ISSAI 5411

INTOSAI

Debt Indicators

PSC-Secretariat
Rigsrevisionen • Landgreven 4 • P.O. Box 9009 • 1022 Copenhagen K • Denmark
Tel.:+45 3392 8400 • Fax:+45 3311 0415 •E-mail: info@rigsrevisionen.dk

INTOSAI

INTOSAI General Secretariat - RECHNUNGSHOF
(Austrian Court of Audit)
DAMPFSCHIFFSTRASSE 2
A-1033 VIENNA
AUSTRIA
Tel.: ++43 (1) 711 71 • Fax: ++43 (1) 718 09 69

E-MAIL: intosai@rechnungshof.gv.at;
WORLD WIDE WEB: http://www.intosai.org

Content

November 2010

1.- Introduction

Three kinds of indicators are used for studying public debt's performance. In the first group, there are indicators that measure the risk that current economic conditions generate over public debt. A second group evaluates the government's ability to face upcoming contingencies considering certain expected circumstances. Finally, there are financial indicators which show the liabilities' market performance.

Each kind of indicators has a distinctive feature, making impossible to consider them separately. First, vulnerability analysis entails the need to create indicators that measure and prevent any situation hindering debt's payment, under the current circumstances. These indicators are usually static; they show pictures of the prevailing situation, and they do not allow outlining medium-term prospects. Likewise, it is essential to continuously and dynamically supervise debt's solvency and sustainability, as well as simulate debt's dynamic performance on adverse scenarios. In order to attain such objective, we use sustainability measures, whose purpose is to analyze whether it is possible for the government to maintain the same fiscal position, or if it will need adjustments to keep any vulnerability indicator under control.

The SAI's role in reducing the government's fiscal vulnerability might consist in promoting best practices in public debt management policies. Those include appropriate information generation and using indicators as the ones considered in this analysis.

This paper aims to analyze and describe the most acknowledged vulnerability, sustainability and financial indicators, as well as their implementation's scope and benefits in public debt policy's management.

Examples regarding the Mexican experience for most of the analized indicators and their calculation, have been included in the appendix.

2.- Vulnerability Indicators

As a result of the monetary crisis afflicting several emerging market economies during the last decade of XX century, the study and analysis of fiscal vulnerabilities and their relation with indebtedness turned into a prioritary issue in the economic policy agenda. International institutions disseminated the importance of controlling variables that might threaten debt's sustainability. In this regard, the International Monetary Fund (IMF) implemented a wide-scope program in order to define whether a country is vulnerable to these crises and, if so, to which extent. Emerging market economies, whose growth depends mostly on external financing and other capital flows, are particularly vulnerable to investors' changes of attitude, therefore, the IMF paid special attention to their work on vulnerability assessment.

Most of the work on vulnerability carried out by international institutions involved the improvement of data's quality and transparency. Availability of appropriate and thorough data on international reserves, external debt, and capital flows, increases the ability to identify vulnerabilities, conferring policy makers enough time to carry out corrective measures. At the same time, the IMF has improved its ability to analyze fundamental data through the definition of some of these indicators' critical values, as well as by carrying out stress tests or using early warning system models.

Consequently the IMF underlines that it is essential for each country to be aware of the importance of keeping close attention to indicators of indebtedness and fiscal performance.

Vulnerability indicators encompass public sector, financial sector, households and firms. When economies are under strain, an imbalance in a particular sector may spread problems to other economy's sectors. Thus, uncertainty regarding public deficit may lead to speculative activities on exchange rates, or to undermine the reliability in banks possessing public debt titles, unleashing a crisis in the financial sector.

Among the indicators that international financial institutions consider particularly important to observe we may find:

- Debt indicators; including maturity profiles, reimbursement schedules, sensitivity to interest rates, and debt's composition in foreign currency. Ratios of external debt or exports to GDP are useful indicators to define debt's evolution and reimbursement capability. Within the context of considerable public sector indebtedness, the relationship between debt and tax income is also relevant to ponder the country's reimbursement capabilities.

- Indicators on reserves sufficiency are very important in order to assess a country's capability to avoid liquidity crises. The relationship between reserves and short-term debt is a key parameter to assess the vulnerability of countries with a considerable —yet limited— access to capital markets.

- Financial soundness indicators are used to evaluate strengths and weaknesses of a country's financial sector. They encompass the capitalization of financial institutions, assets quality and out-of-balance positions, profitability and liquidity, as well as credit growth's rhythm and quality. They are used to assess the financial system's sensitivity regarding market risks, for instance, interest rates fluctuation and exchange rates.

- Given the effects of global crisis 2008-2009, national governments have had to come to the rescue of various sectors of the economy, including the financial, whether the State has a legal obligation to provide funding to meet these contingencies, or simply because circumstances force them to do so. Contingent liabilities can lead to large increases in public debt.

In order to fulfill these needs, the international institutions, governments and the academic sector, have developed different proposals to address the issue of vulnerabilities' management. The most acknowledged indicators on this issue are as follows:

Indicators regarding the GDP

After Blanchard's paper (1990)[1] and due to the difficulties of using other indicators, it is common to observe, in specialized literature, that the most generally used indicator is the evolution of debt-to-GDP ratio. This indicator measures the indebtedness level related to the country's economic activity. It implicitly assumes that all GDP resources are available to finance the debt burden, which is not necessarily true. However, this indicator is recognized as the most important one to measure the indebtedness degree, stressing the government's solvency capability. Also, several other indicators have been established using the debt-to-GDP criterion. Some of them try to measure interest payments or debt's amount in relation to different income scales. The main ratios that use this concept for debt assessment are known as Total Debt Indicators. Some of these refer to debt's composition, that is, the amount of external and domestic liabilities, fixed, variable and real rate liabilities' fractions, and the amount of the short, medium and long term debt. These are useful indicators to define debt's evolution and payment capability; they provide certain signals about the worsening or improvement of government's position as well.

Related indicators

- **Debt balance / domestic budgetary revenues**

  This indicator measures the indebtedness level regarding the government's payment capacity. It shows the number of required years to pay the total debt balance. A constant debt-to-GDP ratio may produce different outcomes, given that this ratio reflects the country's size by showing the Government's possibilities to collect revenues compared to the debt burden.

- **Debt service / domestic budgetary revenue**

  This indicator measures the government's ability to pay the debt's service with domestic sources. Debt service is the addition of interest and capital.

[1] Blanchard, Oliver J.(1990), "Suggestions for a new set of fiscal indicators", OECD Working Paper No.79.

- **Current value / domestic budgetary revenue**

  This indicator measures the current cost of debt's service, compared with government's payment capacity.

- **Interests / GDP**

  This indicator shows how burdensome for the country interests are. It can also be interpreted as the country's possibilities to face unproductive expenditures.

- **Interests / domestic budgetary revenue**

  This indicator measures the financial costs as a proportion of the tax revenue. This ratio is generally used as a measure of the public income tolerance to an increase in unproductive expenditure.

However, all these indicators are static, since they are related to a certain period, and usually it is more useful to observe their evolution dynamically. This entails the existence of a correlation between interest rates and macroeconomic variables. The study of the indicators' dynamics allows us to analyze which relationships occur among these variables in time. The basic indicators have been complemented with macroeconomic variables in order to visualize vulnerabilities from other perspectives. Some of the indicators frequently used together with the aforementioned are the following:

- **Foreign debt / exports**

  This ratio measures the foreign debt level as a proportion of exports of goods and services. It shows the debt burden level over exports or the capability of acquiring currencies. This ratio must be used together with debt's service as a percentage of exports; a ratio comparing unproductive expenditures with the foreign currency reserves.

- **Net International reserves / foreign debt**

  This ratio shows the number of times the external liabilities exceed the reserves. This ratio is usually accompanied with foreign debt as a percentage of reserve accumulation's rhythm. If that is the case, it is interpreted as the years required for the current foreign debt to be paid, keeping a constant accumulation rhythm.

- **Amortization / external debt payments**

  This ratio measures the debt amortization level as a proportion of the external debt payment. This indicator, understood as a revolving ratio, shows when a country is refinancing its debt with new issuing. If this ratio exceeds 100, debt is not refinanced with new debt.

Furthermore, there is no consensus among international organizations with respect to setting minimal acceptable levels for these indicators. The following table portrays the minimal suggested levels for emerging countries, provided by two different international institutions:

Minimal Suggested Levels

Vulnerability Indicator	International Debt Relief *	International Monetary Fund**
Debt Service /income	28%-63%	25%-35%
Debt PV/income	88%-127%	200%-300%
Interest/income	4.6%-6.8%	7%-10%
Debt/GDP	20%-25%	25%-30%
Debt/Income	92%-167%	90%-150%

* Debt Relief International: "Key Aspects of Debt Sustainability Analysis", 2007.
** International Monetary Fund, Foreign Affairs Department: Technical Note "Vulnerability Indicators", April 30, 2003 and several research documents.

3.- Sustainability Indicators

Public debt indicators provide us with a first approach regarding its sustainability. These ratios are *ex-post* indicators, that is, they provide historic facts. In contrast, *ex-ante* indicators provide us with information concerning the magnitude of the fiscal adjustment. In specialized literature a common proposal has been to use indicators that indirectly preserve the debt to GDP ratio constant. However, one of the most serious problems is their discretionary nature: The corresponding levels could turn out to be too high or too low, and these indicators give no criteria whatsoever to define it. Therefore, it is necessary to consider these indicators together with public debt ratios.

For the last decades, several political factors have fostered the design and use of fiscal sustainability indicators. The great burden of debt service on some countries' budgets, in addition to secular pressures operating upon expenditure, made fiscal adjustments based exclusively on political discretionary actions very difficult, causing public debt and the corresponding interest payment to become a structural problem in countries with persistent deficits. Within this context, (became increasingly obvious) the need for using indicators to control and analyze countries' capacity to face new debt contracts before sustainability problems could arise. Since current fiscal decisions impose long-term commitments, fiscal sustainability indicators seek to describe these public finances' inter-temporal aspects, based on year-to-year available information. In addition, the link between fiscal aggregates from one year to another is established through fiscal balances, as well as between these and the stock variables. Thus, net public debt represents the accumulation of previous fiscal deficits, while future expenditures corresponding to interest payments of the resulting public debt are incorporated in the expected budgetary balances. Accordingly, systematic fiscal imbalances will translate into future pressure (interest expenditures), which will in turn contribute to new debt accumulation.

Therefore, the development of sustainability indicators has traditionally been supported on models that explicitly take into consideration these

links between fiscal stocks and flows. The inter-temporal relationship between fiscal balances, public debt and interest payment is thus expressed:

$$D_{t+1} = D_t (1 + r_t) + BP_t$$

where D_t corresponds to public debt during the t period, r_t is the debt's interest rate and BP_t is the primary fiscal balance.

Based on this ratio, the basic condition for sustainability emerges, establishing a consistency relationship between different policy variables, that is, between debt's growth, GDP's growth and primary deficit, given a certain interest rate. Early research studies on this subject were based on this condition in order to propose indicators consistent with the fiscal sustainability principle. The main indicators are listed below:

- **Fiscal Consistency Indicator**

  One of the pioneer studies was carried out by Blanchard (1990)[2] where he proposed a sustainability indicator that takes into consideration the consistency of the current tax policy, while keeping the debt-to-GDP ratio constant. This is the indicator of the taxation gap which measures the difference between the existing fiscal burden and the "sustainable" fiscal burden, and it is expressed as follows:

$$t_n^* - t = \frac{\sum^n g}{n} + (r - q)d^* - t$$

  where t_n^* is the fiscal burden which is assumed to be constant over a period of (n) years, the debt-to-GDP ratio in a level d*, g being the expenditure, r being the interest rate and q being the GDP's growth rate.

[2] Blanchard, Oliver J., *op. cit.*

In this sense, this indicator shows out the tax level required to stabilize the ratio debt / GDP, given an expense level, a GDP increase path and an initial debt balance. If the relation is negative, the indicator shows that the economy's taxation pressure is too low to stabilize the debt-to-GDP ratio.

An alternative way to analyze the same restriction in time –that does not privilege instruments' assessment based only in fiscal policy- is through the primary gap indicator. This instrument indicates the primary balance required to stabilize the debt / GDP ratio, given the forecasted trajectories of the real interest rate and the GDP. Therefore, this indicator shows the difference between the future primary balances value required to stabilize the debt / GDP ratio and the initial primary balance.

- **Buiter's Indicator**

  On the other hand, Buiter (1985)[3] proposes an indicator that also requires to calculate the gap between the sustainable primary balance and the primary effective balance, where the sustainability condition is defined starting from a wider net wealth concept than the one implicit in the debt / GDP ratio. Thus, Buiter's Indicator defines this gap as follows:

$$b^* - b_t = (r - q)w_t - b_t$$

  where b* is the ratio debt / sustainable GDP, b is the ratio debt / GDP, w_t is the net / real government wealth value as a GDP proportion, r is the interest rate and q is the product increase rate.

  A positive indicator value shows that the current primary balance is too low to stabilize the net-wealth-value to GDP ratio. Thus, this indicator defines the tax policy as sustainable if this allows

[3] Buiter, Willem H., (1985), "A Guide to Public Sector Debt and Deficits", Economic Policy, Vol.1 (November), pp.13-79.

keeping the net government wealth steady in an *ex-ante* sense. The practical use of this indicator, nonetheless, is limited by important methodological and measuring problems. An accurate net government wealth measure should include a set of elements whose practical quantification is very difficult. Among the assets, one should include, not only the financial and the real capital, but also the lands and minerals, as well as the current value of future taxes (including the social security contributions), among several others even more difficult to quantify. In addition, liabilities should include not only direct public debt, but also elements such as the current value of future expenses for social security and other benefits automatically habilitated, and the adjusted value based on risk of a series of contingent liabilities of difficult quantification.

- **Short term primary gap indicator**

Another commonly used indicator is the short term primary gap indicator, which provides the primary balance level needed to stabilize debt as a proportion of the GDP:

$$BP^* - BP = (r_t - n_t)b - BP$$

where BP* is the primary balance needed to stabilize debt, BP corresponds to the prevailing primary balance, r is the real interest rate trend, n is the population growth's rate and b is the ratio debt / GDP.

If the permanent primary balance exceeds the current primary balance, the primary path is positive. This means that the fiscal policy is not sustainable; because it tends to increase the debt-to-GDP ratio. On the contrary, when the permanent primary balance is lower than the current primary balance, the fiscal policy tends to reduce the debt to GDP ratio.

- **Macro-adjusted primary deficit**

  This indicator was proposed by Talvi and Végh (2000)[4]. Its definition was motivated by the high volatility of macroeconomic variables which makes deficit to vary around the expected value under normal macroeconomic conditions. Authors propose to calculate the primary balance adjusted by fluctuations in macro variables, that is, estimate a long-term potential value. The basic idea of this indicator is to compare the macro-adjusted balance with the estimations of the current values. The indicator is defined as follows:

$$I_t^M = \frac{(r-g)}{1+g} b_{t-1} + d_t^M$$

  where r is the real interest rate for the analysis, g represents the analyzed year's real growth, and d^M_t is the primary macro-adjusted balance. The inconvenient of this indicator lies within the necessity to establish what a "normal economy condition" is.

- **Sustainable fiscal position indicator**

  In a recent work, Croce and Juan-Ramón (2003)[5] present a fiscal sustainability indicator to complement the analysis associated to traditional sustainability indicators using a methodology which explicitly evaluates the tax authority reaction when variables, linked to sustainability of debt, change over time. In order to achieve this, a sustainability indicator was created: the sustainable

[4] Talvi, E. and C.Végh (2000), "The fiscal policy sustainability: a basic framework, How to solve a puzzle?: new sustainability indicators", Washington, D.C., Inter-American Development Bank.
[5] Croce, E. and V.H. Juan-Ramón (2003), "Assessing Fiscal Sustainability: A Cross-Country Comparison", IMF Working Paper 03/145, Washington, D.C. International Monetary Fund.

fiscal position indicator (PFS, according to its initials in Spanish), which explicitly adds a reaction function of fiscal authority, and whose variation over time allows to evaluate how the fiscal policy has reacted whenever the conditions have changed. The reaction function of the fiscal authority is defined as the ratio between the primary effective balance gap and the primary sustainable balance (or goal) as well as in the debt to GDP ratio. If we analyze this indicator statistically, it may be seen as complementary to the indicators already discussed, and explains how income and expenditure policies (which define the primary balance) are pointed to create a convergence of the debt-to-GDP ratio, to an *ex-ante* sustainable (goal). In the other hand, if interpreted dynamically, this ratio indicates us how the tax authority has reacted from a year to year (through innovations on its fiscal policies), while facing variations in the existing gap between the indebtedness level and sustainable level.

In order to understand the effect on the primary balance level required to stabilize the debt/GDP ratio produced by variations in the long term macroeconomic conditions, the reaction function is compared to the evolution of the conditions defining the stability of the debt / GDP ratio, that is, the relation between the long term interest rate and the GDP's long term growth rate. Thus, the higher long-term interest rate in relation to the GDP's growth rate, the higher primary surplus required to stabilize the ratio debt / GDP in the time and vice-versa. The proposed indicator, therefore, is presented as:

$$I_t^{PFS} = (\beta_t - \lambda_t) = \frac{1 + r_t}{1 + g_t} - \frac{BP_t - BP^*}{b_{t-1} - b^*}$$

where β is the relation between the real interest rate (r) and the GDP's growth rate (g) and λ is the function of fiscal policy's reaction, defined as the reason between the primary effective balance gap (BP) related to the primary sustainable balance or goal (BP*), and the current gap between the ratio debt / GDP from the last period (b) respect to the ratio debt / sustainable GDP or

goal (b*). Thus, if the ratio debt / GDP of the last period is higher than the goal, it will converge to b* if, and only if

$$| \beta_t - \lambda_t | < 1.$$

Therefore, in static terms, a value greater than or equal to 1 implies that the fiscal authority has a fiscal policy inconsistent with the convergence of the debt / sustainable GDP ratio; a value less than 1 indicates that the fiscal position is consistent with the conditions required to ensure sustainability. Dynamically, although the PFS may vary from one period to other, due to changes on variables involved in determining sustainability (growth rate, interest rate, debt's balance), it is assumed that they are exogenous to the fiscal authority and its only chance to adequate the fiscal position is through variations in the primary balance gap.

- **Currency availability indicators**

This indicator was proposed by Calvo, Izquierdo and Talvi (2003)[6]. The initial assumption is that volatility of capital flows variables is higher than that of macroeconomic variables. Thus, a crucial element to debt sustainability is its composition compared to the composition of the industrial production (tradable and non-tradable goods). This indicator compares the external debt-to-internal debt ratio with the proportion of tradable goods related to the non-tradable goods in economy:

$$b = \frac{B + eB^*}{y + ey^*} \quad (a)$$

where b is the debt / GDP ratio , B Is the debt in terms of non-tradable goods, e is the type of real exchange, B* is the debt in terms of tradable goods, y the GDP of non-tradable goods and y* the GDP of tradable goods.

[6] Calvo, G.A., A. Izquierdo and E. Talvi (2003), "Sudden Stops, the Real Exchange Rate, and Fiscal Sustainability: Argentina's Lessons", NBER Working Paper, No.9828, Cambridge, Massachusetts, National Bureau of Economic Research.

A particularly relevant case to the use of this indicator occurs when:

$$\frac{B/_{eB^*}}{y/_{ey^*}} = 1 \quad (b),$$

This happens if debt's composition and production are perfectly consistent. When this condition occurs, the variations in the exchange rate have no effects on fiscal sustainability implying a constant debt-to-GDP ratio. On the other hand, when the value is closer to 0 instead of 1, then there is a high grade of sensitivity of the fiscal position to variations in real exchange rate. Thus, to estimate the indicator (a) is necessary to define (b) and, therefore, the indicator to be estimated is:

$$\frac{B/_{eB^*}}{y/_{ey^*}} = I \quad (0 \leq I \leq 1)$$

Fiscal Sustainability Indicators with Long-Term Restrictions

Debt sustainability is a priority issue in current economic policy discussions. Nevertheless, debt and fiscal sustainability indicators fail since they do not represent long-term budgetary restrictions. That is, eventhough the aforementioned fiscal sustainability indicators are useful to study the behavior of certain variables, they do not allow making estimations with restrictions that will appear in the mid- and long-run, such as the agreed contingent liabilities or future interest payments, among others. In order to try to cover these possible upcoming events, Bagnai (2003)[7] presents two indicators consistent to these restrictions, in order to keep debt sustainability.

The first indicator explored by Bagnai considers that, in the mid- and long-run, a country's generation will act as a source of government funding: debt (financial markets) and tax payment (macroeconomic).

[7] Bagnai, Alberto, "Keynesian and neoclassical fiscal sustainability indicators, with applications to EMU member countries", University of Rome I, Department of Public Economics.

The objective of these considerations is to keep the debt-to-GDP ratio (B/y) stable in time. Dynamic fiscal stability will be reached only when the following two conditions are met:

$$\frac{B}{y} < \tilde{b} = k\left[\frac{\varepsilon\,(1+n)\,\tau}{1-\tau}\right] - \{n - r\,(1-\tau)\}\Phi \qquad (a)$$

$$\Phi \equiv 1 - \eta\,(1-s) + \left[\frac{\varepsilon\,(1+n)}{r\,(1-\tau)} - \frac{s\delta\,(1+\varphi)}{\varphi}\right] < 0 \quad (b)$$

where n is the population growth rate, τ is the income tax, s is the income proportion that is saved, r is the real tax rate, δ is the elasticity of savings related to the interest rate, ε is the investment elasticity related to the interest rate, η is the elasticity of consumption as a proportion of income, k is the capital-to-GDP ratio and φ is the elasticity of the product as a proportion of physical capital, which means the response of output to changes in the stock of the country's infrastructure. If debt exceeds the $\tilde{b}$ level, economic system is dynamically non-sustainable and debt will respond to any exogenous shock following an explosive trajectory.

Moreover, and following the Buiter indicator, it is observed that, when inter-temporal restrictions are introduced, the equilibrium steadiness depends on the fiscal and monetary policies rules. When a monetization coefficient is zero and public expenditure endogenously vary with the increasing of debt, then the necessary condition to achieve a dynamic equilibrium is the following:

$$\tau - r\,(1-\tau)\,w + \alpha\,(1-\tau) + \frac{L}{L_1 y}\left[B + y\frac{\alpha}{r}\right] > 0 \qquad (a)$$

where y is GDP, α is the income proportion by the total income capital, L represents currency, L_1 is the first derivate of the former variable respect to the real interest rate and w is the wealth as a proportion of the GDP. This expression, in turn, depends of the public debt balance in real terms B and can be expressed as follows:

$$\frac{B}{y} < b^* \equiv -\left(\frac{\left[\frac{\tau}{1-\tau} - rw + \alpha\right]\psi + \alpha}{r}\right) \qquad (b)$$

where money's demand to interest rate elasticity,

$$\psi = (1 - \tau)L_1 r / L < 0.$$

The condition (b) is directly proportional to the absolute value of Ψ, this feature resulting from the crowding-out represented by the model. That is, when an expansive fiscal policy is funded by deficit, the interest rate needs to be increased in order to induce the economic agent to reallocate its balance portfolio to the new debt. The greater the response of money demand to the interest rate, measured by Ψ, the lower the interest rate rising required in order to restore the equilibrium in the portfolios of the private sector agents.

4.- Financial Debt Indicators

There are two types of risks, which can be classified in the following categories:

- Market Risk

  The market risk is the loss that an investor may face due to movements in market prices or in the so-called risk factors, such as interest rates, exchange rates, etc. Also it is possible to be defined as the possibility that the net present value of portfolio reacts adversely to changes in macroeconomic variables that define the price of the instruments comprising the portfolio. The most common risk markets indicators are:

  - Interest Rates and Yield Curve

    The concept of interest rates is commonly used to describe the growth of an associated potential gain to an amount of money. These are the gain measure for those who decide to save. Capital markets provide an efficient mechanism to transfer capital between economic agents. The lender receives an interest for the temporally use of his capital, for that reason, the efficient formation of interest rates for different terms depends on the efficiency of the money market. For the government, a more consolidated market represents the possibility of reaching better financing conditions at any term. Therefore, it is necessary to know the interest rates for each type of value and to count on a way to compare them on the same basis. When this happens, it is possible to obtain an inter-temporal structure of interest rates, capable of show in

a consistent manner the interest rates in different terms and periods. This last indicator is known as the yield curve, that can be increasing or decreasing and its slope can be explained of three different manners, as shown below:

Position and Slope of the Yield Curve

Slope	Market Expectations Theory	Liquidity Preferences Theory	Market Segmentation Theory
Positive	It is expected that short term rates rise	Positive premium to liquidity	Excess of supply regarding to demand in long terms
Negative	It is expected that short term rates decrease	Negative premium (punishment) to liquidity	Excess of supply regarding to demand in short terms
Horizontal	It is expected that short term rates remain the same	No liquidity premium	Equilibrium between supply and demand in all terms
Concave	It is expected that short term rates rise and, subsequently, decrease	Positive premium to liquidity followed by a negative premium to liquidity	Excess of supply regarding to demand in mid terms

- Weighted Average Maturity and Duration

These statistics measure the average term in which the issuer must face their debt's service. The weighted average maturity has a limited use because it only considers payment dates of the principal, while the duration also includes the interests' payment dates. The duration is obtained by calculating the average maturity of the bond related to payment terms (coupons and principal), weighing each one of the terms associated to

the referred flows with its respective amounts in present value. As a rule, the longer the duration of a bond, the lower the associated risk, in average. Lower proportions of government debts will be adjusted to the interest rates new level.

- Modified Duration

  It is used to measure the risk of a bond, indicating the impact on the prices as a result of interest rates' variations. If a portfolio's modified duration is 0.40%, this would indicate that a 1% interest rate variation the value of portfolio will diminish around 0.40%.

- Standard Deviation

  The standard deviation indicates the average detachment between a data set and its average value. For instance, if the interest rate of a bond is 1.72% and its standard deviation is 0.23%, the average yield could vary between 1.49% and 1.95%.

- Risk-Adjusted Yield (RaR)

  The risk-adjusted yield is a quantitative analysis that indicates the way in which an expected interest rate associated to an issue, could cover the expected loss due to an increase in such interest rate. This indicator shows the number of times that the loss expectations surpass the expected earnings. Thus, the lower the indicator, the better position the portfolio will have to face eventual crises that can increase the financial cost.

- Amortization Schedule

  An amortization profile is used to distribute on a timeline the capital payments. Several administration strategies can

be used for the amortization schedule, but the main idea is to create a regular series of amortizations that can minimize the risk of refinancing large debt portions in case of adverse market conditions.

- Cost at Risk (CaR)

  Together with the duration and the amortization schedule, CaR is used for risk-management purposes in a debt portfolio. This indicator allows evaluating the consequences in the cost of different issue strategies. The CaR quantifies, with some statistic significance, the maximum level that could reach the financial cost. Its calculation is based on the distribution of costs associated to different risk-variables' scenarios.

- Credit Risk

The credit risk is defined as the potential loss resulting of the default of a counterpart in a financial transaction or some of the terms and conditions of the deal. Also it is conceived like the deterioration of the counterpart credit quality, or the weakening of an originally agreed guarantee or collateral.

Negative variations in bonds' prices can arise from uncertainty regarding the issuer's payment promise in the assessment of the investors. Deterioration in this perception of the financial markets will doubtlessly cause a lower interest rate levels impacting government instruments, thereby increasing the risk of financing costs.

- Credit Default Swap (CDS)

  An important innovation on this matter has been the development of *Credit Default Swaps* (CDS). CDS provide an insurance against bankruptcy risk of any entity. On a CDS contract, the

seller of the protection is forced to buy the bond of reference at its par value in case of a credit event. The purchaser periodically makes payments to the seller during the term of the contract or until a credit event occurs, whichever happens first. The regular payment, expressed like percentage of the national, known as the CDS *spread*, or the CDS premium. The CDS *spread* represents an alternative credit-risk price of the entity.

The financial agents have found in CDS not only the possibility to support the bonds and loans; these instruments have also proved being good credit-quality indicators, an attribute which cannot be observed directly. Several studies that analyze this relation have found that macroeconomic changes cause that the average level of the CDS is modified of anticipated way. This implies that the CDS behavior, particularly in an upcoming crisis scenario, will be followed by a similar movement in the bond market.

- Reputation Risk

Reputation Risk refers to losses resulting from untaken financing opportunities, due to issuer's bad reputation for a default or deteriorating fiscal situation. If the market perceives that the Government is vulnerable, the private agents will eventually consider modifying investment portfolios or demand a greater risk premium, increasing the financial cost for the Government. A country's reputation can be analyzed through credit ratings and sovereign indicators.

  - Credit Ratings

This variable represents the perception that the private agents have about the country's debt situation. The credit quality can be analyzed from two perspectives. On the one hand, there are

rating agencies that assign a qualification to the debt based on established criteria. A high rate results when the rating agent finds few indications of future bankruptcy or liquidity problem that compromise the regular payments. On the other hand, a low rate represents a scenario that the commitments already contracted cannot be fulfilled.

- Sovereign Risk Indicators

  Sovereign Risk is an index intended to measure the degree of risk operating within a country for foreign investments. When investors decide where and how to invest, they seek for earnings' maximization; they also take into account the risk of less than expected earnings, or loss occurrence. In statistical terms, earnings are usually measured according to the expected yield; and the risk, according to the expected yield's standard deviation. Due to the great amount of available information and the cost of obtaining it, there are asymmetry information problems, and mainly, the impossibility of knowing the future, it is hard to accurately anticipate an investment's expected yield and standard deviation.

  However, indexes are elaborated to decrease the cost of information, while taking advantage of the existing scale economies when searching information.

  The sovereign risk index is a basic indicator of the economic situation of a country and is used by international investors as a supplementary element to make decisions. The sovereign index equals the over-rate that a country pays for its bonds as compared to those of the United States Treasury. In other words, it is the difference between the yield of a national public security issued by the government and the yield of a similar security issued by the United States Treasury.

For barely developed countries within the global financial market, the sovereign risk index has become a fundamental variable; on one hand, it is used as an indicator of the county's economic situation and of the rating agencies' expectations regarding future economic evolution (debt payment capability, in particular); on the other hand, the sovereign risk is a reference of the indebtedness cost that the country can face. This indicator is therefore a crucial element with two major implications.

First, the more deteriorated the sovereign rating is, the larger it will be the indebtedness cost; furthermore, the larger this cost is, the lesser economic policies can be handled and the larger the risk of default will be present, resulting again in increases of such sovereign index.

In second place, high sovereign risk levels will have an impact on investment decisions, thus causing diminished fund flows and increasing interest rates within the country. In other words, not only the governmental, but also the private sector's cost of debt is susceptible of increasing, with negative effects in the rates of investment, growth and employment.

Although the sovereign risk index seems to assess debt performance, this indicator by itself cannot describe the economic cycle course.

Analysts generally consider that a decrease in the sovereign risk index is associated to a lower indebtedness cost in the private sector and a raise in investment, growth and employment. This interpretation is based on the neoclassic model and under the perfect-mobility assumption regarding physical resources, financial capitals and perfect information.

However, there are cases in which the governmental fiscal solvency can improve (a decline in the sovereign risk) and, at the same time, the private sector's expected future productivity index can worsen. This is the case, for example, of an increased fiscal burden imposed to fund the State's unproductive deficit, thus allowing financing its own operation, or financing less-productive investments scarcely associated with the private sector's investments, or simply addressing the cost of debt contracted in the past. In this case, it is possible that decreased interest rates resulting from a reduced sovereign risk level do not compensate for productivity downfalls.

Rating agencies usually generate these indicators; for instance, the EMBI and the GBI are calculated by JP Morgan and represent the two main sovereign risk indicators for emerging economies. The first one considers external bonds, while the second one considers internal bonds.

- Rating Agencies

Rating agencies are the companies that summarize the information available of regarding a certain country, while specifying parameters and levels for the different analyzed indicators. Therefore, rating agencies are private companies specialized in country assessment —from a political, economic and social point of view— that produce a rating. This rating is used as an instrument guiding investment decisions; it also allows risk mitigation when investing on different borrowers' financial assets (such as countries, State-owned companies, federal states, cities or companies).

In other words, what these agencies qualify is a sovereign issuer's capacity and willingness to return issued debt, including the principal as well as interests.

Agencies emphasize within their ratings the possible course of fiscal and monetary policies, as well as the resulting levels and trends consequential with the overall financial balance of governments, the public debt volume, and inflation. The assessment of these monetary and fiscal policies is carried out within the context of political stability, and of economic and income structures.

However, agencies believe that assessment cannot be based only on indicators' and ratios' analysis, both political and economic ones, but instead a reference comprising the whole country should exist, thus including public and private debtors.

This becomes important given the magnitude of the global crisis of 2008-2009, which created problems in the financial sector of the United States that had an impact in all economies of the world, forcing national governments to take steps to reduce adverse effects. The fiscal analysis should focus not only on explicit direct liabilities of the state, including payments on sovereign debt, budget expenditures for the current year and the longer-term expenditure stipulated by law (such as salaries and pensions public officials and in some countries, the comprehensive social security system).

The classification criteria are based on two crucial aspects. First, failure of a country in fulfilling its obligations can result from a chronic currency-generation deficiency, usually stemming from political and economic conditions. In second place, failure of a country in complying with its international debt obligations can result from a short-term liquidity crisis.

The financial external factors limiting government's access to international currencies (needed to ensure timely payment of obligations in foreign currency) are additionally analyzed.

As outcome, the sovereign ratings in foreign currencies also evaluate the resilience shown by a country's balance of payments, as well as its external debt and liquidity situations.

Finally, regarding the classification of sovereign debt risk, agencies portray the global perception regarding the financial condition of a country.

Information provided by these research companies is used by investors as signs depicting future payment-assurance conditions regarding acquired debt documents within a certain country, thus impacting market behavior and its demand for securities. Hence, there is a great incentive of controlling all variables and indicators (used to summarize credit information), since markets respond to agency-provided information.

5.- Final Consideration

These three major groups of indicators (vulnerability, sustainability and financial) give us the possibility to understand the public debt phenomena from different perspectives, thus allowing governments to control and manage public debt on a sound credit-practice basis.

SAIs can play an active role in promoting the implementation of best lending practices and debt management, including the use of various types of indicators discussed in this document. They can also encourage governments to focus more on monitoring of vulnerabilities, and to give high priority to risk management, production and publication of quality financial information. The improvement of regulation and supervision in the financial services sector in line with international standards should not be set aside. This will reduce the vulnerability of public debt to events affecting the private sector.