016) who applied Gosh, Kim Mendoza, Ostry & Qureshi (2013) Model on emerging countries.

Our main goal is to assess public debt limits endogenously, considering the role of the debt level in the financing costs of a government. When debt reaches very high levels, the fiscal reaction function shows "fiscal fatigue" property, according to which the decrease of fiscal efforts makes primary balance unable to manage the growing debt.

Fiscal fatigue, combined with the reaction of interest rates to the growing debt, allows determining the public debt limit above which debt could not be rolled over.

The framework used in this paper manages to show the conditional nature of debt limits and hence, the government's vulnerability towards changing macroeconomic conditions and market reactions, unlike the deterministic debt sustainability assessment frameworks (used by the IMF for instance).

Gosh (2013) takes into account the reaction of the governments and the markets to debt increases in debt dynamics analysis. It shows also how fiscal space (the difference between the debt limit and the current debt) can quickly decrease when macroeconomic environment changes. In addition, even if debt is far under its limit, governments should be careful because when market confidence is lost, interest rates increase drastically in a self- fulfilling crisis.

The Bank of International Settlements (BIS, 2016) focused on the importance of fiscal space estimation according to Gosh methodology, as well as on its limits: the estimation of debt limits are subject to a very high degree of uncertainty; and these limits are very sensitive to the economic and financial conditions of the countries. Consequently, the BIS strongly recommends that "*the debt limits should not be interpreted as boundaries that can be safely tested"* (BIS Annual Report, 2016). Hence, a prudent fiscal policy should establish mechanisms in order to maintain the debt level at this limit.

One should notice that the debt limit, as defined by Gosh, takes into account an extreme event, i.e the threshold from which debt follows an explosive path. National political authorities should take into account other factors in order to determine their own limits, like the effect of debt accumulation on financing costs or on sovereign rating.

This analytical framework will be presented in the second section. In section 3, I will estimate financing costs and the fiscal reaction functions. In section 4, I will present the estimates of debt limits for some MENA countries, as well as the corresponding fiscal spaces. In the last section, I will conclude.

2- The analytical framework of debt limit (Ganiko, Melgarejo & Montoro Model, 2016)

Since markets are worried about some countries capacity to serve their debt (Greece, Ireland, Portugal, Spain), some authors have focused on the ability of these countries to adjust their fiscal balance to face growing public debt.

Gosh & al. (2013) have developed an original framework in order to assess debt sustainability of advanced countries. The goal is to determine a limit to debt beyond which fiscal adjustment becomes impossible. Then, authors have determined "fiscal space", i.e the difference between debt limit and current debt. The model includes a sovereign borrower with a fiscal reaction function (FRF) to debt changes; as well as lenders arbitrating between expected return from government debt and risk free interest rate, taking into account the case that the government can default because of his inability to pay. The growing default risk increases the risk premium, leading to an increase of the service debt and a higher default probability.

Gosh analysis starts from the fact that governments increase their primary surpluses in reaction to an increasing debt service, in order to stabilize the debt ratio at a reasonable level (Bohn, 2008 ; Mendoza & Ostry, 2008…). Some shocks, like financial crises or wars, can lead to temporary deviations from this implicit or explicit primary balance rule. As long as the increase of the primary balance is sufficient to neutralize the debt increase, debt ratio will converge to its long term value.

Nevertheless, the primary balance cannot always increase in order to face increasing debt, since at some extremely high levels, the primary balance should exceed the GDP. The government is unable to indefinitely decrease public spending and increase taxes. If the primary balance is unable to follow service debt variations when debt increases, debt will reach a threshold beyond which debt dynamics become explosive and the government will certainly default.

Effectively, default will take place before this threshold, since risk premium will exacerbates debt dynamics due to imminent default. In particular, as far as default probability is increasing, risk premium will also increase, decreasing the probability that primary balance will be enough sufficient to face interests, increasing hence default probability. At this point (the debt limit), the government will lose market access, will be unable to rollover its debt and is forced to be in default.

The analytical framework of Gosh & al. (2013) is based on Bohn (1998, 2008). While Bohn shows that a sufficient condition for a government to satisfy its intertemporal budget constraint would be a positive reaction of the primary balance to lagged debt, Gosh argues that this sustainability criterion is weak, since it can lead to a primary surplus exceeding the GDP when debt increases. Hence, Gosh adopts a strict sustainability criterion according to which public debt should converge towards a *certain finite proportion of GDP*. If primary balance always represents a constant proportion of lagged debt, a sufficient condition for this strict definition would be that the reaction of primary balance would be higher than the interest- growth differential (IRGD). However, once the case of fiscal fatigue is adopted, in which the primary balance reaction to the debt increase becomes lower than IRGD, the debt limit becomes finite.

Our analytical framework is based on Ganiko & al. (2016). The authors adopted Gosh methodology for emerging countries.

The public debt accumulation is given by the following government intertemporal budget constraint :

$$\Delta d_t = \Phi_t \, d_{t-1} - pb_t \qquad (1)$$

Where d_t is the public debt ratio to GDP ; $\Phi_t = \frac{r-g}{1+g}$ is the interest- growth differential (IRGD), r_t is the effective nominal interest rate; g_t the nominal GDP growth rate and pb_t is the primary balance (in % of GDP).

This equation is an accounting identity showing that the debt ratio accumulation is given by the difference between financing costs ($\Phi_t\ d_{t-1}$) and the primary balance ratio to GDP.

I assume that nominal effective interest rate depends on the lagged debt and other control variables, showing the positive relation between financing costs and observed debt ratio in emerging countries, due to an increase in the risk perception.

$$r_t = r\ (d_{t-1}\ ,\ \text{control variables}) \qquad (2)$$

The nominal effective interest rate can be affected by the international risk free rate, international financial volatility and exchange rates. The latter represents a very important factor in our analysis since emerging countries cannot borrow abroad in their local currency (original sin).

Furthermore, Ganiko & al. (2016) assume that the primary balance depends on the lagged debt ratio among others:

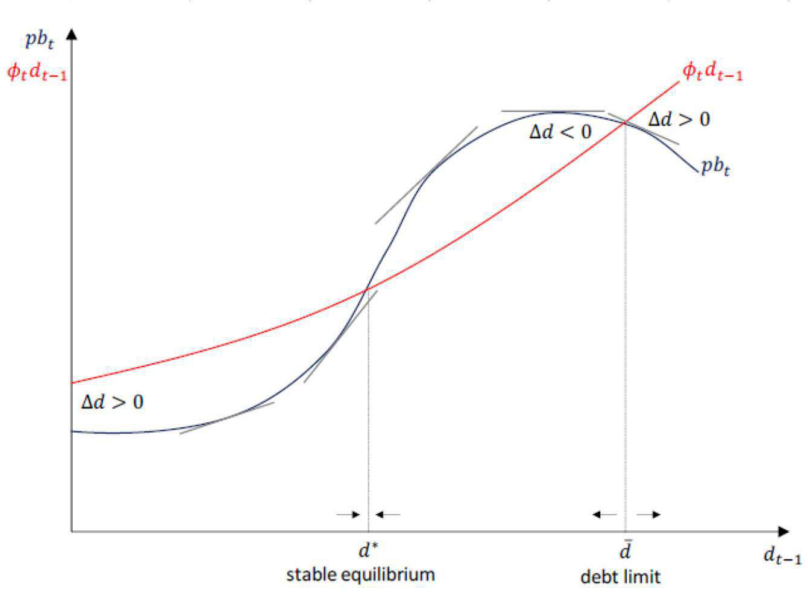
$$pb_t = pb\ (d_{t-1}\ ,\ \text{control variables}) \qquad (3)$$

Potential control variables for the FRF are : output gap, energy index, inflation rate (see Appendix 2).

Figure 1 shows the financing costs dynamics, defined as $\Phi_t\ d_{t-1}$, as well as the primary balance dynamics as a function of the lagged debt ratio. One can clearly see that the interest rate is a positive and convex function of the debt ratio ($r'(d_{t-1}) > 0$ and $r''(d_{t-1}) > 0$).

Furthermore, the shape of the FRF captures « fiscal fatigue », a feature highlighted by Gosh & al. (2013) for advanced countries: the reaction of the primary balance to debt ratio variations, measured through the slope of the PB curve, is increasing for low debt levels. As debt increases, this reaction weakens and becomes even negative from a certain threshold, when the government loses its ability to control the debt accumulation through the consolidation of its primary balance.

Figure 1 Determination of the Debt Limit



Source : Ganiko et al. (2016)

The difference between the two curves on the figure 1 represents the debt ratio variation (Δd_t). When $\Phi\ d_t$ is above (under) pb_t, the debt ratio variation is positive (negative). The intersection of the curves determines two possible equilibria according to which debt ratio is constant ($\Delta d_t = 0$).

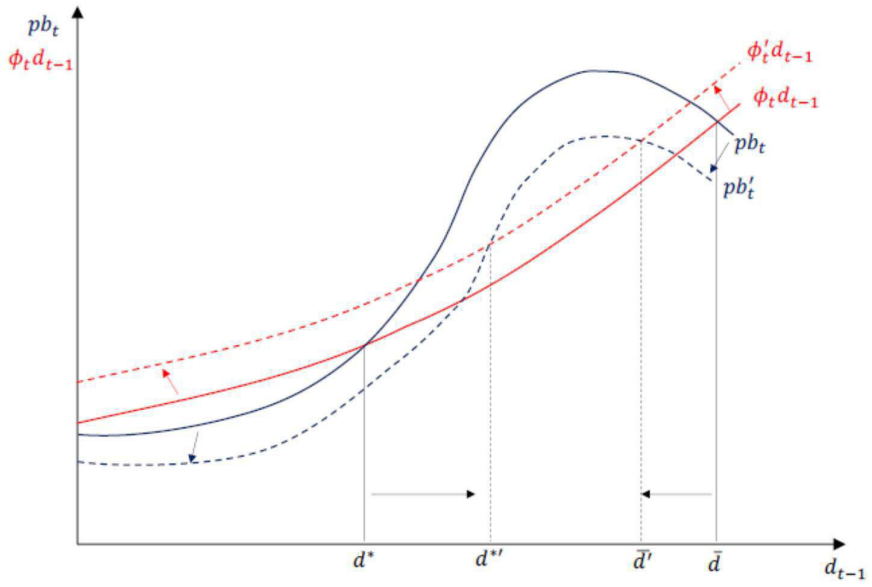
The first equilibrium at the left (d*) is a stable equilibrium: when one depart towards the left (right) from d*, d_t increases (decreases) to the equilibrium level d*. Likewise, one can show that the second equilibrium $\overline{d}$ is unstable: if one departs to the left (right) from $\overline{d}$, d_t will increase (decrease) moving away from $\overline{d}$. Hence, d* represents "the debt stable equilibrium" and $\overline{d}$ "the debt limit".

The former represents the level towards which debt converges when it varies, while the latter is the level from which debt becomes to increase without limits.

Fiscal space is defined as the distance between debt limit and the observed (or projected) level of public debt.

Figure 2 shows a comparative static analysis of public debt equilibria. First, an increase of the international financial volatility, of international interest rates or of the country risk premium, leads to an upward shift of the financing costs curve (financing costs will be higher for each debt level). Likewise, shocks reducing persistently the primary balance, like a decrease in output gap or in energy prices (for energy importers), will shift the primary balance curve downward (a lower primary balance for each debt level). These changes in economic and financial conditions lead to an increase of the stable equilibrium from d* to d*'; as well as a reduction of the debt limit from $\overline{d}$ to $\overline{d}'$. Hence, a worsening of fiscal conditions increases the public debt equilibrium. The opposite effect will be noticed for the debt limit: negative economic and financial conditions decrease this level.

Figure 2 Comparative Static analysis of public debt dynamics



Source : Ganiko et al. (2016)

This analysis shows also that the debt limit is not fixed, but depends not only on macroeconomic conditions and the model parameters, but also on the reaction of international investors,

specially when volatility is high and/or public debt is increasing. As a consequence, even if debt levels are under the limit, changes in economic and financial conditions can reduce the debt limit below the initial debt ratio; debt ratio will start to follow an unstable increase, even in the absence of fiscal policy changes.

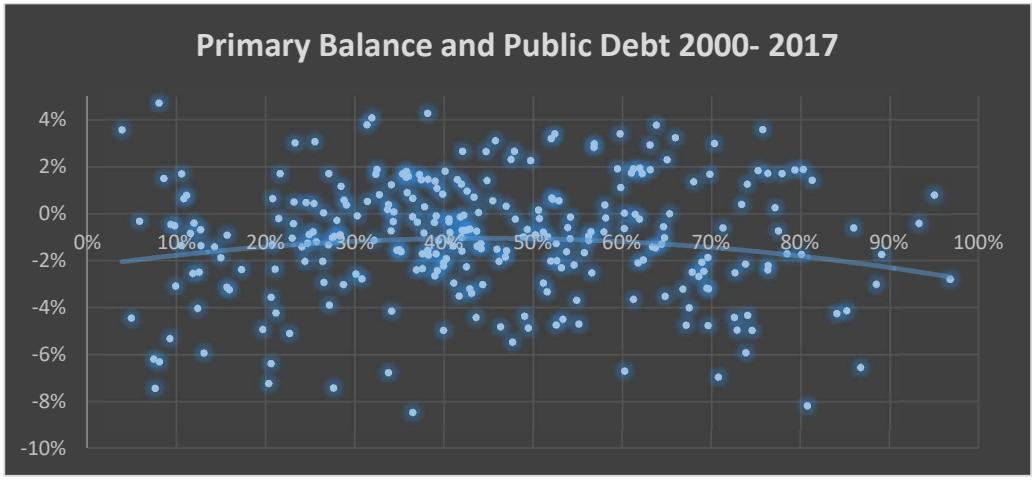
3- Empirical Application:

The determination of the debt limit requires the estimation of the financing costs equation as well as the fiscal reaction function estimation.
Each equation is estimated using a panel data model with fixed effects and annual data of 27 countries over 2000- 2017 period. The countries of the sample are: Algeria, Argentina, Brazil, Chile, China, Colombia, Ecuador, Egypt, Hungary, India, Indonesia, Jordan, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Tunisia, Turkey, Ukraine, Uruguay, Venezuela.

3-1 *A non linear Fiscal Reaction Function :*

The Fiscal Reaction Function (FRF) makes the fiscal policy endogenous; so that political authorities react to the lagged stock of debt, economic cycle, as well as other control variables. Furthermore, fiscal policy persistence is taken into account using autoregressive term error.
Many studies have recently assessed fiscal reaction functions (Mélitz, 1997; Galí and Perotti, 2003; IMF, 2003, 2004; Wyplosz, 2005; Celasun, Debrun and Ostry, 2006). The main goal of the FRF estimation is to get a prediction of the primary balance to GDP. However, one should notice that most of these authors use a linear FRF, i.e they assume that the government reaction is the same for any debt level. Gosh & al (2013), Fournier & Fall (2015) as well as Ganiko & al. (2016) have shown the presence of fiscal fatigue using a non linear FRF. Figure 3 suggests a non linear relation between the primary balance and the lagged debt for emerging countries over the 2000- 2017 period: for very low levels of debt ratios, there is a positive relation between the lagged debt and the primary balance. As debt increases, the primary balance starts to deteriorate.

Figure 3 Primary balance and Public debt



Source : World Economic Outlook (IMF)

I have estimated a non linear FRF for 27 emerging countries for 2000- 2017 period (Staehr, 2008 ; Abaid et Ostry, 2005 ; Celasun, Debrun et Ostry, 2006 ; Ostry et al., 2010)
Empirical specification of the FRF :

$$p_{i,t} = \alpha + \beta_1 d_{i,t-1} + \beta_2 d_{i,t-1}^{\ 2} + X_{i,t}\beta + \eta_i + \varepsilon_{i,t} \qquad (4)$$
$$t = 1,\ldots,T \qquad i = 1,\ldots\ldots, N$$
$$\varepsilon_{i,t} = \rho\varepsilon_{i,t-1} + v_{i,t}$$

Where α is the fixed effect specific for each country, $p_{i,t}$ represents the primary balance-to-GDP ratio of the country i for the period t, $d_{i,t-1}$ the public debt-to-GDP ratio at the end of the previous period, $X_{i,t}$ a vector of control variables, and $\varepsilon_{i,t}$ is an error term. As Ganiko & al. (2016), our baseline model has a quadratic relationship between the primary balance and the lagged debt, the figure 3 shows only one turning point (different from Gosh & al. who use a cubic polynomial on the lagged debt ratio). The autoregressive process for εi,t captures the persistence of the primary balance data. The inclusion of fixed effects, which generate individual intercepts for each country, captures the observed heterogeneity observed in the primary balance.

The FRF shows above all the reaction of the primary balance ratio to public debt variation: a positive reaction to the lagged debt and a negative one to the squared lagged debt is expected in case of fiscal fatigue.

The choice of the control variables used for the FRF estimation is based on the literature (Gosh & al., 2013; Pommier 2015; Fournier & Fall 2015, Ganiko & al. 2016) such as output gap, which captures the cyclical dependence of the primary balance, and expenditure gap as a measure of temporary governments spending.

Moreover, I have also include different independent variables having an impact on the primary balance (Appendix 1). The dependence of emerging economies fiscal accounts on commodity prices (energy and minerals) is captured using the energy and minerals index gaps (the gap from their long-run value).

The results of our estimation of the FRF are presented in table 1. Coefficients associated with the non linear relationship between lagged debt and primary balance are statistically significant. The signs of the coefficients clearly show fiscal fatigue: the primary balance reacts positively to debt increases for low levels of debt and negatively for debt levels higher than 50- 60%.

Table 1 Estimation of the fiscal reaction function with fixed effects

Dependent variable	Primary Balance
Lagged debt	0.117***
	(0.003)
Lagged debt (squarred)	-0.00044***
	(0.058)
Output Gap	0.129***
	(0.01)
Energy Index Gap	0 .179***
	(0.000)
Constant	-5.652***
	(0.000)

Standard Errors into parentheses, significance levels ***1%

Gosh & al have shown that the reaction of primary balance starts to decline from a debt level of 150% of GDP for advanced countries. Similarly to Ganiko & al. (2016), the cyclical component of fiscal policy represented by the estimated coefficient of output gap is positive, that means that emerging countries adopted counter-cyclical fiscal policy during 2000- 2017. Finally, the coefficient associated to energy index gap is positive, showing the dependence of fiscal balances of emerging countries to commodity prices.

3-2 The Financing costs :

According to the literature, the construction of the interest rate-growth differential uses the historical effective interest rate or the 10 year Treasury bonds yields (Ghosh et al, 2013; Zandi et al, 2011; Fournier and Fall, 2015; Pommier, 2015). However, Ganiko & al. pointed many shortcomings to this procedure. First, the effective interest rate as the historical rates average does not completely include the reaction of the financial market to higher debt levels. Second, the 10 Year Treasury bond yield is not the best reference for the financing costs of emerging countries since debt is generally issued for less than 10 years in average.

I follow the methodology of Ganiko & al. who have decomposed the nominal effective interest rate "r" into two elements. The first component is defined as the implicit historical interest rate $r^{H}{}_{t}$, corresponding to interest payments divided by the lagged debt stock. The second component represents the nominal market interest rate $r^{M}{}_{t}$, determined on the financial market when new debt is issued. The nominal effective interest rate is given by the following equation:

$$r_t = \lambda_t \, r^{H}{}_{t} + (1- \lambda_t) \, r^{M}{}_{t} \qquad (5)$$

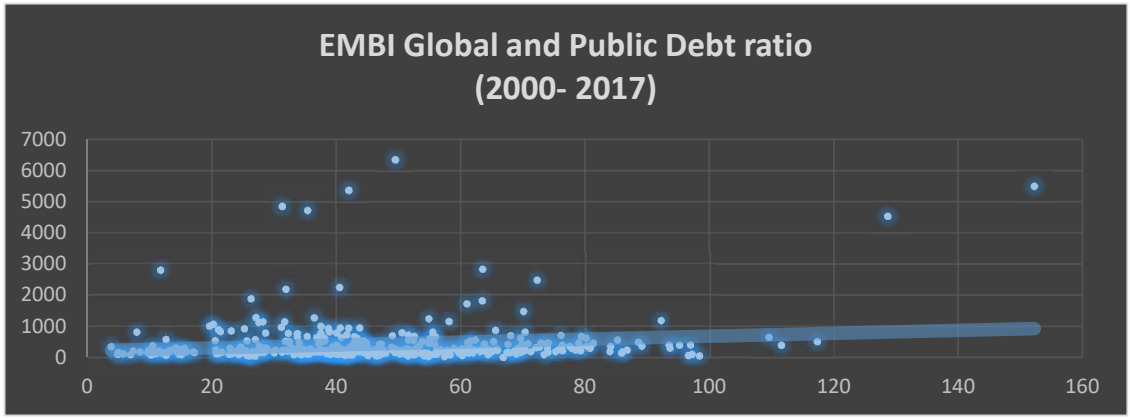
where $\lambda_t = 1$ si $D_t < D_0$ and $\lambda_t = D_0 / D_t$ if $D_t > D_0$, being D_0 the nominal value of the debt stock at the beginning of the analysis. Consequently, the effective nominal interest rate corresponds to the implicit historical one for debt levels lower or equal to the initial level, and the weight of this interest rate decreases as new debt is issued and the debt level increases.

Moreover, the nominal market interest rate includes three components: the free risk interest rate, represented by the 10-year Treasury Bond Yields, r^{f} ; the national currency depreciation (Δs_t) and the risk premium measured by the EMBI Global index:

$$r^{M} = r^{f} + EMBIG_t + \Delta s_t \qquad (6)$$

The EMBI Index depends on the lagged ratio as well as a set of control variables having an impact on the sovereign risk perception.

Figure 4 EMBI Global and public debt ratio



Source: WEO

The figure 4 shows a positive correlation between EMBI Index and the lagged debt for our sample of emerging countries over the 2000- 2017 period, and this relations strengthens as the debt increases. Even if the default probability is not modeled (as Gosh & al. 2013), the positive relation between the EMBI Index and the debt ratio captures the impact of the latter on default risk, and on financing costs.

$$EMBIG_t = f(d_{t-1}, \text{control variables}) \qquad (7)$$

As the FRF estimation, I have estimated EMBIG with panel data for a sample of 25 emerging countries[1] for the 2000- 2017 period, using a panel data model with fixed effects. The EMBI estimation results are presented in the table 2.

Table 2 Estimated results of the Financing costs function

Dependent variable	EMBI Global (Basic points)
Lagged debt	16.27***
	(0.000)
Output Gap	-37.34***
	(0.002)
VIX Index	18.84***
	(0.000)
REER (lagged)	19.06***
	(0.000)
Constant	-2738.73***
	(0.000)

Standard Errors into parentheses, significance levels ***1%

The positive relation between the lagged debt ratio and the EMBI Global shows that the effect of the debt level on the sovereign risk perception is positive. The negative coefficient of output gap proves that an expansionary episode reduces the sovereign risk perception, and vice- versa. As expected, the risk perception increases during high financial volatility periods (high VIX index). Finally, an over-appreciated domestic currency increases sovereign risk.

3-3 Debt limit and fiscal space for some MENA countries :

According to Gosh model, the government reaches its debt limit when debt level stabilizes ($\Delta d=0$). Graphically, it is represented by the intersection of the primary balance curve and the financing costs one (figure 1), as estimated for Tunisia, Morocco, Egypt and Jordan. To do so, I use equations (4), (5), (6) and (7) for different levels of debt (from 0 to 300 percent of GDP), using data described in Appendix 1 and 2. According to figure 1, there are two intersections between both curves, corresponding respectively to the stable equilibrium debt and the debt limit. Finally, fiscal space is defined as the difference between the debt limit and the current or projected debt ratio.

The results are summarized in the table 3 below:

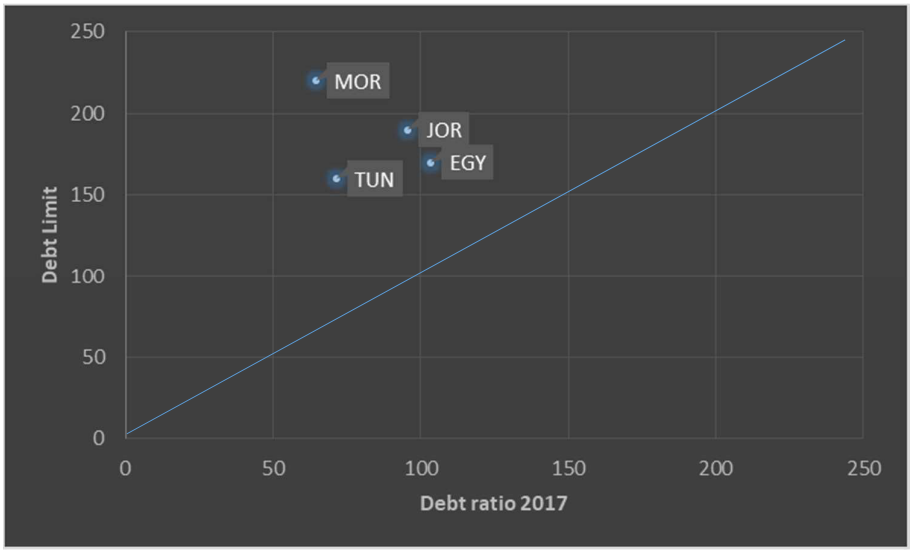
	Stable equilibrium debt d* (2017)	Debt limit $\overline{d}$ (2017)	Current Debt (2017)	**Fiscal Space (2017)**
Tunisia	60	160	71.3	**88.7**
Morocco	60	220	64.4	**155.6**
Egypt	40	170	103.3	**66.7**
Jordan	60	190	95.6	**94.4**

[1] Data on EMBI Global are missing for Algeria and Thailand

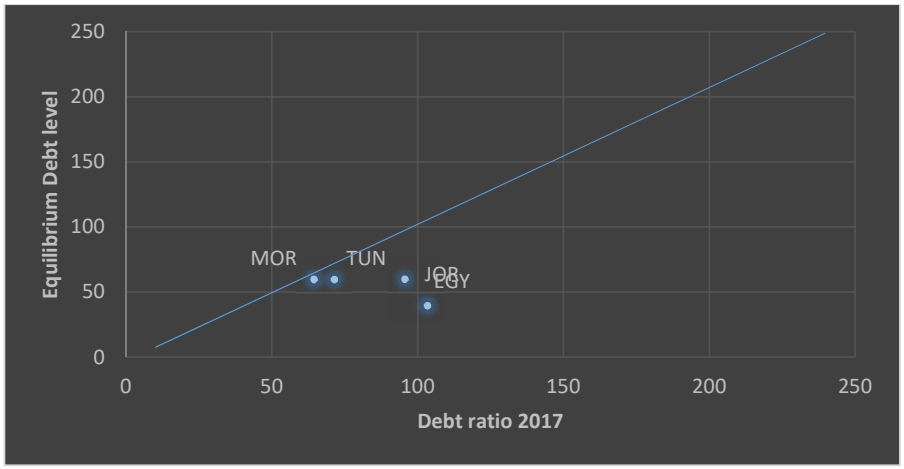
The equilibrium debt levels obtained for our sample are consistent with those found by Ganiko & al. for emerging countries and Gosh & al. for advanced economies. Debt limits are lower for Tunisia, Morocco, Egypt and Jordan than advanced countries like the USA (183% of GDP) or Ireland (245%).

Figure 5 Stable equilibrium debt and debt limit for Tunisia, Morocco, Egypt and Jordan

5-A

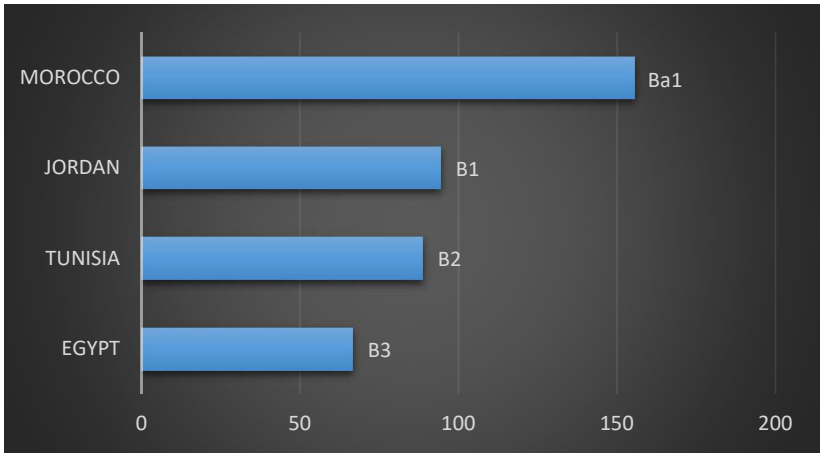


5-B



As shown in the figure 5-A, the four coutries reached in 2017 a debt ratio higher that the equilibrium debt level. This result can be explained by an increase of the fiscal deficit (Tunisia) or high interest rates (Egypt). Similarly, as shown in graph 5-B, the 2017 debt ratio is below the estimated debt limit for the four countries. The difference between the estimated debt limit and the 2017 debt ratio represents the fiscal space, reported in the table above and the figure 6 below.

Figure 6 Fiscal space for Tunisia- Morocco- Egypt- Jordan



Source: Moody's

The estimated fiscal spaces for the whole sample are positively correlated with sovereign debt ratings issued by Moody's[2]. Hence, Morocco which has the highest fiscal space has the best credit rating.

Finally, as mentioned by Ganiko & al. (2016), one has to be "very careful in interpreting these measures as a space that can be consumed completely, as the uncertainty about the model parameters, the historical volatility of the control variables and the behavior of financial agents, can drastically reduce unexpectedly this measure of fiscal space".

4- *Conclusions*

In this paper, I have tried to estimate debt limit for some MENA countries. Here debt limit is defined as the level from which public debt starts to follow an explosive path. To do so, I have adopted Ganiko & al. (2016) methodology, based on Gosh Model (2013). This methodology takes into account some particular factors of public debt dynamics in emerging countries and their effect on public balances, like energy prices, the sensitivity of financing costs to debt levels; as well as some external factors like international financial volatility, international interest rates and exchange rates.

As Gosh and Ganiko & al., my estimation of the fiscal reaction function shows a fiscal fatigue, defined as the capacity loss of the government to control debt accumulation using its primary balance consolidation as the debt increases. I also found that the lagged public debt is an important factor of the cost of financing.

The fiscal reaction function estimation combined with the cost financing one allowed me to determine the debt limits for the four countries of our sample.

My results show a debt limit ranging between 160 and 220% of GDP, values far above current debt levels observed in 2017. Fiscal spaces turn out to be positive for the four countries.

I have to notice that the results of our estimations are very sensitive to international and domestic factors, like commodity prices, exchange rates, international interest rates and global financial volatility, in other words, all the determinants used in our FRF and financing costs estimation.

[2] I didn't use credit rating from Standard & Poor's since Tunisia is no longer rated by this agency since 2013.

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Appendix 1 Data used for FRF estimation

Variable	Definition	Source
pb	Primary balance (Primary net lending/borrowing is net lending (+)/borrowing (–) plus net interest payable/paid (interest expense minus interest revenue) in % of GDP	World Economic Outlook
Lagged Public debt	General Government Gross Debt (in % of GDP)	World Economic Outlook
Output Gap	Gap from HP Filter trend (in % of potential GDP)	World Economic Outlook
Expenditure Gap	Gap from long run trend (in %)	World Economic Outlook
Energy and Mineral Index Gap	Gap from long run trend (in %)	World Bank Commodity Price Data
Trade Openess	X+IM/ GDP	World Bank

Appendix 2 Data used for EMBI estimation

Variable	Definition	Source
EMBI Global	JP Morgan Emerging Markets Bond Index (in basic points)	MacroBond Database
Lagged debt	General Government Gross Debt (% of GDP)	World Economic Outlook
Output gap	Gap from HP Filter trend (% of potential GDP)	World Economic Outlook
Inflation	CPI (% change)	World Economic Outlook
VIX Index		CBOE Database
US Bonds		Macro Trend
REER	Real Effective Exchange Rates (CPI based)	Bruegel REER Database
Overall Balance	**General government net lending/borrowing (in % of GDP)**	World Economic outlook
Debt Dummy	**=1 if public debt ratio is > 60%; =0 otherwise**	World Economic Outlook
Market Capitalization	Market capitalization of listed domestic companies (% of GDP)	World Bank
FDI	Foreign direct investment, net inflows (% of GDP)	World Bank