

# Cyclicalities of taxes and External Debt

By Noa Srebrnik and Michel Strawczynski<sup>1</sup>

Hebrew University of Jerusalem, Federman School of Public Policy

## *ABSTRACT*

*Vegh and Vuletin (2015) have shown that statutory tax rates are acyclical in developed economies and procyclical in developing ones. This paper extends their analysis by checking the interaction of statutory tax rates with the external public debt. After building a simple model that shows that developing countries are expected to have a lower threshold debt level, above which lenders will not be willing to provide additional credit and will consequently require an increase in tax rates, we perform regressions aimed at characterizing the cyclical behavior of the statutory tax rates under different circumstances concerning the external public debt. In general we found that the V.A.T rates are changed procyclically in both developed and developing countries (i.e., taxes are risen in bad times and reduced in good times). However, when the external debt is high, in the developing countries the procyclicality increases, while the opposite result holds for developed economies. This result occurs mainly in recessions, a time when the need for loans is the highest. Although we found that after the 2000s there was a reduction in procyclicality, these findings pose a challenge to policy makers, who shall think of ways for dealing with lack of foreign funds in difficult times.*

Key Words: Taxes, Cyclicalities, External Debt.

JEL Classification Numbers: H21, H60.

---

<sup>1</sup> Email Addresses: noasre@gmail.com; [Michel.strawczynski@mail.huji.ac.il](mailto:Michel.strawczynski@mail.huji.ac.il). Noa Srebrnik is thankful to Diego Ladowski Scholarships Fund for financial support.

# 1. Introduction

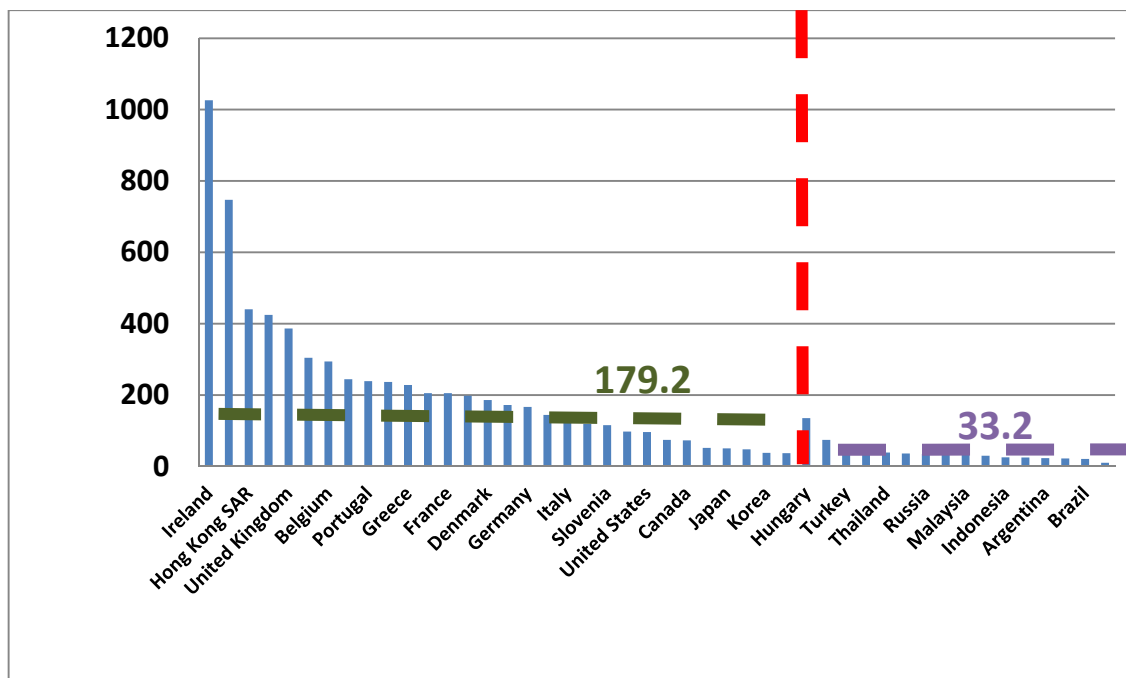
In recent years many papers documented the difference among cyclical fiscal policy of developing and developed economies: while developed economies run acyclical or counter-cyclical policies, developing economies often perform procyclical fiscal policies (Ilzetzki & Vegh, 2008) . While most works were based on expenditure and cyclically adjusted deficit, recently Vegh and Vuletin (2015) have shown for the first time an analysis based on statutory tax rates. Similarly to previous works on expenditure, they have shown that developed economies act acyclically while developing economies change their tax rates in a procyclical manner.

At the same time, many papers analyzed the impact of external and internal debt on budgetary policy outcomes. Barro (1979) considered the debt as a shock absorber during the business cycle. Other authors analyzed the debt as a growth enhancing device, especially in situations in which funds are needed so as to create development strategies (Hameed, Ashraf, & Chaudhary, 2008). However, in light of Latin American countries negative experience during the eighties external debt was considered a risky mechanism, since in situations of uncertainty foreign lenders may require repayment of principal, in particular when they are in difficult times. The concept of a debt threshold (i.e., a maximum amount of debt that lenders are ready to accept) was analyzed by Borenstein (1989). In such a situation the marginal return of a profitable investment may not be tangible for the country with a high debt, because of large interest payments that are cause by an increase in the interest rate (risk premium). Another drawback of a high external debt is the dependence on foreign lenders, who are not familiar with country's economic dynamics and may demand repayment or may defeat new loans in times of crisis – which are the periods in which this kind of finance is needed.

After many years of debt reduction, toward the end of the first decade of 2000s and as a consequence of the world economic crisis, many countries increased abruptly their debt – and in particular developed economies (Reinhart, Reinhart, & Rogoff,

2012). Thus, in 2012 the median of the external debt in developed economies became almost six times higher than the one of developing economies (Figure 1).<sup>2</sup>

Figure 1: External debt as a percent of GDP, 2012



Source: WEO, IMF.

This situation in which developed economies have a higher external debt than developing ones makes the main question of this paper even more intriguing: is the usual finding of procyclical policy in developing economies influenced by the external debt? Since normally statutory taxes is a variable that reacts to government expenditure financial needs, at least ex-ante – we shall expect that procyclical behavior is less evident in developing economies, given their lower level of external debt. As we shall see later, this is not necessarily the case. In particular, we check the hypothesis that foreign lenders have in mind a lower threshold debt, which affects the analysis.

<sup>2</sup> Note that the relevant concept from the point of view of this paper is gross external debt. This is so since lenders do not know ex-ante whether governments will be able to use reserves or whether individuals in general will be able to use other assets in order to re-pay loans. For many other questions, the relevant debt is lower, like in the case of Ireland where a high portion is related to financial activities (see Creedon, Fitzpatrick and Gaffney, 2012), or when we compute government debt that is net of central bank reserves.

Before getting into our analysis it is worthwhile to analyze the impact of foreign loans during recessions. During these periods the GDP goes down causing a reduction in government tax revenues, with a consequent increase in government deficit and debt. As a reaction, foreign lenders are likely to demand an increase in statutory taxes that will avoid creating new external loans. However, we shall note that implementing this measure in times of a recession may have the opposite effect: the increase in statutory tax rates, like V.A.T., affects individuals with a high marginal propensity to consume. Thus, this decision may worsen the recession by causing a further increase in unemployment, which in these periods is characterized by a rising trend.

The paper is organized as follows: in the next section we present a short literature survey. In section 3 we present a model that distinguishes between the expected interaction of statutory tax rates and external debt for both developed and developing economies. In section 4 we show the data, our econometric approach and some basic descriptive statistics. In section 5 we show the empirical results. Finally, section 6 summarizes and concludes.

## **2. A Literature Review**

The literature documents a clear pattern of fiscal policy along the business cycle: developed economies tend to show an acyclical or counter-cyclical fiscal policy, while developing economies run a procyclical fiscal policy. This pattern is documented mainly using government cyclically adjusted deficit and expenditure. One recent survey is provided by Frankel, Vegh and Vuletin (2011), who stress that Gavin and Perotti (1997) and Talvi and Vegh (2000) were among the first papers showing that developing economies tend to cut expenses in difficult times. A more recent analysis was presented by Strawczynski and Zeira (2013). Kaminski, Reinhart and Vegh (2005) extended the analysis to monetary policy, in a 40 years sample that includes 104 countries. They show that also monetary policy is procyclical in developing economies.

Policy-makers control statutory tax rates, as opposed to government revenues which are endogenous. Thus, when checking the cyclicity of statutory tax rates it is crucial to collect data on the tax rates. Because of a lack of available data, many studies in the past were based on the inflation tax<sup>3</sup> or of government revenues as a percent of GDP<sup>4</sup>, which are readily available. However, this data has at least two limitations. First, there is a discussion on the validity of the inflation tax as a source of government revenue<sup>5</sup>, an issue that receives scarce support at the empirical level. In particular, it is claimed that the inflation tax revenues depend on the independence of the central banks and their financial relationship to governments, which vary across countries. Second, there is a clear endogeneity between the GDP and government revenues, which difficults the assessment of the sensitivity of the latter to business cycles.

Recently, these problems were tackled by Vegh and Vuletin (2015) and Strawczynski (2014, 2015), who used data on statutory tax rates instead of data as a percent of GDP. This is the procedure that will be followed in the present paper. Note that according to normative models on optimal debt policy would imply performing an acyclical tax policy (Barro, 1979) or a countercyclical one (as obtained in a Keynesian model, like Strawczynski and Zeira, 2013); i.e., the former would imply not changing the tax rate in recessions, while the latter implies reducing it as a way of stimulating the economy (see also Spilimbergo et al., 2008).

Vegh and Vuletin (2015) is one of the first papers that deals with the cyclicity of tax rates among countries, separating between developing and developed economies. They analyze 62 countries in a sample of 49 years that includes V.A.T., income tax and corporate tax. They found that that in developed economies the tax policy is acyclical, while in developing ones it is procyclical: in recessions the ratio of government to private consumption goes up, and the opposite happens in expansions.

---

<sup>3</sup> Talvi and Vegh (2005), Kaminsky, Reinhart and Vegh (2005);

<sup>4</sup>; Gavin and Perotti (1997), Sorensen, Wu and Yosha (2001), Sturzenegger and Wernek (2006)

<sup>5</sup> See Roubini and Sachs (1989), Poterba and Rotemberg (1990), Edwards and Tabellini (1991), and Roubini (1991).

One possible explanation for the different behavior of developed and developing economies is that the latter group of countries confront a credit constraint during crisis: borrowers require fiscal consolidation, which results in a procyclical reaction (Kaminsky, Reinhart and Vegh, 2005). Bernanke and Gertler (1989, 1990) showed that when a country performs a project that requires new investment, it usually borrows through external debt. However, these authors show that debt terms (interest rate) go up during difficult times because of a risk premium. Leung (2003) shows that while foreign loans are needed for financing economic growth, in recession periods this type of loans act procyclically and consequently developing economies shall consider this drawback when taking new loans. The importance of foreign debt for developing economies together with the difficulties that it imposes on them, is an interesting pattern and it is the focus of the present paper.

Many papers discussed the foreign debt paradox for developing countries. Hameed, Ashraf and Chaudhary (2008) show that the reason those countries take foreign loans is the lack of funds for financing new initiatives which drive development. In fact, Izquierdo, Romero and Talvi (2007) show that these loans have a considerable impact on growth among developing countries. Karagol (2002) shows, however, that excessive foreign debt may act as a tax on future output. Another explanation was given by Nishimura and Oyashama (1995): the increase in foreign debt maybe explained by changes in time preferences. A lively example of the difficulties of foreign debt was provided by Latin American countries during the seventies: Sachs and Williamson (1985) show that these countries suffered from a debt crisis which was aggravated because of the dynamics of foreign loans.

In recent years new research has documented that a change of this pattern may have taken place: Strawczynski and Zeira (2013) show that following the globalization process in the nineties, there is reduction in procyclicality of fiscal policy in developing economies. These authors show that countries with a high proportion of Foreign Direct Investment (FDI) reduced substantially the procyclical pattern of their policy. Recently, Vegh and Vuletin (2014) document a transition of some Latin American countries like, Mexico, Brazil and Chile from procyclical fiscal policy to an acyclical one.

### 3. Tax rates and cyclicity: a simple model

In this sub-section we present a simplified model in order to think about the possible behavior of tax rates along the cycle in developed and developing economies, in a situation of credit constraints.<sup>6</sup> The main difference between our model and the previous ones is the characterization of tax rates, which was completely absent in previous models. Moreover, most previous models did not differentiate between developed and developing economies.<sup>7</sup>

Assume a small open economy with exogenous output and interest rate. According to Barro (1979), the optimal policy would imply tax smoothing, according to equation 1:

$$(1) \quad \tau_t^e = \tilde{g} + rd_{t-1}$$

Where  $\tau_t^e$  is the expected tax rate at time t,  $\tilde{g}$  is the permanent government expenditure as a percent of GDP calculated using available information at time t, r is the exogenous interest rate and  $d_{t-1}$  is the ratio of debt to GDP at the previous period. This is the well-known tax smoothing result, which implies that the tax rate is aimed at financing government expenditure and interest payments.

In order to avoid Ponzi games we modify the solution so as to have a finite horizon that allows for repayment of principal. Introducing this assumption implies the following modified solution:

$$(2) \quad \tau_t^e = \tilde{g} + rd_{t-1} + \frac{d_{t+n}^e}{(1+r)^n}$$

Where  $d_{t+n}^e$  is the expected debt at the end of the planning horizon (n), that appears at this equation according to its present value; i.e., the government shall plan the tax rate so as to re-pay the debt at the end of the planning horizon.

The expected debt is the debt at the beginning plus the additional planned debt:

---

<sup>6</sup> An alternative model that is based on expenditure is proposed by Bruckner and Gradstein (2014). Other models showing the impact of credit constraints are: Gavin, Hausman, Perotti & Talvi, 1996; Gavin & Perotti, 1997; Riascos & Vegh, 2003; Caballero & Krishnamurthy, 2004; Hercowitz and Strawczynski (2004).

<sup>7</sup> One exception is Talvi and Vegh (2000).

$$(3) \quad d_{t+n}^e = d_t + \Delta d_{t+n}$$

Plugging equation 3 into equation 2 we get:

$$(4) \quad \tau_t^e = \tilde{g} + rd_{t-1} + \frac{d_t + \Delta d_{t+n}}{(1+r)^n}$$

Equation 4 implies that the expected tax rate is a function of actual debt:

$$(5) \quad \tau_t^e = \tau_t^e(d_t)$$

Assume now that the actual tax rate causes a deadweight loss (represented by L), and that the marginal excess burden increases with the tax rate. The way to write this result is that the G.D.P., Y, is a function of the deadweight loss. The following is the formula for tax revenues, T:

$$(6) \quad T = \tau[Y(1 - L(\tau))], \quad L' > 0; L'' > 0$$

For simplicity let us assume that the deadweight loss is quadratic. We shall note that in developing economies there is a huge informal sector<sup>8</sup> which implies that the tax rates are imposed on a smaller share of the economy. As a consequence of that, the government is forced to allow lower exemptions – otherwise it will not get the needed revenues. Thus, in a developing country the deadweight loss of a given tax rate is higher – since it is imposed at a larger extent.<sup>9</sup> This fact implies a higher excess burden in developing economies ( $L_U$ ) compared to developed economies ( $L_D$ ) for a given tax rate:

$$(7) \quad L_D = \tau^2; L_U = 2\tau^2$$

Plugging equation 7 in equation 6 allows for the calculation of the Laffer curves in both the developed ( $T_D$ ) and developing ( $T_U$ ) economies:

$$(8) \quad T_D = \tau Y - \tau^3 Y; T_U = \tau Y - 2\tau^3 Y$$

In order to calculate the maximum tax rate (the highest point at the Laffer curve) we derive and equalize to 0:

---

<sup>8</sup> See Tanzi and Zee (2000).

<sup>9</sup> For example in the income tax the threshold is expected to be lower – so as to get more revenues; in the corporate tax, the government will be less benevolent for allowing trespassing of losses to the future.



$$(9) \quad T'_D(\tau) = Y(1 - 3\tau^2) = 0; T'_U(\tau) = Y(1 - 6\tau^2) = 0$$

$$\tau_D = \left(\frac{1}{3}\right)^{0.5} = 0.57; \tau_U = \left(\frac{1}{6}\right)^{0.5} = 0.407$$

i.e., as expected the solution shows that the maximum tax rate is higher in the developed economies. This result is in line with real-world data (Tanzi and Zee, 2000).

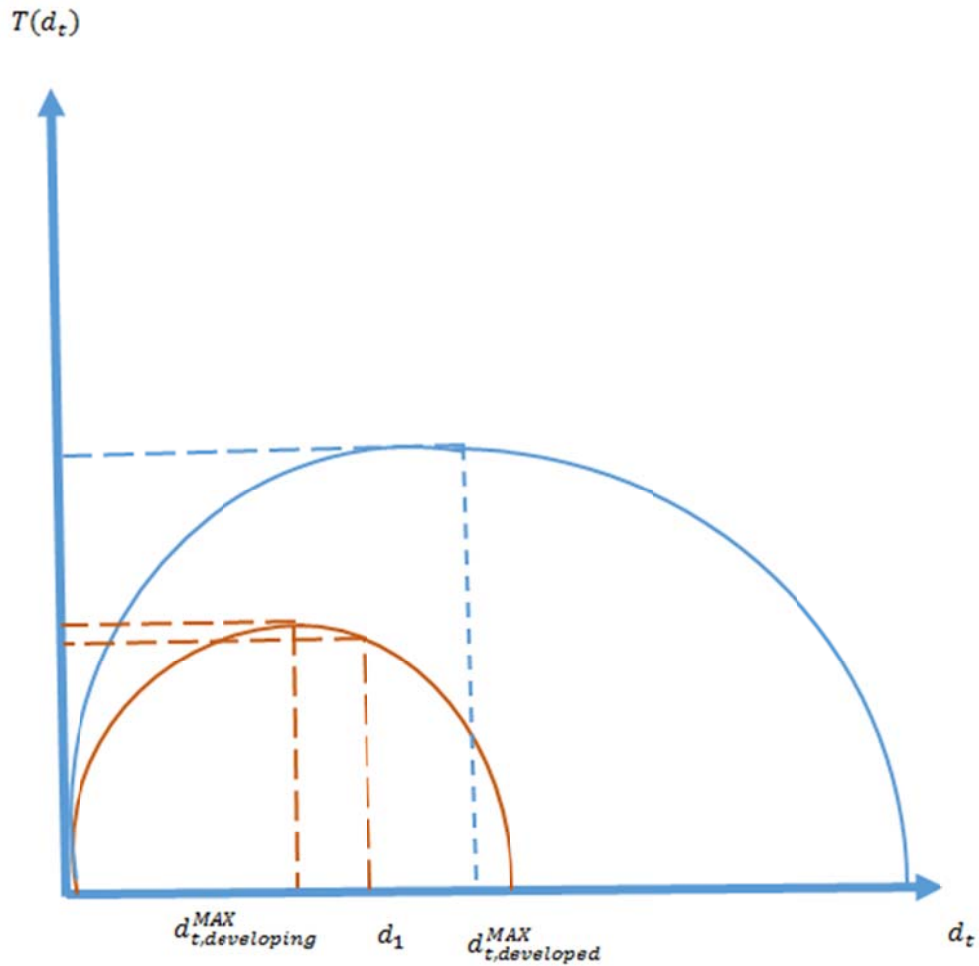
Let us compare a developing to a developed economy with the same government expenditure and initial level of debt. Suppose that permanent expenditure is 30 percent of GDP, the initial debt is 50 percent of GDP and the interest rate is 3 percent.

We can plug these numbers in equation 4, in order to calculate the maximum amount of debt that is tolerated by lenders: note that this debt is related to the maximum tax rate imposed by a country. We shall stress that the borrowers will not be able to sell new bonds if the debt is beyond this threshold: in their perception that would imply that the government is not able to re-pay the debt, because rising the tax rate would actually imply a reduction of tax revenues. The following is the result:

$$(10) \quad d_D^{MAXe} = 0.862; d_U^{MAXe} = 0.466$$

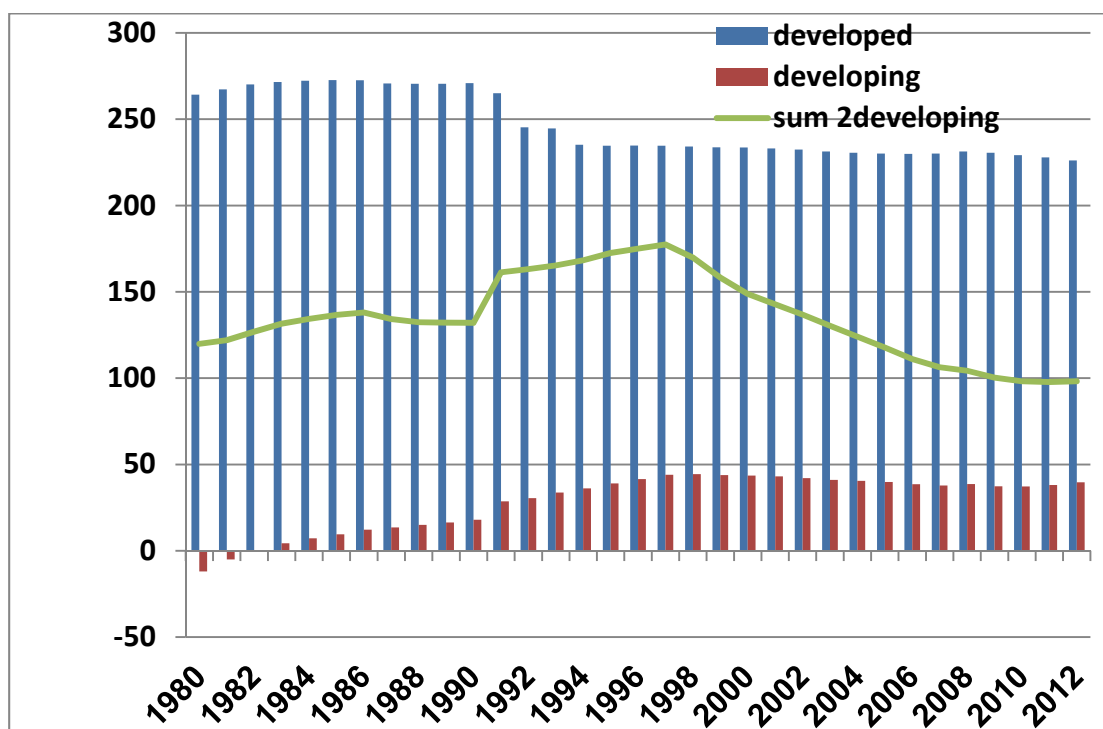
This result implies that developing countries will have a difficult time to finance expenditure by foreign debt at times of crises: if the debt is close to the maximum debt level, which is lower for developing countries, the single available alternative is cutting expenditure – which implies a procyclical fiscal policy . Figure 2 shows that the ratio of debt to GDP  $d_1$  is considered feasible at a developed economy, while it is not in a developing one. The issue of an additional bond in a developing economy would require raising the tax rate, which is not desirable since tax revenues would decline.

Figure 2 – Tax revenues and Maximum Debt



One clear consequence of this analysis is that in developing economies there will be a demand for cutting expenditures or raising taxes at lower levels of debt compared to the ones existing in developed economies. This analysis can explain the pattern observed in real life, as shown in Figure 3: even after considering 2 standard deviations, the debt acquired by developing economies is lower than the one taken by developed economies.

Figure 3: Developing Economies External Debt + 2 standard deviations



Note that this analysis implies that the situation is reinforcing: developing economies are actually the ones that need financing resources for enhancing growth. However, the lack of opportunity for taxing the informal economy drives borrowers to demand a low foreign external debt level by these countries.

## 4. The Empirical Framework

### 4.1 Data

We use data for 30 developed economies and 17 developing countries (the detailed list is shown in the Appendix). Because of lack of data, and similarly to Vegh and Vuletin (2015), we base the analysis on three sources of taxation: income tax, corporate tax and V.A.T.<sup>10</sup>

As well-known in most countries there are different income tax brackets and in some countries such brackets exist for the corporate tax. Since we are interested on government's reaction along the cycle we choose specific criteria that is uniform for all countries; in particular, we choose the marginal tax rate for both income and corporate tax (i.e., the highest one). The data is taken from the World Database, with

<sup>10</sup> In the U.S., Brazil and Hong Kong there is no V.A.T. at the federal level.

some blanks that were filled with data from the OECD (see the details at the Appendix).<sup>11</sup> It is worth stressing that the three sources taken here constitute 65% of total tax revenues in developing countries and 80 % in developed ones (see also Vegh and Vuletin, 2015). It is worth stressing that our data does not include all tax resources and exemptions, which are also important for understanding tax revenues. However, we believe that our analysis has a value added since it takes care of direct decisions taken by the government in the form of statutory tax rates, which suffers to a lesser extent from endogeneity.

As for the control variables used in our regressions, we use standard variables appearing in this kind of analysis. The political data used here were taken from the World Bank Database and include the electoral system (*system*), which took the value 1 for direct elections, 2 for parliamentary elections and 3 for a presidential system; it also included the political affiliation of the elected party (*Gov\_Party*) which took a value of 1 for a right-wing ruling party, 2 for center and 3 for a left party; finally it included years at office (*yrs\_offic*) and the number of years according to the ruling law (*9yrs\_left*).

#### **4.2 Statutory Tax Changes**

While government spending runs continuously during the year, statutory tax rates are discrete in nature, since they must be approved by the parliament. Tables 1 to 3 show the changes in statutory tax rate in the different countries during our sample period. Similarly to the findings shown by Vegh and Vuletin (2015), statutory decisions on V.A.T. are fewer compared to income and corporate tax. Since the V.A.T. is regressive, one possible explanation would be that governments in developed economies are more careful when raising its tax rate, compared to direct sources of taxation. In fact, also the magnitude of the changes in V.A.T. is lower compared to the income tax, which is the highest. Note also that changes in V.A.T. are higher in magnitude compared to developed economies, while the opposite is true for income and corporate taxes. In general developing economies perform less changes in statutory taxes, but once they are done the magnitude is higher by a

---

<sup>11</sup> University of Michigan, Ross School of Business.

factor of 1.5. Note, however, that there are less developing economies in our sample; normalizing these changes by the number of countries, the difference become almost inexistent.

As opposed to Vegh and Vuletin (2015), we found that developed economies made more frequent tax changes than developing ones. One possible explanation for the higher frequency of statutory tax changes in developed economies could be the political stability, which is usually higher. Another possible explanation is related to the functioning of democracies at these countries, which may imply a more frequent examination of the citizens to politicians, causing a more frequent use of tax changes.

**Table 1 – Statutory V.A.T. tax changes: Summary Statistics**

	<b>Developed</b>	<b>Developing</b>	<b>Total</b>
<b>Number</b>	33	90	123
<b>Average</b>	0.09	0.88	0.67
<b>Median</b>	1	1	1
<b>Maximum</b>	5	8	8
<b>Minimum</b>	-8	-12	-12
<b>Number of rises</b>	20	68	88
<b>Total number of observations</b>	339	778	1117

**Table 2: Corporate Tax Changes**

	<b>Developing</b>	<b>Developed</b>	<b>Total</b>
<b>Number</b>	96	266	362
<b>Average</b>	-2.83	-1.93	-2.18
<b>Median</b>	-2	-2	-2
<b>Maximum</b>	19	22.2	22.2
<b>Minimum</b>	-21	-25	-25
<b>Number of rises</b>	27	56	83
<b>Total number of observations</b>	504	960	1464

**Table 3: Income Tax Changes**

	<b>Developing</b>	<b>Developed</b>	<b>Total</b>
<b>Number</b>	97	257	354
<b>Average</b>	-4.30	-2.82	-3.22
<b>Median</b>	-3	-2	-2
<b>Maximum</b>	15.25	46	46
<b>Minimum</b>	-40	-45	-45
<b>Number of rises</b>	20	58	78
<b>Total number of observations</b>	497	961	1458

#### 4.3 Descriptive Statistics

Before getting to the regressions framework we present descriptive statistics. In Table 4 we see that the correlation between income and corporate tax is higher than the ones among them and the VAT.

**Table 4 – Correlation between tax changes**

	<b>VAT</b>	<b>INCOME</b>	<b>CORP</b>
<b>CORP</b>	0.013	0.597	1.000
<b>INCOME</b>	0.109	1.000	0.597
<b>VAT</b>	1.000	0.109	0.013

Once we divide the sample between developed and developing countries (Tables 5 and 6) an interesting result arises: the correlation jumps abruptly. This result affirms the need for differentiating among these two groups, as stressed in previous research. When comparing the correlations between these two groups we see that the correlation between different taxes is higher for developing countries, which suggest that when taxes are corrected these countries tend to do it across the board.

**Table 5 – Correlation among tax rates in developed countries**

	<b>VAT*DEVELOPED</b>	<b>INCOME* DEVELOPED</b>	<b>CORP* DEVELOPED</b>
<b>CORP*DEVELOPED</b>	0.781	0.907	1.000
<b>INCOME*DEVELOPED</b>	0.762	1.000	0.907
<b>VAT*DEVELOPED</b>	1.000	0.762	0.781

**Table 6 – Correlation among tax rates in developing countries**

	<b>VAT*DEVELOPING</b>	<b>INCOME* DEVELOPING</b>	<b>CORP* DEVELOPING</b>
<b>CORP*DEVELOPING</b>	0.861	0.944	1.000
<b>INCOME* DEVELOPING</b>	0.891	1.000	0.944
<b>VAT*DEVELOPING</b>	1.000	0.891	0.861

In Tables 7 to 10 we see the correlations for countries with high and low external debt, for both developed and developing groups. The correlation is higher for countries with a high debt.

**Table 7 – Correlation among tax rates for the High External Debt Countries in developed economies**

	<b>VAT* HIGH_ DEVELOPED</b>	<b>INCOME* HIGH_ DEVELOPED</b>	<b>CORP* HIGH_ DEVELOPED</b>
<b>CORP*HIGH_DEVELOPED<sup>12</sup></b>	0.898	0.956	1.000
<b>INCOME*HIGH_ DEVELOPED</b>	0.903	1.000	0.956
<b>VAT*HIGH_ DEVELOPED</b>	1.000	0.903	0.898

<sup>12</sup> High=High External Debt (compared to the median) in Dollars.

**Table 8 – Correlation among tax rates for High External Debt Countries in developing economies**

	<b>VAT*HIGH_ _DEVELOPING</b>	<b>INCOME*HIGH_ _DEVELOPING</b>	<b>CORP*HIGH_ _DEVELOPING</b>
<b>CORP*HIGH_ _DEVELOPING</b>	0.892	0.964	1.000
<b>INCOME*HIGH_ _DEVELOPING</b>	0.908	1.000	0.964
<b>VAT*HIGH_ _DEVELOPING</b>	1.000	0.908	0.892

**Table 9 – Correlation among tax rates for the Low External Debt Countries in developed economies**

	<b>VAT*LOW_ _DEVELOPED</b>	<b>INCOME*LOW_ _DEVELOPED</b>	<b>CORP*LOW_ _DEVELOPED</b>
<b>CORP*LOW<sup>13</sup> _DEVELOPED</b>	0.764	0.904	1.000
<b>INCOME*LOW_ _DEVELOPED</b>	0.769	1.000	0.904
<b>VAT*LOW_ _DEVELOPED</b>	1.000	0.769	0.764

**Table 10 – Correlation among tax rates for the Low External Debt Countries in developing economies**

	<b>VAT*LOW_ _DEVELOPING</b>	<b>INCOME*LOW_ _DEVELOPING</b>	<b>CORP*LOW_ _DEVELOPING</b>
<b>CORP*LOW_ _DEVELOPING</b>	0.599	0.828	1.000
<b>INCOME*LOW_ _DEVELOPING</b>	0.607	1.000	0.828
<b>VAT*LOW_ _DEVELOPING</b>	1.000	0.607	0.599

A possible explanation for this correlation is the fact that countries with high external debt are forced to raise taxes in difficult times, both in developed and developing countries. In order to know whether this is the case we need to run

<sup>13</sup> Low=low external debt (compared to the median) in dollars.



regressions that control for the different aspects that drive countries to raise their tax rates, an exercise that will be performed in the next section.

#### 4.4 The Econometric Framework

Ex-ante we expect statutory tax rates to be a stationary variable, since theoretically they should converge to a given level, according to the long-run size of the government. In fact, we show in the Appendix that the ADF and PP exams reject the hypothesis that the tax variables have a unit root. However, the corporate tax rate is not stationary. Thus, for this variable we also performed regressions using the first difference (not reported).

Since the main explaining variable is the rate of increase in the GDP, it is important to cope with a possible endogeneity between this variable and the explained variable, as argued by Yilzetzki and Vegh (2008). For this purpose we use an instrumental variable for the GDP, based on the Income of trade partners of different countries. This variable is clearly correlated with exports, and consequently with the GDP, while it is not expected to be correlated with the statutory tax rates. For this purpose we collected data on trade volumes and chose the most prominent countries that were partners with each of the 41 countries in our sample, until completing 50 percent of the exports volume.<sup>14</sup> This method was used by Jaimovich and Panizza (2007).

With respect to the other variables, we use lagged values as instruments. Beyond that, we use both cross-section and time fixed effects, which control respectively for country peculiarities and common business cycles. We also present a sensitivity analysis by excluding from the regression government expenditure, which is the variable that is suspected to have the highest endogeneity with GDP.

We start by running a regression with the main explaining variables, including gdp as the variable that measures cyclicalities (variables definition is shown in Appendix 2):

$$(1) \text{ Tax} = c + \alpha_1 d(\text{exp}) + \alpha_2 d(\text{pop}) + \alpha_3 \text{inf} + \alpha_4 \text{system} + \alpha_5 \text{gov\_party} + \alpha_6 \text{yrs\_left} + \alpha_7 \text{yrs\_offic} + \alpha_8 d(\text{debt}) + \alpha_9 \text{reserves\_gdp} + \alpha_{10} d(\text{gdp})$$

---

<sup>14</sup> i.e., in countries in which exports are concentrated in few countries we took less countries compared to cases in which exports are spread among several countries.

Following the literature, the next regression separates between developed and developing countries. For developed countries we use a dummy variable that takes the value of 1, and 0 otherwise.

$$(2) \text{Tax} = c + \alpha_1 d(\text{exp}) + \alpha_2 d(\text{pop}) + \alpha_3 \text{inf} + \alpha_4 \text{system} + \alpha_5 \text{gov\_party} + \alpha_6 \text{yrs\_left} + \alpha_7 \text{yrs\_offic} + \alpha_8 d(\text{debt}) + \alpha_9 \text{reserves\_gdp} + \alpha_{10} d(\text{gdp}) + \alpha_{11} d(\text{gdp}) * i_{1,2}^{15}$$

As shown in the model, the novelty of this paper is by thinking of the external debt as a variable that constraints the ability of countries for performing countercyclical fiscal policy. For this purpose we build two dummy variables for the groups of developed and developing, separately. The dummy takes the value 1 if the external debt in a given country is higher than the median of its group, and 0 otherwise. The regression is presented in equation 3.

$$(3) \text{Tax} = c + \alpha_1 d(\text{exp}) + \alpha_2 d(\text{pop}) + \alpha_3 \text{inf} + \alpha_4 \text{system} + \alpha_5 \text{gov\_party} + \alpha_6 \text{yrs\_left} + \alpha_7 \text{yrs\_offic} + \alpha_8 d(\text{debt}) + \alpha_9 \text{reserves\_gdp} + \alpha_{10} d(\text{gdp}) * \text{mex}_{i,2} d_{1,2}^{16}$$

Next, we check whether the counter\procyclicality of taxes is asymmetric during the cycle. For this purpose we use in equation 4 a dummy variable that takes the value of 1 in recessions, defined as the years in which the rate of increase of the GDP is lower than the average rate of increase for a given country, and 0 otherwise. In equation 5 we present a parallel analysis for expansions (i.e., the dummy variable takes the value 1 when the growth rate is higher than average for a given country).

$$(4) \text{Tax} = c + \alpha_1 d(\text{exp}) + \alpha_2 d(\text{pop}) + \alpha_3 \text{inf} + \alpha_4 \text{system} + \alpha_5 \text{gov\_party} + \alpha_6 \text{yrs\_left} + \alpha_7 \text{yrs\_offic} + \alpha_8 d(\text{debt}) + \alpha_9 \text{reserves\_gdp} + \alpha_{10} d(\text{gdp}) + \alpha_{11} d(\text{gdp}) * \text{High\_ExtDebt}_{i,2} d_{1,2} * (\text{recession})$$

$$(5) \text{Tax} = c + \alpha_1 d(\text{exp}) + \alpha_2 d(\text{pop}) + \alpha_3 \text{inf} + \alpha_4 \text{system} + \alpha_5 \text{gov\_party} + \alpha_6 \text{yrs\_left} + \alpha_7 \text{yrs\_offic} + \alpha_8 d(\text{debt}) + \alpha_9 \text{reserves\_gdp} + \alpha_{10} d(\text{gdp}) + \alpha_{11} d(\text{gdp}) * \text{High\_ExtDebt}_{i,2} d_{1,2} * (\text{Boom}).$$

---

1=Developing, 2=Developed <sup>15</sup>

<sup>16</sup> 1= Dollars, 2=GDP

## 5. Empirical Results

The corporate and income tax regressions derived in insignificant coefficients. Consequently, we show results for the VAT.<sup>17</sup>

### 5.1 Cyclicity of VAT

In the following tables we show the results of the significant coefficients of regressions. The list of all variables appear in the footnotes to each Table.

Table 11: Cyclicity of VAT<sup>18</sup>

Variables	<b>i = 0</b>	<b>i = DEV<sup>19</sup></b>	<b>i = 1-DEV</b>
<b>C</b>	4.737 (0.925)***	4.601 (0.949)***	4.601 (0.949)***
<b>D(GDP)</b>	<b>-0.035</b> <b>(0.016)**</b>	<b>-0.048</b> <b>(0.021)**</b>	<b>-0.028</b> <b>(0.017)*</b>
<b>D(GDP)*i</b>		<b>0.019</b> <b>(0.018)</b>	<b>-0.019</b> <b>(0.018)</b>
<b>D(POP)</b>	-0.674 (0.389)*	-0.732 (0.401)*	-0.732 (0.401)*
<b>VAT(-1)</b>	0.764 (0.043)	0.767 (0.044)***	0.767 (0.005)***
<b>ADJ*R<sup>2</sup></b>	0.987	0.986	0.986
<b>DW</b>	2	2.011	2.011

When checking the cyclicity of VAT in a panel sample we obtain procyclicality, with a coefficient of -0.035 that is significant at 5 percent. Procyclicality is obtained for both developed and developing countries. This result is similar to the one obtained by Vegh and Vuletin (2015).

In Table 12 we check the interaction with a high external debt, measured in current dollars and in percent of GDP. The results are suggesting: in developed economies the coefficient is positive and equal to 0.036, while in developing economies it negative and significant, and equal to -0.048. By adding these coefficients to the one

<sup>17</sup> In all reported regressions the levels of significance are: 1% \*\*\*, 5% \*\*, 10% \* .

<sup>18</sup> The following are the variables that were not significant : D(EXP), SYSTEM, GOV\_PARTY, YRS\_LEFT, YRS\_OFFIC, D(DEBT) & RESERVES\_GDP.

<sup>19</sup> Dev = Developed

of the GDP we obtain the procyclicality in each group of countries: in developed economies it is -0.016, while in developed ones it equals -0.08. This result means that while in developed economies countries with high debt have a mild procyclical policy, in developing ones tax rates are strongly procyclical. While the results in developed economies are close to the ones stated by Barro, the result for developing economies is consistent with the model shown above according to which this type of country has a non-formal debt threshold.

**Table 12: Cyclicity of VAT with a high external debt<sup>20</sup>**

Variables	i = GDP j = DEV	i = DOLLAR j = DEV	i = GDP j = 1-DEV	i = DOLLAR j = 1-DEV
<b>C</b>	4.801 (0.948)***	4.734 (0.925)	4.592 (0.936)***	4.723 (0.981)***
<b>D(GDP)</b>	<b>-0.052</b> <b>(0.020)***</b>	<b>-0.031</b> <b>(0.018)*</b>	<b>-0.030</b> <b>(0.017)*</b>	<b>-0.032</b> <b>(0.017)*</b>
<b>D(GDP)*HIGH_</b> <b>EXTDEBT(i, j)</b>	<b>0.036</b> <b>(0.015)**</b>	<b>-0.008</b> <b>(0.014)</b>	<b>-0.020</b> <b>(0.014)</b>	<b>-0.048</b> <b>(0.024)**</b>
<b>D(POP)</b>	-0.784 (0.397)**	-0.666 (0.389)*	-0.712 (0.396)*	-0.822 (0.425)*
<b>INF</b>	0.026 (0.013)**	0.019 (0.013)	0.019 (0.013)	0.029 (0.014)**
<b>VAT(-1)</b>	0.768 (0.044)***	0.762 (0.043)***	0.769 (0.043)***	0.764 (0.045)***
<b>ADJ*R<sup>2</sup></b>	0.986	0.987	0.987	0.985
<b>DW</b>	2.02	1.990	2.023	2.026

<sup>20</sup> The following are the variables that were not significant: D(EXP), SYSTEM, GOV\_PARTY, YRS\_LEFT, YRS\_OFFIC, D(DEBT) & RESERVES\_GDP.

Table 13: Cyclicity of VAT during recessions<sup>21</sup>

Variables	i = GDP j = DEV	i = DOLLAR j = DEV	i = GDP j = 1-DEV	i = DOLLAR j = 1-DEV
<b>C</b>	4.739 (0.939)***	4.754 (0.929)***	4.804 (1.031)***	4.692 (0.994)***
<b>D(GDP)</b>	<b>-0.043</b> <b>(0.016)***</b>	<b>-0.034</b> <b>(0.016)**</b>	<b>-0.040</b> <b>(0.020)**</b>	<b>-0.032</b> <b>(0.017)*</b>
<b>D(GDP)*HIGH_</b> <b>EXTDEBT(i,</b> <b>j)*RECESSION</b>	<b>0.039</b> <b>(0.021)*</b>	<b>-0.011</b> <b>(0.024)</b>	<b>-0.089</b> <b>(0.047)*</b>	<b>-0.078</b> <b>(0.062)</b>
<b>D(POP)</b>	-0.701 (0.394)*	-0.675 (0.390)*	-0.810 (0.436)**	-0.862 (0.464)*
<b>INF</b>	0.022 (0.013)*	0.020 (0.012)	0.023 (0.014)	0.023 (0.014)
<b>VAT(-1)</b>	0.768 (0.044)***	0.762 (0.043)***	0.764 (0.047)***	0.766 (0.046)***
<b>ADJ*R<sup>2</sup></b>	0.986	0.987	0.984	0.985
<b>DW</b>	1.999	1.996	2.089	2.069

In Tables 13 and 14 we further characterize the cyclicity during recessions and expansions. The most interesting result concerns developing economies with high debt: these countries act procyclically mainly during recessions, with a very high coefficient: -0.089.<sup>22</sup> The practical characterization of this finding is as follows: in difficult periods, when the GDP growth is low (and in many cases declines) causing an increase in the government budget deficit, governments tend to cope with the situation by raising the VAT, as a way to cope with the undesired situation as perceived by lenders. This result extends previous findings in the literature that were based on expenditure, as shown by Strawczynski and Zeira (2013) who show that government spending in developing economies is procyclical in recessions; the new element here is that this behavior is aggravated by the existence of a high external debt. This situation is actually problematic, since the government spending cut and the rise of the tax rate actually undermines the developing country chance of successfully coping with the crisis. Thus, this finding implies that in times of crisis

<sup>21</sup> : The following are the variables that were not significant : D(EXP), SYSTEM, GOV\_PARTY, YRS\_LEFT, YRS\_OFFIC, D(DEBT) & RESERVES\_GDP.

<sup>22</sup> This coefficient is statistically different from the coefficient obtained in Table 12 which does not differentiate between sub-periods (according to a Wald test).

there is a policy challenge for these countries, and new solutions ('out of the box') should be called for. Note that paradoxically, the observed behavior actually hurt both the lender and the borrower.

Note that for developed economies we obtained the opposite result: during recessions countries with high debt have a positive coefficient, which implies that for these countries the procyclicality is alleviated during these periods. However, by summing the general and specific coefficients we obtain -0.004, which implies that all in all they have a low positive coefficient; i.e., a mild procyclical behavior. This small number compares to -0.129, which is the sum of coefficients for the group of developing economies.

In Table 14 we show the results for expansions. In general the coefficients for high debt countries in both developed and developing economies are not significant, which implies that during expansions lenders do not put pressure on borrowers which allow them to run a acyclical policy.

**Table 14: Cyclicity of VAT during expansions<sup>23</sup>**

<b>Variables</b>	<b>i = GDP j = DEV</b>	<b>i = DOLLAR j = DEV</b>	<b>i = GDP j = 1-DEV</b>	<b>i = DOLLAR j = 1-DEV</b>
<b>C</b>	4.760 (0.933)***	4.673 (0.926)***	4.836 (0.925)***	4.713 (0.936)***
<b>D(GDP)</b>	<b>-0.040</b> <b>(0.019)</b>	<b>-0.035</b> <b>(0.019)*</b>	<b>-0.040</b> <b>(0.019)**</b>	<b>-0.034</b> <b>(0.016)**</b>
<b>D(GDP)*HIGH_ EXTDEBT(i, j)*BOOM</b>	<b>0.016</b> <b>(0.018)</b>	<b>0.015</b> <b>(0.017)</b>	<b>0.010</b> <b>(0.014)</b>	<b>-0.018</b> <b>(0.020)</b>
<b>D(POP)</b>	-0.711 (0.392)*	-0.679 (0.389)	-0.663 (0.392)*	-0.680 (0.393)
<b>INF</b>	0.022 (0.013)	0.021 (0.013)	0.022 (0.013)*	0.022 (0.013)*
<b>VAT(-1)</b>	0.764 (0.043)***	0.765 (0.043)***	0.761 (0.043)***	0.764 (0.043)***
<b>ADJ*R<sup>2</sup></b>	0.987	0.987	0.987	0.987
<b>DW</b>	2.013	2.012	1.99	2

<sup>23</sup> The variables that we used in the regressions and were not significant are: D(EXP), SYSTEM, GOV\_PARTY, YRS\_LEFT, YRS\_OFFIC, D(DEBT) & RESERVES\_GDP.

## 5.2 Granger causality tests

In order to see whether the results above reflect causality we ran Granger causality tests. For checking causality between VAT tax rates and cycles we use relatively short lags (2 and 3 years), while for checking the impact on debt we use a longer horizon (until 5 years).

In table 15 we check the causality between VAT rates and the change in gdp for developing countries, and in table 16 we do so for recession periods.

**Table 15: Causality tests of cycles and VAT in high debt developing countries**

<b>High external debt defined in dollars</b>	<b>2 lags</b>	<b>3 lags</b>
Vat does not cause d(gdp)	1.3 (0.3)	1.0 (0.4)
d(gdp) does not cause vat	1.1 (0.3)	0.8 (0.5)
<b>High external debt defined as % of gdp</b>	<b>2 lags</b>	<b>3 lags</b>
Vat does not cause d(gdp)	8.8 (0.0)***	6.4 (0.0)***
d(gdp) does not cause vat	10.1 (0.0)***	7.3 (0.0)***

**Table 16: Causality tests of cycles and VAT in high debt developing countries during recessions**

<b>High external debt defined in dollars</b>	<b>2 lags</b>	<b>3 lags</b>
Vat does not cause d(gdp)	0.4 (0.7)	1.4 (0.2)
d(gdp) does not cause vat	4.1 (0.02)**	3.3 (0.01)***
<b>High external debt defined as % of gdp</b>	<b>2 lags</b>	<b>3 lags</b>
Vat does not cause d(gdp)	1.9 (0.2)	1.0 (0.3)
d(gdp) does not cause vat	0.4 (0.7)	0.9 (0.3)

Results show that causality goes in both directions when the debt is measured as a percent of gdp. The most interesting result is presented in table 16: the change in gdp during recessions causes a change in VAT rates for countries with a high external debt measured in dollars. The result was obtained for both 2 and 3 lags.

In table 17 we check whether there is causality between VAT rates and the change in debt for developing countries, while table 18 does so for recession periods.

**Table 17: Causality tests for the debt and VAT in high debt developing countries**

<b>High external debt defined in dollars</b>	<b>2 lags</b>	<b>3 lags</b>	<b>5 lags</b>
Vat does not cause d(debt_n)	2.5 (0.08)	1.2 (0.3)	3.4 (0.0)***
d(debt_n) does not cause vat	24.4 (0.0)***	17.5 (0.0)***	12.5 (0.0)***
<b>High external debt defined as % of gdp</b>	<b>2 lags</b>	<b>3 lags</b>	
Vat does not cause d(debt_n)	3.3 (0.04)**	2.7 (0.04)**	2.5 (0.03)**
d(debt_n) does not cause vat	17.9 (0.0)***	12.3 (0.0)***	9.7 (0.0)***

**Table 18: Causality tests for the debt and VAT in high debt developing countries during recessions**

<b>High external debt defined in dollars</b>	<b>2 lags</b>	<b>3 lags</b>	<b>5 lags</b>
Vat does not cause d(debt_n)	0.4 (0.7)	0.5 (0.7)	0.3 (0.9)
d(debt_n) does not cause vat	5.4 (0.00)***	3.3 (0.02)**	2.6 (0.03)**
<b>High external debt defined as % of gdp</b>	<b>2 lags</b>	<b>3 lags</b>	<b>5 lags</b>
Vat does not cause d(debt_n)	0.8 (0.4)	0.5 (0.9)	0.3 (0.9)
d(debt_n) does not cause vat	4.4 (0.01)***	2.9 (0.01)***	2.5 (0.01)***

In general we found that there is always causality from the change in debt to VAT rates, in accordance with our theory. Note that this result is consistent with the one shown in Table 13 for the case in which the debt is defined as a percent of gdp: during recessions causality goes from debt to taxes, as expected according to our model. The result is consistent during recession periods in all lags specifications – 2, 3, and 5 lags.

### 5.3 Checking cyclicity for single countries

Since in our sample single countries are characterized by a relatively small number of cycles, it is important to assure that our results reflect reactions due to cyclicity and not some other spurious phenomena. Thus, we restrict ourselves to countries that stand in the following standard: i) countries with complete data unless since 2000; ii) unless two statutory tax changes took place; iii) the VAT change does not represent a structural reform (which usually implies a high discretionary jump in the VAT rate). In Table 19 we show the results for the nine countries that were available according to this criteria, which include only one developing economy.



Table 19: Time Series Results

Variables	ISR	CAN	ICE	SPA
C	2.810 (2.239)	-1.993 (0.887)*	8.664 (1.971)***	-0.277 (0.840)
D(GDP)	<b>-0.089</b> <b>(0.035)**</b>	<b>-0.039</b> <b>(0.020)*</b>	<b>-0.022</b> <b>(0.009)**</b>	<b>-0.042</b> <b>(0.020)*</b>
D(EX_DEBT)	-0.046 (0.069)	0.076 (0.052)	-0.002 (0.006)	0.020 (0.029)
GOV_PARTY	0.107 (0.297)			
YRS_OFFIC	0.071 (0.106)	0.081 (0.031)**	-0.003 (0.028)	0.092 (0.031)***
AR(1)	-0.035 (0.202)	0.642 (0.296)*	-0.555 (0.178)*	-0.016 (0.300)
AR(2)	-0.294 (0.212)	-0.596 (0.291)*	-0.367 (0.174)*	-0.511 (0.324)
AR(3)		-0.157 (0.272)	-0.273 (0.172)	-0.492 (0.371)
VAT(-1)	0.865 (0.150)***	1.261 (0.135)***	0.656 (0.080)***	1.001 (0.044)***
<i>ADJ*R<sup>2</sup></i>	0.245	0.915	0.301	0.88
<i>DW</i>	1.661	2.180	1.346	2.138

Variables	NOR	POR	SLO	UK	PERU
C	1.795 (1.808)	3.617 (2.070)	-1.993 (0.887)*	29.845 (62.070)	-7.448 (0.622)***
D(GDP)	<b>0.064</b> <b>(0.037)*</b>	<b>-0.102</b> <b>(0.052)*</b>	<b>-0.039</b> <b>(0.020)*</b>	<b>0.194</b> <b>(0.027)***</b>	<b>-0.050</b> <b>(0.022)**</b>
D(EX_DEBT)	-0.031 (0.031)	0.076 (0.074)	0.076 (0.052)	0.078 (0.081)	-0.011 (0.031)
GOV_PARTY				-0.708 (0.145)***	-0.196 (0.148)
YRS_OFFIC	-0.026 (0.032)	-0.021 (0.148)	0.081 (0.031)**	-0.189 (0.032)***	-0.073 (0.029)**
AR(1)	-0.267 (0.205)	-0.126 (0.386)	0.642 (0.296)*	0.189 (0.205)	-0.417 (0.055)***
AR(2)		-0.683 (0.305)	-0.596 (0.291)*	0.304 (0.190)	
AR(3)		-0.352 (0.384)	-0.157 (0.272)	0.489 (0.198)**	
VAT(-1)	0.910 (0.089)***	0.805 (0.103)***	1.261 (0.135)***	0.226 (0.110)**	1.468 (0.032)***
<i>ADJ*R<sup>2</sup></i>	0.946	0.842	0.915	0.894	0.986
<i>DW</i>	1.953	2.143	2.180	2.089	2.475

All countries except Norway and United Kingdom show a procyclical VAT policy. Similarly to the results shown by Vegh and Vuletin (2015), these two countries have a countercyclical policy. An interesting finding is that for specific countries, like Israel and Portugal, the coefficient of procyclicality is quite high, even higher than in developing economies.<sup>24</sup> In fact, the single developing economy analyzed, Peru, is characterized by a milder procyclical policy compared to Israel and Portugal.

#### 5.4 Procyclicality during 2000s

Strawczynski and Zeira (2013) showed that during globalization, after the nineties, there was a reduction of procyclicality in government spending, caused by the fact that investors are forced to learn better the different economies, avoiding abrupt reactions to temporary difficulties confronted by single countries. It is interesting to check whether this result is valid also for taxation. These authors checked this issue using a dummy variable after the nineties. Due to lack of data we check this point from 2000 onwards, using a dummy that equals 1 since 2001 and 0 otherwise.

<sup>25</sup> Table 20 – Procyclicality after 2000

Variables	i = GDP	i = DOLLAR
<b>C</b>	4.708 (0.932)***	4.675 (0.932)***
<b>D(GDP)</b>	<b>-0.034</b> <b>(0.016)**</b>	<b>-0.030</b> <b>(0.016)*</b>
<b>D(GDP)*HIGH_</b> <b>EXTDEBT</b> <b>(i,DEVELOPING)*</b> <b>RECESSION*2000</b>	<b>-0.051</b> <b>(0.030)*</b>	<b>-0.066</b> <b>(0.047)</b>
<b>D(POP)</b>	-0.696 (0.394)*	-0.760 (0.407)*
<b>VAT(-1)</b>	0.764 (0.043)***	0.764 (0.043)***
<b>ADJ*R<sup>2</sup></b>	0.987	0.987
<b>DW</b>	2.033	2.032

<sup>24</sup> The finding about Israel is corroborated by Strawczynski (2014).

<sup>25</sup> The variables that we used in the regressions and were not significant are: D(EXP), INFLATION, SYSTEM, GOV\_PARTY, YRS\_LEFT, YRS\_OFFIC, D(DEBT) & RESERVES\_GDP.

Results in Table 20 show a clear reduction in procyclicality: while the sum of the two coefficients in Table 13 was -0.129, in this table the parallel sum is -0.085, which is still negative but lower than before the 2000s. According to this result procyclicality declines by a third after 2001.

## 6. Summary and Conclusions

Based on government spending and deficits, many papers document that fiscal policy is acyclical or counter-cyclical in developed economies, and procyclical in developing ones. Recently there are attempts to check whether tax policy, as represented by statutory tax changes, follow such patterns. In addition to corroborating such findings, the contribution of this paper is by checking the mechanism at place: countries with a high external debt may be forced to be more procyclical.

First, we show that the median external debt of developing economies is significantly lower than the one for developed economies, with a gap that is higher than one standard deviation. This fact clearly suggests that the threshold level of debt that is acceptable for lenders is lower in developing economies. We built a simple model that shows that when the tax base is thinner, as is the case in developing countries, a Laffer Curve type of model is reflected on a lower threshold external debt.

Second, we run empirical tests on the cyclicity of taxation based on three items: V.A.T., corporate and income taxes. Based on a sample of 47 developed and developing economies during the period 1980-2012 we obtained the following results: i) While corporate and income taxes (represented by their maximal tax rate) do not follow a significant cyclical pattern, the V.A.T. tax rate acts procyclically: it is raised in recession times and reduced in booms. This result is valid for both type of countries; ii) For countries with a high external debt procyclicality exists across the board, but a significant gap in behavior arises when comparing developing to developed economies: in the latter group procyclicality is milder, while in developing economies pro-cyclicality is very intensive; iii) a further look into this phenomenon by

differentiating among recessions and booms shows an interesting finding: while in developed economies procyclicality is very low (-0.004) and almost acyclical, in developing economies the procyclicality is very high (-0.129), posing a huge challenge for policy makers during these periods; note, however, that this last finding is mitigated by the result that during the globalization era, after the 2000s, the procyclicality declines. Finally, we stress that causality tests corroborate in general the direction of causality from cycles or debt to VAT rates.

These findings imply a significant challenge for policy-makers in developing economies, in particular given the fact that the V.A.T. affects all citizen and thus is a general policy issue. One interesting question is whether this behavior is related to the political/procedural process of tax decisions: in many developing economies the decision can be done by the Finance Minister without parliamentary discussion, a fact that may drive policy makers to raise the V.A.T. as a way to cope with crises as quick as possible. If this is the case, a discussion on the right way to change taxes should be pursued. Another way to cope with this issue may be related to the international background of crises. In particular, it would be interesting to inquire into the impact of the globalization process which links lenders from developed economies to governments of developing ones.

## *Bibliography*

- Barro, R. J. (1979). On the Determination of the Public Debt. *The Journal of Political Economy*, Vol. 87, Issue 5, part 1, 940-971.
- Barro, R. J. (1990). On the Predictability of Tax- Rate Changes. In R. J. Barro, *Macroeconomic Policy* (pp. 268-297). Harvard University Press.
- Bernanke, B. S., & Gertler, M. L. (1989). Agency Costs, Net Worth, and Business Fluctuations. *The American Economic Review*, Vol. 79, No. 1, pp. 14-31.
- Bernanke, B. S., & Gertler, M. L. (1990). Financial Fragility and Economic Performance. *Quarterly Journal of Economics*, Vol. 105, Issue 1, pp. 87-114.
- Borensztein, E. (1989). Debt overhang, credit rationing and investment. IMF Discussion Paper No 89/74.
- Bruckner M. and M. Gradstein (2014), "Government spending cyclicality: evidence from transitory and persistent shocks in developing countries", *Journal of Development Economics*, vol. 111.
- Creedon C., Fitzpatrick T. and E. Gaffney (2012), "Ireland's external debt : economic and statistic realities", Bank of Ireland Economic Letters Series, Vol. 12., pp. 1-7.
- Frankel , J. A., Vegh, C. A., & Guillermo, V. (2011). On graduation from fiscal procyclicality. *Journal of Development Economics*, pp. 32-47.
- Gavin, M., & Perotti, R. (1997). Fiscal Policy in Latin America. *NBER Macro- Economics Annual*, pp. 11-61.
- Hameed, A., Ashraf, H., & Chaudhary, M. A. (2008). External Debt and its Impact on Economic and Business Growth in Pakistan . *International Research Journal of Finance and Economics*, pp. 132-140.
- Hercowitz, Z., & Srawczynski, M. (2004). Fiscal Policy Dynamics with A Public- Debt Guideline. *Israeli Economic Review Vol. 2 No. 1*, pp. 91-106.
- Ilzetzki, E., & Vegh, C. A. (2008). *Procyclical Fiscal Policy In Developing Countries: Truth or Fiction?* Retrieved from NBER Working Paper Series: <http://www.nber.org/papers/w14191>

- Izquierdo, A., Romero, R., & Talvi, E. (2007). Business cycles in Latin America: The Role Of External Factors. Center of Economic and Social Reality Studies.
- Jaimovich, D., & Panizza, U. (2007). Procyclical or Reverse Causality? *RES Working Papers 1029, Inter- America Development Bank, Research Department*.
- Kaminsky, G. L., Reinhart, C. M., & Vegh, C. A. (2005). When It Rains, It Pours: Procyclical Capital Flows and Macroeconomic Policies. *NBER Macroeconomic*, pp. 11-82.
- Karagöl, E. (2002). The Causality Analysis of External Debt Service. *Central Bank Review, Central Bank Of Turkey*, 39-64.
- Leung, H. M. (2003). External debt and worsening business cycles in less developed countries. *Journal of Economic Studies vol.30 No.2*, pp. 155-168.
- Nishimura, K., & Ohyama, M. (1995). External Debt Cycles. *Structural Change in Economic Dynamics 6*, pp. 215-236.
- Poterba, J. M., & Rotemberg, J. J. (1990). Inflation and Taxation with Optimizing Governments. *Journal of Money, Credit and Banking, Vol.22*, pp. 1-18.
- Reinhart, C. M., Reinhart, R. V., & Rogoff, S. K. (2012). *Debt Overhangs: Past and Present*. Retrieved from NBER Working Paper: <http://www.nber.org/papers/w18015>
- Roubini, N. (1991). Economic and Political Determinantes on Budget Deficit in Developing Countries. *Journal of International Money and Finance, vol. 10*, pp. S49-S72.
- Roubini, N., & Sachs, J. (1989). Government Spending and Budget Deficits in the Industrial Economies. *NBER Working Papers No. 8*.
- Sachs, J. strAD., & Williamson, J. (1985). External Debt and Macroeconomic Performance in Latin America and East Asa. *Brookings Papers on Economic Ectivity*, 523-573.
- Sorensen, B. E., Wu, L., & Yosha, O. (2001). Output Fluctuations and Fiscal Policy: U.S. State and Local Governments 1978-1994. *European Economic Review, Vol. 45*, pp. 1271-1310.
- Spilimbergo, Symansky, Blanchard and Cottarelli (2008), "Fiscal Policy for the crisis", IMF Staff Position Note, December.

- Strawczynski, M., & Zeira, J. (2013). Procyclicality of Fiscal Policy in Emerging Countries: the Cycle is the Trend. *Fiscal Policy and Macroeconomic Performance, vol. 17, Central Bank of Chile*, pp. 427-466.
- Strawczynski, M. (2014). Cyclicity of Statutory Tax Rates. *Israel Economic Review, 11 (1)*, pp. 67-69.
- Strawczynski, M. (2015). Optimal design of new generations fiscal rules: coping with the business cycle and discretionary tax reductions. *Business and Economics Journal, 6:3*.
- Sturzenegger, F., & Werneck, R. L. (2006). Fiscal federalism and procyclical spending : the cases of Argentina and Brazil. *Económica, Vol. 52.2006*, pp. 151-194.
- Tanzi, V. and H. Zee (2000), "Tax policy for emerging markets: developing countries", IMF Working Paper No 00/35.
- Vegh, C. A., & Talvi, E. (2005). Tax Base Variability And Procyclical Fiscal Policy In Developing Countries. *Journal of Development Economics, No. 78*, pp. 156-190.
- Vegh, C. A., & Vuletin, G. (2014). The road to redemption: policy reponse to crises in Latin America, N.B.E.R. Discussion Paper No 20675.
- Vegh, C. A., & Vuletin, G. (2015). How is tax policy conducted over the business cycle? *American Economic Journal: Economic Policy, 7(3): 327-70*.

## *Appendix*

### **Appendix no. 1 – Countries in our sample**

<b>Developing countries</b>	<b>Developed countries</b>
Argentina	Australia
Brazil	Austria
Chile	Belgium
China	Canada
Costa Rica	Czech Republic
Hungary	Denmark
India	Estonia
Indonesia	Finland
Malaysia	France
Mexico	Germany
Peru	Greece
Poland	Hong Kong
Russia	Iceland
South Africa	Ireland
Thailand	Israel
Turkey	Italy
	Japan
	Korea
	Luxembourg
	Netherlands
	New Zealand
	Norway
	Portugal
	Singapore
	Slovakia
	Slovenia
	Spain
	Sweden
	Switzerland
	UK
	USA



## Appendix no. 2 – Variables Description

<b>Variable Name</b>	<b>Description</b>	<b>Unit</b>	<b>Source</b>	<b>More Details</b>
<b>D(GDP)</b>	Percent change of Gross Domestic Product, Normalized	Percent Change	IMF	WEO
<b>EXTDEBT(GDP)</b>	General Government External Debt	Percent of GDP	CIA, WEO	By the author
<b>EXTDEBT(DOLLARS)</b>	General Government External Debt	Billions of American Dollars	CIA, WEO	By the author
<b>D(EXP)</b>	General government total expenditure	Percent of GDP	IMF	WEO
<b>D(POP)</b>	Population	Persons	IMF	WEO
<b>INF</b>	Inflation, average consumer prices	Percent Change	IMF	WEO
<b>SYSTEM</b>	Political System	1-3	World Bank	DPI2012
<b>GOV_PARTY</b>	Party orientation with respect to economic policy	1-3	World Bank	DPI2012
<b>YRS_LEFT</b>	Years left in current term	No. of years	World Bank	DPI2012
<b>YRS_OFFIC</b>	How many years has the chief executive been in office?	No. of years	World Bank	DPI2012

<b>D(DEBT)</b>	Debt in current prices	Billions, Current Currency	IMF	WEO
<b>RESEVES_GDP</b>	Reserves of the National Banks	אחוז מהתוצר	IMF	IFS
<b>RECCESION</b>	Lower than average GDP growth	0-1	IMF	By the author

### Appendix no. 3 – Unit Root Test

The Unit Root test results show that for VAT, Income tax and Inflation we can reject the null hypothesis of a Unit Root.

<b>Variable Name</b>	<b>ADF</b>	<b>PP</b>
<b>VAT</b>	0.0277	0
<b>INCOME</b>	0.0017	0
<b>CORP</b>	0.5967	0.7226
<b>GDP</b>	1	1
<b>EXP</b>	0.9223	0.4918
<b>POP</b>	0.8999	0
<b>INF</b>	0	0
<b>DEBT</b>	1	1
<b>RESEVES_GDP</b>	0.8812	0.8963

## Appendix no. 4 – Income Tax Cyclicity

In this appendix we show the results of income tax cyclicity, which were mostly not significant.

**Dependent variable: top income tax rate**

Variables Name	i = 0	i = DEV	i = 1-DEV
<b>C</b>	8.816 (5.666)	6.587 (2.990)**	6.587 (2.990)**
<b>D(GDP)</b>	0.026 (0.132)	0.083 (0.101)	0.004 (0.080)
<b>D(GDP)*i</b>		-0.078 (0.096)	0.078 (0.096)
<b>D(EXP)</b>	-0.010 (0.014)	-0.004 (0.003)	-0.004 (0.003)
<b>D(POP)</b>	-1.733 (5.526)	0.671 (1.514)	0.671 (1.514)
<b>INF</b>	0.047 (0.137)	0.019 (0.068)	0.019 (0.068)
<b>SYSTEM</b>	0.263 (2.882)	0.107 (1.751)	0.107 (1.751)
<b>GOV_PARTY</b>	0.222 (0.321)	0.055 (0.162)	0.055 (1.621)
<b>YRS_LEFT</b>	0.143 (0.184)	0.167 (0.107)	0.167 (0.107)
<b>YRS_OFFIC</b>	0.090 (0.167)	0.036 (0.053)	0.036 (0.053)
<b>D(DEBT)</b>	0.000 (0)	0.000 (0)	0.000 (0)

<b>RESEVES_GDP</b>	-0.103 (0.093)	-0.043 (0.036)	-0.043 (0.036)
<b>INCOME TAX(-1)</b>	0.765 (0.052)***	0.801 (0.025)***	0.801 (0.025)***
<b>ADJ*R<sup>2</sup></b>	0.8	0.936	0.928
<b>DW</b>	1.997	1.798	1.798

### Appendix no. 5 – Corporate Tax Cyclicity

In this appendix we show the results of corporate tax cyclicity, which were mostly not significant.

#### Dependent variable: top corporate tax rate

Variables Name	i = 0	i = DEV	i = 1-DEV
<b>C</b>	7.137 (4.354)*	5.926 (2.355)**	5.926 (2.355)**
<b>D(GDP)</b>	-0.040 (0.106)	-0.072 (0.081)	0.014 (0.064)
<b>D(GDP)*i</b>		0.086 (0.076)	-0.086 (0.076)
<b>D(EXP)</b>	-0.003 (0.011)	0.003 (0.002)	0.003 (0.002)
<b>D(POP)</b>	-1.874 (4.386)	-0.415 (1.199)	-0.415 (1.199)
<b>INF</b>	0.054	0.086	0.086

	(0.109)	(0.053)	(0.053)
	0.675	1.137	1.137
<b>SYSTEM</b>	(2.301)	(1.387)	(1.387)
	0.277	0.181	0.181
<b>GOV_PARTY</b>	(0.237)	(0.126)	(0.126)
	0.113	0.154	0.154
<b>YRS_LEFT</b>	(0.147)	(0.085)*	(0.085)*
	0.049	0.003	0.003
<b>YRS_OFFIC</b>	(0.133)	(0.041)	(0.041)
	0.000	0.000	0.000
<b>D(DEBT)</b>	(0)	(0)	(0)
	-0.020	-0.013	-0.013
<b>RESEVES_GDP</b>	(0.072)	(0.028)	(0.028)
	0.725	0.725	0.725
<b>CORP(-1)</b>	(0.060)	(0.033)***	(0.033)***
<b><i>ADJ*R<sup>2</sup></i></b>	0.686	0.887	0.887
<b><i>DW</i></b>	2.043	1.915	1.915

## Appendix no. 6 – Variables' Bibliography

### VAT:

Electronically Papers and Reviews:

[http://www.ic.keio.ac.jp/en/download/jjwbgsp/2000/2000\\_01Introduction.pdf](http://www.ic.keio.ac.jp/en/download/jjwbgsp/2000/2000_01Introduction.pdf)

<http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/indirect-tax-rates-table.aspx>

[http://www.pwc.co.za/en\\_ZA/za/assets/pdf/vat21-september-2012.pdf](http://www.pwc.co.za/en_ZA/za/assets/pdf/vat21-september-2012.pdf)

[http://www.siepr.stanford.edu/conferences/FFReform\\_LA/Tanzi\\_Taxation\\_in\\_LAC.pdf](http://www.siepr.stanford.edu/conferences/FFReform_LA/Tanzi_Taxation_in_LAC.pdf)

<http://www.itdweb.org/vatconference/Documents/VAT%20-%20EXPERIENCE%20AND%20ISSUES.pdf>

OECD Economic Survey: Iceland (2001).

### Papers:

Bernardi L., Barriex A., Marenzi A. & Profeta P. (2007). Tax System and Tax Reforms In Latin America. *società italiana di economia pubblica, Working Paper No. 587.*

Bumpei M. (2011). The Effect of the VAT Rate Change on Aggregate Consumption and Economic Growth. Working Paper Series No. 297. Center of Japan Economy and Business, Columbia University.

Centrangolo O., Sabaini G. & Carlos J. (2009). Tax Policy in Argentina: Between Solvency and Emergency. *Initiative for Policy Dialogue Working Paper Series, Columbia University.*

Go S. D., Kearney M., Robinson S. & Thierfelder K (2005). An Analysis Of South Aafrica's Value Added Tax. *World Bank Policy Research Working Paper No. 3671.*

Koulayev s. (2009). History of Russian Vat. Columbia University.

[http://policydialogue.org/files/publications/ch5\\_Sergei\\_Koulayev.pdf](http://policydialogue.org/files/publications/ch5_Sergei_Koulayev.pdf)

Ruangmalai R. (1993). Value Added Tax in Thailand. *Revenue Law Journal, Vol. 3 Is. 2 pp.135-142.*

Electronically Papers and Reviews:

<http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/individual-income-tax-rates-table.aspx>

[http://www.us.kpmg.com/microsite/tax/ies/2002\\_Flash\\_Alerts/fa02-151.pdf](http://www.us.kpmg.com/microsite/tax/ies/2002_Flash_Alerts/fa02-151.pdf)

<http://www.tradingeconomics.com/>

[http://www.taxreform.gov.hk/eng/pdf/Chapter\\_01.pdf](http://www.taxreform.gov.hk/eng/pdf/Chapter_01.pdf)

### **Papers:**

Gwartney J. D. & Lawson R. A. (2006). The Impact Of Tax Policy On Economic Growth, Income Distribution and allocation of Taxes. *Social Philosophy and Policy*, Vol. 23, Iss. 2, pp. 28-52.

Norrman E. & McLure C. E. Jr. (1997). Tax Policy in Sweden. *The Welfare State in Transition: Reforming the Swedish Model*, University of Chicago Press, pp. 109-154.  
<http://www.nber.org/chapters/c6521.pdf>

### **Corporate Tax:**

Electronically Papers and Reviews:

<http://www.gfmag.com/component/content/article/119-economic-data/12526-corporate-tax-by-country.html#axzz2uuFhGYTt>

<http://www.kpmg.com/Global/en/services/Tax/tax-tools-and-resources/Pages/corporate-tax-rates-table.aspx>

<http://www.lib.uwo.ca/files/business/KPMGCorporateTaxRateSurvey.pdf>

### **External Debt:**

<https://www.cia.gov/library/publications/the-world-factbook/rankorder/2079rank.html>

### **Trade Partners:**

World Trade Organization, Statistics Database, Trade Profiles,

<http://stat.wto.org/CountryProfile/WSDBCountryPFHome.aspx?Language=E>