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# SOVEREIGN DEBT CRISIS
# THEORETICAL AND PRACTICAL ASPECTS

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*Abstract: The economic crisis we are facing can be considered as the law that governs the economic evolution of countries worldwide, now and for the next 10 years. The current problem and part of the economic crisis, sovereign debt, must be approached both theoretically and practically in order to understand and improve monetary financial mechanisms, but also to find methods to diminish countries' dependency to institutions such as the IMF and World Bank, etc.*
*        This paper aims to look at both theoretical and practical aspects of the sovereign debt crisis, as it expresses the degree of dependency debtor countries have in relation with creditor institutions and other countries.*

*Keywords: economic crisis, sovereign debt crisis, ecconomic-mathematical model to highlight probability of foreign debt crisis*

## 1. INTRODUCTION

Countries defaulting, or basically bankrupting, has become an increasingly intense problem in the past 20 years, starting from the 80's. Table 1 shows aspects of what has happened in the economic sphere in the past 30 years.

| Country | Number of crisis | Years in Crisis | Crisis episode (entry-exit) |
|---|---|---|---|
| Algeria | 1 | 6 | 1991–97 |
| Argentina | 3 | 15 | 1995–96, 2001– |
| Bolivia | 2 | 13 | 1986–94 |
| Brazilia | 3 | 16 | 1998–00, 2001– |
| Chile | 1 | 8 | 1983–91 |
| China | 0 | 0 | |
| Columbia | 0 | 0 | |
| Costa Rica | 1 | 10 | 1981–91 |
| Cipru | 0 | 0 | |
| Republica Cehă | 0 | 0 | |
| Republica Dominicană | 1 | 22 | 1981– |
| Ecuador | 2 | 16 | 1982–96, 1999–01 |
| Egipt | 1 | 1 | 1984–85 |
| El Salvador | 1 | 16 | 1981–97 |
| Estonia | 0 | 0 | |
| Guatemala | 1 | 1 | 1986–87 |
| Ungaria | 0 | 0 | |
| India | 0 | 0 | |
| Indonezia | 2 | 5 | 1997–01, 2002– |
| Israel | 0 | 0 | |
| Jamaica | 3 | 14 | 1978–80, 1981–86, 1987–94 |
| Iordania | 1 | 5 | 1989–94 |

| | | | |
|---|---|---|---|
| Kazakhstan | 0 | 0 | |
| Republica Coreei | 2 | 4 | 1980–82, 1997–99 |
| Latvia | 0 | 0 | |
| Lituania | 0 | 0 | |
| Malaysia | 0 | 0 | |
| Mexic | 2 | 10 | 1982–91, 1995–96 |
| Maroc | 2 | 6 | 1983–84, 1986–91 |
| Oman | 0 | 0 | |
| Pakistan | 1 | 2 | 1998–00 |
| Panama | 1 | 14 | 1983–97 |
| Paraguay | 1 | 7 | 1986–93 |
| Peru | 3 | 19 | 1976–77, 1978–81, 1983–98 |
| Philippine | 1 | 10 | 1983–93 |
| Polaonia | 0 | 0 | |
| România | 0 | 0 | |
| Rusia | 1 | 3 | 1998–01 |
| Republica Slovacă | 0 | 0 | |
| Africa de Sud | 4 | 7 | 1976–78, 1985–88, 1989–90, 1993–94 |
| Thailanda | 2 | 2 | 1981–82, 1997–98 |
| Tunisia | 1 | 7 | 1991–92 |
| Turcia | 2 | 7 | 1978–83, 2000–02 |
| Ucraina | 1 | 3 | 1998–01 |
| Uruguay | 3 | 6 | 1983–86, 1987–88, 1990–92 |
| Venezuela | 3 | 10 | 1983–89, 1990–91, 1995–98 |

**Table[1] 1.** *Countries defaulted and the periods of debt crises*

Presented in table 2 are countries with sovereign debt crises in the 80's and 90's.

[1] Realized by Paolo Manasse and Nouriel Roubini

| 1991 | Algeria | 1984 | El Salvador | 1984 | Niger |
|---|---|---|---|---|---|
| 1983 | Argentina | 1995 | El Salvador | 1972 | Nigeria |
| 1978 | Bangladesh | 1987 | Ethiopia | 1986 | Nigeria |
| 1991 | Bangladesh | 1985 | Guatemala | 1987 | Panama |
| 1983 | Brazil | 1983 | Haiti | 1984 | Paraguay |
| 1982 | Burkina Faso | 1976 | Honduras | 1983 | Peru |
| 1986 | Burundi | 1982 | Honduras | 1984 | Philippines |
| 1979 | Cameroon | 1998 | Indonesia | 1984 | Senegal |
| 1985 | Cameroon | 1989 | Jordan | 1989 | Senegal |
| 1973 | Chile | 1990 | Kenya | 1972 | Sierra Leone |
| 1983 | Chile | 1998 | Korea | 1992 | Sri Lanka |
| 1985 | Colombia | 1990 | Lesotho | 1976 | Sudan |
| 1981 | Costa Rica | 1980 | Madagascar | 1998 | Thailand |
| 1987 | Cote D'Ivoire | 1982 | Malawi | 1988 | Trinidad & Tobago |
| 1976 | Dominican Rep. | 1987 | Malawi | 1991 | Tunisia |
| 1982 | Dominican Rep. | 1982 | Mexico | 1979 | Turkey |
| 1983 | Ecuador | 1985 | Morocco | 1984 | Venezuela |
| 1986 | Egypt | 1978 | Nicaragua | 1975 | Zaire |
| | | | | 1978 | Zambia |

**Table 2.** *Episodes of Debt Crisis by Year and country*

## 2. THEORETICAL ASPECTS

### 2.1. Conceptualizing the sovereign debt crisis

In the following we will present theoretical aspects regarding the sovereign debt crisis.

A country is defined to be in a situation of debt crisis if:

- there are considerable remnant payments or foreign obligations interest of commercial creditors (banks or bonds) surpasses 5% of total remnant commercial debt
- there is a rescheduling or debt restructuring accord with commercial creditors, counted in GDF (Global Development Finance).

In specialty literature, sovereign debt analysis is divided into four categories:

- theoretical models of sovereign debt
- empirical studies regarding debt crisis determining factors
- empirical studies regarding credit rating agency's prediction powers
- empirical studies regarding determining the degree of sovereign debt distribution

Defaulting, a particular aspect of sovereign debt crises, is approached in most specialized literature. According to these studies, there is a series of macroeconomic factors that influence

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the probability of defaulting and inability to pay sovereign debt.

## 2.2. The awareness stage

Sachs, Tornell and Velasco (1996) created a study regarding countries affected by the Tequila crisis, by analyzing the proportion of short term debt (STD) in the overall capital flow, by verifying the existence of a correlation between STD and economic vulnerability of the analyzed countries.

On the other hand, Radelet and Sachs (1998) and Rodrik and Velasco (1999) have shown that the proportion between DTS and reserves help predict capital flow. As their analysis is based on small samples, their conclusions are simply suggestive. Eichengreen and Mody (1998, 1999) demonstrated that the spread risk of loans on emergent markets and bonds leads to an increased ratio between STD and the emitting country's reserves.

Obstfeld (1996) and Krugman (1998) developed a model in order to exit the UME from the second and third generation of monetary crisis. They treat the UME as the promise to participate in a fixed exchange rate program and introduce a control variable for the government, the decision to opt in or out of the euro zone. At the same time, defaulting procedures for sovereign states were analyzed (Sachs, 1995; Fischer, 1998; Miller and Zhang, 2000). By using bigger samples, Frankel and Rose (1996) and Milesi-Ferretti and Razin (1998) did not discover any proof of liquidity effects on monetary crises.

Diamond and Rajan (2000), in the theoretical model they developed, show that when economic circumstances deteriorate, countries with inadequate financial infrastructures, such as the countries affected by the Asian crisis ca only finance short term investments.

Jeanne (2001) shows that the government in a vulnerable country engages in fiscal adjustment only in when it is sufficiently threatened by foreign funds withdrawal, and in order to avoid this phenomenon, creditors must lend money on short term.

In 2010, the financial crisis lead to increasing public debts in the eurozone, so that many economists fear that the euro could collapse (Arghyrou and Tsoukalas, 2010).

International risk factor was vital in determining the spread of the crisis (Codogno et al (2003), Geyer et al (2004), Longstaff et al (2007), Barrios et al (2009), Sgherri and Zoli (2009), Manganelli and Wolswijk (2009), Favero et al. (2010)). This effect was especially powerful during the hardening of financial international conditions (Haugh et al, (2009), Barrio et al (2009)), especially for countries with a high level of public debt (Codogno et al (2003)).

This point of view is contested: Manganelli and Wolswijk (2009) raise the question of whether or not the sanctions imposed by economic markets were sufficient to encourage EU governments to change unsustainable fiscal policies.

The role of liquidity risk is controversial. Codogno et al. (2003), Bernoth et al. (2004), Pagano and Von Thadden (2004) and Jankowitsch et al. (2006)found a limited effect of lack of liquidities in the spread of the economic crisis. At the same time, Gomez-Puig (2006), Beber et al. (2009), and Manganelli and Wolswijk (2009) plead in favor of a more prominent effect, especially in times when financial conditions are rough, times with high interest rates.

Specialized literature that cover crisis periods reveal a consensus on two points of view:

- firstly, the vast spread noticed in the EU is primarily determined by the increased risk factor on a global level. In this process, the local financial sector's role is crucial in its symbiosis with the global financial system, by rising transformation risk into sovereign risk by two methods (Gerlach et al, 2010):
- during periods of governmental financial difficulties, it could be forced to recapitalize bank with taxpayer money, increasing its financial obligations
- lack of liquidity in the banking sector limits credit given to the private sector, causing economic recession, accentuation of fiscal unbalances. Attinasi et al. (2009), Sgherri and Zoli (2009), Mody (2009), Barrios et al. (2009), Gerlach et al. (2010) and Schuknecht et al. (2010) established the importance of the risk factor on a global level during crisis periods and the impact the former has on the latter, through the financial sector
- secondly, during the market crisis, fiscal unbalances and other macroeconomic unbalances (for example, excessively large current accounts) were sanctioned. Markets place even greater pressure on fiscal imbalances (Barrios et al (2009), Haugh el et al (2009), Manganelli and Wolswijk (2009 ) and Schuknecht et al. (2010)). On the other hand, reality shows that even though a country's role with a specific liquidity risk is not to be ignored, it is still fairly limited (Attinasi et al. (2009), Sgherri and Zoli (2009), Barrios et al (2009), Haugh et al. (2009), and Manganelli and Wolswijk (2009))

## 3. PRACTICAL ASPECTS

A country is defined as being in a „debt crisis" when it is classified implicitly so by Standard&Poor, or when it receives a large non-concessional loan from the IMF (where large means in excess of 100% of the quota). Standard & Poor rates sovereign emitters implicitly when a government cannot fulfill principal debt or interest for external obligations at the due date (including exchange offers, capital swap of debts, or cash buyback).

## 3.1. European sovereign debt crisis – 2010 to present

In 2010, the financial crisis lead to further public debt in the Eurozone, so that many economists fear the euro might collapse. Countries with problems include Greece, Portugal, Spain, Ireland and Italy. Diffusion of bond yields between these countries and other EU members, particularly Germany, has dramatically increased.

On the 2nd of May 2010, Euro countries and the IMF agreed to a 110 billion euro loan to Greece, which, in exchange for it, promised an austerity regiment. In July 2011, Greece asked for a new loan, and problems overflowed for Spain and Italy.

In August of the same year, the ECB showed that it is prepared to buy Italian and Spanish bonds to counteract the sovereign debt crisis of these countries. However, the ECB has potential to buy only half of Italian and Spanish transitioned debt.

## Characteristics of affected EU countries particularly affected by the sovereign debt crisis

**Greece**
- annual deficit is under 3%, but not of gross public debt, under 60% of its GDP
- Standard and Poor reduced Greece's sovereign rating under the minimal BBB- requested by the ECB from a major rating agency
- has approximately 360 billion Euro in debts and potential credit losses (12 billion euro from the EU economy)

**Portugal**
- little under 90% of GDP, still smaller than Greece's 113%

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- savings rate was 7.5% of GDP compared to Greece's 6%
- Italy had a savings rate 17.5%, 20% Spain, 19% France and 23% Germany
- country ratings for long term bonds were reduced by Moody to Ba2, which is two levels lower and attributes a negative perspective, which implies possibility for further degradation

**Ireland**

- passive external & passive internal
- large basis for monetary aggregates, such as M1, went up by 20-30% anually
- choosing bankruptcy instead of salvation
- stocks dropped 95% compared to their maximum
- Irish Crown went down 60% compared to the Euro

**Italy**

- Italy's debt reaches 120% of GDP in 2011 and will then slowly drop to 118% by the end of 2016
- sovereign insurance bonds against defaulting risks went up 11% when the EU finally gave Greece the cash flow necessary to pay dues in July
- Spanish and Portuguese insurance bonds went up 3%, starting from july 2011, and credit default swap for Italian debt went up to 6.7%
- France's debt is 85% of GDP and is expected to grow over the following years
- as of July 2011, Italian bonds had a 4.9% spread over German bonds reaching approximately two percentage points (Greek-German spread is 13%)
- further interest rate growth could push prognosis for Italy's debt closer to Greece's

- Italy has almost 2000 billion Euro in debt

**Spain**

- unemployment rate in Spain went up to 20.09% (4.6 million people)
- in 2009, unemployment rate between 16 and 24 years was 42.9%, the greatest in Europe
- real estate bubble growth: 760000 houses were constructed in a year, over 650000 were begun in that year in France and the UK, with a total population almost triple that of Spain

In the US, banks are more exposed in Italy than in any other country in the eurozone, worth 269 billion dollars, according to Barclays. Bank exposure in Spain follows the national exposure, with deficits ranging up to 179 thousand billion dollars.

### 3.2. Economic-mathematical model to highlight probability of foreign debt crisis

The main equation of the empirical model (Detragiache, Spilimergo, 2011) is as follows:

$$P = \alpha_1 s + \alpha_2 c + \overline{\beta X} + \eta \quad (1), \text{ where:}$$

$P$ – is the probability of foreign debt crisis

$\overline{X}$ - is the exogenous vector of macroeconomic fundamental variables and loan characteristics

$s$ – is the ratio between the short term loan from the total loan

$c$ – is the sum of the credit and interest at maturity level, t, because long term credits (as a ratio of total debt), which will be from here on called service debt, its ratio in the total external loan that must be returned at time $t$.

**Observations:** Variables $s$ and $c$ are significant and positively correlated with the crisis probability

$\eta$ - is the random perturbation

The ratio equation for short term credits is:
$$s = \theta P^e + \overline{\gamma} \overline{X} + \overline{\delta} \overline{Y} + \mu c + \varepsilon \qquad (2)$$

$P^e$ - expected probability of debt crisis

$\overline{Y}$ - a multitude of variables that affect short term ratio of debt, $s$, without directly affecting the probability of debt crisis

If expectations are rational then $P = P^e$ and equation (2) becomes:
$$s^e = \gamma'\overline{X} + \overline{\delta}'\overline{Y} + \mu'c + \varepsilon' \qquad (3)$$

**Observations:**

1. Equations (1) and (2) can be estimated as a system.
2. In practice, equation 2 is, probably, weakly specified, because there is no model that applies the structure of external debt to maturity

For these, we will use equation (1) under a form in which we substitute the real value of $s$ with the value given by equation (2):
$$P = \alpha_1 s^e + \alpha_2 c + \overline{\beta}\overline{X} + \eta \qquad (4).$$

If short term debt increases the probability of crisis, coefficients $\alpha_1$ and $\alpha_2$ are positive and significant. On the other hand, if the correlation between liquidity variables and crisis present the causality from the probability of the crisis to loan structure deadline, then coefficients $\alpha_1$ and $\alpha_2$ are not significant.

Data that can e used in the model are: explicative variables like liquidity indicators, control variables like the size and structure of external debt, as well as a set of macroeconomic variables. On the other hand, all variables connected to debt (with the exception of service debt) are delayed by an year, as they are at the end of their time frame.

Macroeconomic variables are delayed similarly, to limit simultaneously generated problems.

## 4. CONCLUSIONS

The sovereign debt crisis is an important aspect of the current economic crisis and must be analyzed quantitatively to realistically depict the negative reality behind affected macroeconomic indicators.

Mathematical modeling can estimate the probability that a country may find itself in the sovereign debt crisis, thus helping predictions regarding this phenomenon.

Due to the complexity of macroeconomic mechanisms (knowing that economy can be considered a cybernetic system), modifications at a macroeconomic level can affect, through symptoms of the sovereign debt crisis, the future development of the economy.

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