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DEFAULT PREDICTION FOR VARIOUS NATIONAL ECONOMIES THROUGH SYNTHETIC INDICATORS

Abstract

In the current situation, involving a global economic crisis, national economies are under a high pressure. Greek and Irish bailouts have prompted many people to wonder about the economic situation in other countries. The global crisis is causing First World countries need help from institutions such as the IMF or the ECB. The goal of this paper is to analyze the risk that these countries have to be rescued by the economic institutions. In order to prepare this ranking, we are going to use two synthetic indicators. The first one is called Distance Principal Components (DPC) and the other one Goal Programming Synthetic Indicator (GPSI). We develop this indicator taking into account variables from both the public economy and the financial markets. Concerning the public economy, we use variables such as the public debt ratio and its total amount (% of GDP), public revenues, public deficit, real GDP growth and unemployment rate. We strongly believe that the soundness of an economy in the long-term depends on the behavior of these variables. Therefore, if they show a positive trend, other variables exposed to speculation in the financial markets should present a proper behavior as well. With this we mean two variables negotiated in the markets: debt risk premium and credit default swap levels.

This paper will bring easily understandable results that will let us know what the bankruptcy situation is in the rest of the countries analyzed.

Keywords

National Economies, Synthetic Indicators, GPSI indicator.

Introduction

In a world that is totally globalized, the situation of the worldwide economies is of increasing importance. After Greece's and Ireland's rescues by the European Institutions, there is a special worry about a new hypothetical bankruptcy in Europe.

The European Union (EU) has been able to deal with this problem until this moment. Taking into account that Greece's and Ireland's Gross Domestic Product (GDP) represented only around the 4% of the EU GDP in 2009, the problem was not too serious, so that EU institutions could solve it without any external help. In addition, the EU will only ask for help to the International Monetary Fund (IMF) if it is impossible to fix the situation within the EU. It makes no sense to create an Economic and Monetary Union if later they cannot solve their own problems. However, what if a powerful economy like Spain or Italy has to be rescued? Can the EU afford it? That is the reason why the current economic context has such a great importance. It is said that, if there is a new bailout, IMF funds would have to be used. In that case, what we know as 'Eurozone' would be over and we should reconsider the EU as something else than a simple 'geographical Union'.

Through this paper we try to quantify the risk countries have to be rescued. We have focused on important economies from the European Union and the rest of the world. Firstly, because what happens in the EU affects us directly, and secondly, because the non-European economies we have chosen are very powerful and, as we said before, in a globalized world we are strongly influenced by them, it must be said that many companies try to quantify the default risk countries. However, they build the index taking into account only the Credit Default Swap of a country [Kan and Pedersen 2011]. We believe that other variables have to be added to the index because the CDS value is fixed in the financial markets and it is a very volatile variable. The strengths and weaknesses of an economy lie mainly in the real economy. Credit default swaps have existed since the early 1990s. At the beginning they had a marginal role only in the economy. However, in 2003 there was a 'boom' and the market increased tremendously. We think that a variable that is always under negotiation and speculation cannot be a good indicator of the actual state of an economy.

We have chosen a sample of countries. Many of them belong to the Eurozone and EU27 but we also wanted to see how the index works in some countries which do not have the same political economy. We could have increased the number of countries as much as we had wanted but we strongly believe that 20 countries from different parts of the world suffice.

Why Venezuela? The reason why we have chosen Venezuela lies in the particular Venezuelan political situation. Even though Venezuela presents quite good results for the economic variables, the default risk is much higher than in countries with a higher level of debt or deficit. The answer for this is pretty clear and we will study it later. The CDS variable has a huge adverse effect on the index. The fact that Venezuelan political regime is a dictatorship makes the situation gets very unstable. In this context, insurance for this debt is too expensive.

In conclusion, taking Venezuela into consideration we prove that not only is the economic situation important, but the political system also plays a key role in the bankruptcy risk.

We are going to use two kinds of methodologies in order to obtain the results [Nardo et al. 2008]. The first one is called Distance-Principal Components (DPC) – [Blancas et al. 2010b] and the second one is called Goal Programming Synthetic Indicator (GPSI) – [Blancas et al. 2010a].

The rest of the paper is organized as follows. In Section 1, we are going to present aspects related to the basic methodology of the synthetic indicators. In the next section we will present the countries analyzed and the basic indicators we used in our study. The final results using both synthetic indicators are shown in Section 3.

1. Methodological aspects of the syntethic indicators

In this section, we are going to discuss the methodology behind the composite indicators:

We consider an initial system of *m* indicators to assess a set of *n* units, where I_{ik} is the value of the i-the unit in the k-th indicator.

We distinguish between positive and negative indicators, depending on the improvement direction ("more is better" or "less is better"). The indicator is considered positive when a higher value represents an improvement in the area. In contrast, the indicator is negative when a higher value represents deterioration.

In the DPC composite indicator [Blancas et al. 2010a] we have to normalize the data so that measuring units used for each indicator have no effect on the end result. The procedure involved divides the distance to the anti-ideal point by the difference between the maximum and the minimum values, in the case of positive indicators

$$IN_{ik} = \frac{I_{ik} - Min_k\ I_{ik}}{Max_k\ I_{ik} - Min_k\ I_{ik}}$$

The synthetic indicator, called DPC (distance – principal components), is then defined by the following formula:

$$DPC_i = \sum_{j=1}^{q}\left[VE_j \left(\sum_{k=1}^{m} IN_{ik} \left| Corr_{jk} \right| \right) \right],$$

for i = 1, 2,…, n,

where:

n is the number of units.
m is the number of original indicators.
q is the number of components selected.
VE_j is the variance explained by the j-th component.
$Corr_{jk}$ is the correlation between the j-th component and the k-th indicator.

More details about this composite indicator can be found in [Blancas et al. 2010a]

To define the composite indicator GPSI [Blancas et al. 2010b] we don't need to normalize the basic indicators as in the previous method, as this way this indicator is easier to interpret. We let I_{ij}^{+} denote the value that represents the *i*th unit in the *j*th positive indicator, with $j \in J$, where *J* is the set of positive indicators in the system. In the case of negative indicators, we let I_{ik}^{-} denote the value that provides the *k*th indicator for the *i*th unit considered, with $k \in K$, where *K* is the set of negative indicators included in the initial system. Therefore, $|J| + |K| = m$.

The proposed procedure requires us to identify the improvement direction of each indicator, but without the need to convert all of them into the same type, positive or negative. This facilitates the interpretation and management of the results, as no conversion is required.

With the basic elements of the synthetic indicator defined, the synthetic indicator can be based on the concept of goal used in Goal Programming. This methodology is well-known within the area of Operations Research, and is characterized by an underlying process of optimization that aims at finding the solution that most closely matches the aspiration levels established. Nevertheless, we use the underlying concept of goal rather than the optimizing process [Diaz-Balteiro and Romero 2004a, 2004b]. So, in our case, each unit is compared, for each indicator, with a given predetermined aspiration level. This way, the strength or weakness of this unit with respect to an indicator is established depending on the comparison of the indicator value with the predetermined aspiration level.

In particular, we must set weights, w_j, to state the relative importance of each indicator. Finally, the proposed methodology has to define an aspiration level for each indicator. u_j^+ will be used to refer to aspiration levels of the positive indicators and u_k^- for negative indicators.

The interpretation of the aspiration level differs depending on the indicator type. In the case of positive indicators, the value establishes the minimum level at which a unit is considered to indicate a good situation regarding the aspect evaluated by the indicator. When the indicator is negative, the aspiration level reflects the maximum level that indicates a favourable situation regarding the aspect analysed.

Given the set of aspiration levels, the value that each unit presents in each indicator is compared with the aspiration levels, as in goal programming. We define a goal for each indicator using deviation variables denoted by *n* and *p*. For each unit, these variables indicate the difference between the value of an indicator and the corresponding aspiration level. For the *i*th unit, the goals are represented as follows:

– If the indicator I_j is positive, the goal is formulated as

$$I_{ij}^+ + n_{ij}^+ - p_{ij}^+ = u_j^+ \quad \text{with} \quad n_{ij}^+, p_{ij}^+ \geq 0 \;\; n_{ij}^+ \cdot p_{ij}^+ = 0$$

where n_{ij}^+ is the under-achievement or negative deviation variable and p_{ij}^+ is the over-achievement or positive deviation variable associated with the positive indicator.

– If the indicator I_k is negative, the goal is formulated as

$$I_{ik}^- + n_{ik}^- - p_{ik}^- = u_k^- \quad \text{con} \quad n_{ik}^-, p_{ik}^- \geq 0 \quad n_{ik}^- \cdot p_{ik}^- = 0$$

where n_{ik}^- is the under-achievement or negative deviation variable and p_{ik}^- is the over-achievement or positive deviation variable associated with the negative indicator.

At this point, we propose global measures that serve to evaluate each destination depending on the level of fulfilment of the predetermined aspiration levels. Quantification of the indicators is based on the deviation variables associated with the goals set for each indicator. These measures differ from each other by the degree of compensation for the fulfilment and non-fulfilment of the aspiration levels.

The first component $\left(GPSI^+\right)$ quantifies the strengths displayed by each unit in the concept evaluated, indicating the degree to which the unit fulfils the aspiration levels set. Its definition is based on the aggregation of deviation

variables, for which a higher value shows a better relative position: the positive deviation variable for positive indicators $\left(p_{ij}^{+}\right)$ and the negative deviation variable for negative indicators $\left(n_{ik}^{-}\right)$. This aggregation is computed by using the weight of each indicator and normalizing the deviation variables with the corresponding aspiration levels to obtain a correct non-dimensional measure.

Thus, the formulation of this component for the unit *i* is as follows:

$$GPSI_i^{+} = \sum_{j \in J} \frac{w_j p_{ij}^{+}}{u_j^{+}} + \sum_{k \in K} \frac{w_k n_{ik}^{-}}{u_j^{-}} \quad \forall i \in \{1,2,...,n\}$$

The second component enables us to measure the weaknesses of each unit with respect to the indicator system, quantifying the degree to which the units do not fulfil the set of aspiration levels. This is similar to the way in which the first component is determined, by adding the unwanted deviation variables for each type of indicator, normalized and weighted. The formulation of this component for the unit *i* is as follows:

$$GPSI_i^{-} = \sum_{j \in J} \frac{w_j n_{ij}^{+}}{u_j^{+}} + \sum_{k \in K} \frac{w_k p_{ik}^{-}}{u_k^{-}} \quad \forall i \in \{1,2,...,n\}$$

In this way, the ratios that define the components of the vector indicator are a measure of the unfulfilled values described by the initial indicators, normalized as percentages. This first component shows its strengths for each unit without taking its weaknesses. The second component quantifies the degree of weakness shown by each unit without taking into account its strengths.

We can now consider how to achieve such compensation. This leads to the Net Goal Programming Synthetic Indicator $\left(GPSI^{N}\right)$. This indicator aims at assessing each unit, by aggregating its strengths and weaknesses. These components are weighted to take into account situations where the strengths are not given the same importance as weaknesses. That is:

$$GPSI_i^{N} = \lambda\, GPSI_i^{+} - \gamma\, GPSI_i^{-}$$

where λ and γ are relative weights of strengths and weaknesses, respectively.

In this way, the difference between the components of the vector indicator makes it possible to define a compensatory measure. The strengths of the indicators, which are the strengths of each unit, can compensate for the weaknesses in other indicators.

2. Economic Data

In this section we are going to present the countries chosen for this paper and the indicators used. The first step is to define the theoretical framework. Eurostat [2010] has been our main source for data collection but we have also used some data from *'Global Finance 2010'* database. However, we have taken into account some limitations of the theoretical framework, especially in the collecting data stage. That is why we have selected only those indicators which provide rigorous information about the variables to study. Even though Eurostat provides a lot of information about these variables, we have been interested only in those that provide relevant, complete and objective information.

According to what we have explained above, we are going to present the variables selected:

1. Debt-to-Gross Domestic Product (GDP) Ratio: this is one of the indicators of the health of an economy [Cecheti and Zampolli 2010]. It is the amount of federal debt of a country as a percentage of its Gross Domestic Product (GDP). A low debt-to-GDP ratio indicates an economy that produces a large number of goods and services and probably profits that are high enough to pay back debts.

2. Taxes Income-to- GDP Ratio: the percentage of national income that is compulsorily transferred from private pockets to the public exchequer. It is probably the most important variable. I It can be said that the value of the Debt-to-GDP Ratio is irrelevant if the country makes enough money to pay the debt.

3. Government Bond 10 years yield (in basis points, 1/100 of 1%): There is a direct relationship between the yield and the economic uncertainty of a country. It is the interest rate countries have to pay for the bond.

4. GDP real growth rate (annual %): It shows the increase or decrease in value of all final goods and services produced within a nation in a given year, taking into account inflation.

5. Credit Default Swap (in thousands of Euro): A credit default swap (CDS) is an agreement that the seller of the CDS will compensate the buyer in the event of a loan default. The buyer of the CDS makes a series of payments (the CDS “fee” or “spread”) to the seller and, in exchange, receives a payoff if the loan defaults. This might be the most difficult concept to understand.

This number means how much money an investor has to pay to insure 10 Million Euro Bonds. However, it is not as simple as it seems because bounds can be object of speculation in the financial markets.

6. Unemployment rate: This is an indicator of the economic activity. Moreover, less unemployment means less public expenditure and more public income so this is very important variable that affects the economy in a double sense.

7. Deficit-to-GDP Ratio: Nowadays it is a priority for all the countries to reduce the public deficit. This is also a way to reduce the public debt[1].

Next step in our work is to identify the positive or negative sign for each indicator. In this sense, the sense of this paper is to analyze the bankruptcy risk for an economy so that the indicator is considered positive when higher values cause a favorable effect on the 'health' of an economy. By contrast, the indicator will be considered negative when higher values of the indicator entail harmful consequences for an economy. You can find a summary of the nature of the indicators in Table 1.

Table 1

Sign of the indicators

Indicator	Description	Sign
1	Debt-to-Gross Domestic Product (GDP) Ratio	Negative
2	Taxes Income-to- GDP Ratio	Positive
3	Bond 10 years yield (in basis points, 1/100 of 1%)	Negative
4	GDP real growth rate (annual %).	Positive
5	Credit Default Swap (in thousands of Euro)	Negative
6	Unemployment rate	Negative
7	Deficit-to-GDP Ratio	Negative

We have collected data for four different periods (Bloomberg, CMA database, Markit Index, Trading Economics, 2010): first semester 2009, second semester 2009, first semester 2010 and second semester 2010 in order to show the situation in each period.

Table 2 shows all the information related to second semester 2010. Similarly, the same data have been collected for the other periods.

[1] This information comes from Eurostat database, Global Finance Database and Bloomberg database.

Table 2

2010s2 observed data

	1	2	3	4	5	6	7
SPAIN	63,5	34,7	531	0,2	252,5	20,2	9,3
BELGIUM	101	48,1	399	1,9	201	8,1	6
SWITZERLAND	41	36,5	184	3,1	85	3,6	1,4
GERMANY	75	44,5	315	3,9	53,37	6,6	4,5
PORTUGAL	83,1	38,8	653	1	471,44	10,9	7,3
GREECE	131	36,9	1147	–4,7	912,97	12,9	8
IRELAND	93,6	34,5	845	–0,5	598,67	13,8	17,7
FRANCE	84,2	48,4	351	1,7	104,55	9,7	8
ITALY	118	46,6	480	0,9	208,7	8,6	5,10
USA	92,7	30	348	2,6	39,56	9,4	11,10
NETHERLANDS	66	46	332	1,9	60	4,3	6
POLAND	55,2	37,2	598	4,8	316,6	10	7,4
SWEDEN	41,9	53,7	321	6,9	32,55	7,8	2,2
UK	76,7	40,4	369	2,6	67,63	7,8	10,2
CHINA	19,1	25	399	10,5	72,02	4,1	2,9
BRAZIL	65	23	465	7,5	115	7,2	1,7
VENEZUELA	34,8	14	1275	–1,3	1149	8,6	3,8
MEXICO	45,2	15,2	476	5	118,58	5	3,6
JAPAN	226	35	125	5,3	82,17	4,9	9,6
AUSTRALIA	21,9	40,3	556	3	53,14	5,2	4,6

It can be seen that there is a big difference between the countries. Emerging countries show good values of the variables related to the actual economy. By contrast, there are several countries in the Eurozone that really need to make changes in their economies.

3. Results and discusion

3.1. Results by DPC indicator

Once all the previous steps are completed, we will proceed to put together all the indicators in a common synthetic index according to the DPC method. As the method is based on statistical techniques, in our analysis the weighting given for subsequent variables will be elaborated separately for each variable. Thus, according to authors as Chen et al [2004], using the percentage of total explained variance for each component as the weight is the most frequent option.

To facilitate the managerial use of the information contained in the system, we have obtained DPC composite indicators, the methodology of which presents some advantages. Specifically, the proposed procedure allows the determination of a single common set of objective weights for all units. Furthermore, unlike composite indicators derived using statistical methods, the DPC indicator weights are always positive and allow the identification of the initial indicators that have the most influence on bankruptcy risk. Also, from a practical point of view, the DPC indicator is easier to interpret than other composite indicators obtained with statistical procedures. As mentioned, using initial indicator values to define analogous distances to the anti-ideal situation allows the association of the highest composite indicator values with better sustainability [Blancas et al. 2010a]. Table 3 shows the normalized data from Table 1.

Table 3

2010s2 normalized data

	1	2	3	4	5	6	7
SPAIN	0,215	0,521	0,353	0,322	0,197	1,000	0,485
BELGIUM	0,392	0,859	0,238	0,434	0,151	0,271	0,282
SWITZERLAND	0,106	0,567	0,051	0,513	0,047	0,000	0,000
GERMANY	0,272	0,768	0,165	0,566	0,019	0,181	0,190
PORTUGAL	0,309	0,625	0,459	0,375	0,393	0,440	0,362
GREECE	0,537	0,577	0,889	0,000	0,789	0,560	0,405
IRELAND	0,360	0,516	0,626	0,276	0,507	0,614	1,000
FRANCE	0,315	0,866	0,197	0,421	0,064	0,367	0,405
ITALY	0,478	0,821	0,309	0,368	0,158	0,301	0,227
USA	0,356	0,403	0,194	0,480	0,006	0,349	0,595
NETHERLANDS	0,227	0,806	0,180	0,434	0,025	0,042	0,282
POLAND	0,175	0,584	0,411	0,625	0,254	0,386	0,368
SWEDEN	0,110	1,000	0,170	0,763	0,000	0,253	0,049
UK	0,279	0,665	0,212	0,480	0,031	0,253	0,540
CHINA	0,000	0,277	0,238	1,000	0,035	0,030	0,092
BRAZIL	0,222	0,227	0,296	0,803	0,074	0,217	0,018
VENEZUELA	0,076	0,000	1,000	0,224	1,000	0,301	0,147
MEXICO	0,126	0,030	0,305	0,638	0,077	0,084	0,135
JAPAN	1,000	0,529	0,000	0,658	0,044	0,078	0,503
AUSTRALIA	0,014	0,662	0,375	0,507	0,018	0,096	0,196

Finally, before moving on to discuss the results obtained using DPC method, we will see that the matrix of correlations between the indicators (presented in Table 4) is different from the identity matrix, so that we can continue with our analysis.

Table 4

Indicator correlation matrix

Indicator	1	2	3	4	5	6	7
1	1	0,489	–0,207	0,346	–0,402	–0,001	0,364
2	0,489	1	0,116	0,1042	–0,301	0,116	0,373
3	–0,207	0,116	1	–0,313	0,485	–0,009	0,174
4	0,346	0,104	–0,313	1	–0,134	0,206	0,196
5	–0,402	–0,301	0,485	–0,134	1	0,182	0,162
6	–0,001	0,116	–0,009	0,2069	0,182	1	0,563
7	0,364	0,373	0,1741	0,1967	0,162	0,563	1

Thus, in Tables 5 and 6 we find the values of our synthetic indicator of bankruptcy risk for the main economies calculated by the DPC (as a table and as a graph). We are going to show the evolution of this indicator in four different periods, every semester during the last two years. We should take into account the changes in the economic situation in the past two years due to financial crisis.

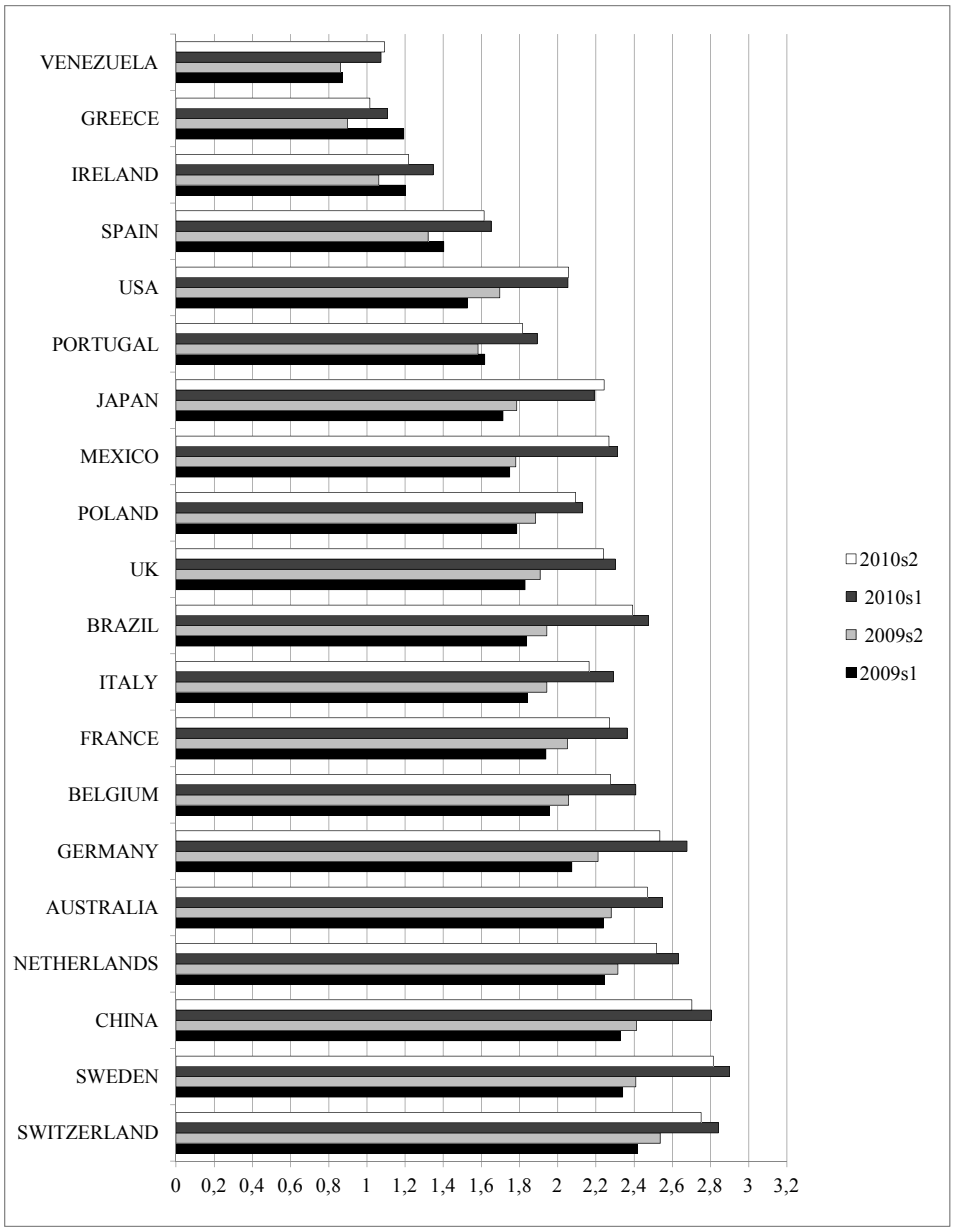
Table 5

DPC Synthetic Index

COUNTRY	2009s1	COUNTRY	2009s2	COUNTRY	2010s1	COUNTRY	2010s2
SWITZERLAND	2,416	SWITZERLAND	2,531	SWEDEN	2,900	SWEDEN	2,8152
SWEDEN	2,3408	CHINA	2,411	SWITZERLAND	2,840	SWITZERLAND	2,750
CHINA	2,326	SWEDEN	2,4085	CHINA	2,804	CHINA	2,702
NETHERLANDS	2,244	NETHERLANDS	2,315	GERMANY	2,677	GERMANY	2,533
AUSTRALIA	2,239	AUSTRALIA	2,279	NETHERLANDS	2,631	NETHERLANDS	2,517
GERMANY	2,074	GERMANY	2,211	AUSTRALIA	2,547	AUSTRALIA	2,4692
BELGIUM	1,956	BELGIUM	2,056	BRAZIL	2,474	BRAZIL	2,392
FRANCE	1,9373	FRANCE	2,049	BELGIUM	2,408	BELGIUM	2,276
ITALY	1,841	ITALY	1,942	FRANCE	2,363	FRANCE	2,271
BRAZIL	1,837	BRAZIL	1,942	MEXICO	2,312	MEXICO	2,267
UK	1,827	UK	1,907	UK	2,301	JAPAN	2,242
POLAND	1,785	POLAND	1,884	ITALY	2,292	UK	2,239
MEXICO	1,748	JAPAN	1,785	JAPAN	2,191	ITALY	2,164
JAPAN	1,712	MEXICO	1,779	POLAND	2,130	POLAND	2,094
PORTUGAL	1,616	USA	1,695	USA	2,052	USA	2,056
USA	1,5263	PORTUGAL	1,582	PORTUGAL	1,893	PORTUGAL	1,815
SPAIN	1,402	SPAIN	1,320	SPAIN	1,651	SPAIN	1,613
IRELAND	1,200	IRELAND	1,063	IRELAND	1,347	IRELAND	1,218
GREECE	1,192	GREECE	0,898	GREECE	1,108	VENEZUELA	1,092
VENEZUELA	0,873	VENEZUELA	0,861	VENEZUELA	1,073	GREECE	1,014

Table 6

DPC Synthetic Index graph



From this information, we can observe two groups standing out: those situated at the top of the table and those situated at the bottom. They are always the same. The case of Venezuela is eye-catching. We are tired of hearing from the news that Mediterranean countries are likely to suffer a default. However, even if this paper confirms that fact, Venezuela presents a higher risk than any other country on the list. This is because of the CDS price and the 10-years--bond-yield. Economic stability depends on both political situation and economic situation. In Venezuela, the political situation penalizes the economy a lot. People will not buy Venezuelan Debt if they are not sure that they will get a return. Who knows how much political and economic situation in Venezuela can change in the next ten years?

As we could anticipate, it is confirmed that countries such as China, Switzerland, Sweden or even Germany have a strong economy. The case of Japan is very interesting. Japanese Public Debt is more than 200% of GDP. However, they do not have to pay too much interest. At the same time, Japan is starting to grow after almost twenty years of economic stagnation. The situation is not as worrying as it was a couple of years ago. Anyway, the recent earthquake and tsunami will have terrible consequences also for the economy.

Lastly, we want to focus on the USA case as well. USA is penalized by a high public debt, high public deficit and taxes incomes below average. By devaluating the dollar, they want people to buy US production but this solution is recommendable in the very short term only, in the long term it could cause inflation and other harmful consequences to the economy. To summarize, there are three different groups of countries: Those whose economies enjoy perfect health, those that really have to apply contracting monetary (if possible) and fiscal policies and, finally, countries in the middle with very different characteristics (the cases of United Kingdom, Brazil, Japan and so on).

3.2. Results by GPSI indicator

We are presenting a new methodology which offers several advantages over existing ones. In particular, it is designed to be practical and to facilitate obtaining easy-to-interpret synthetic indicators. Inspired by goal programming, this method allows us to obtain several synthetic indicators based on information provided by the goals corresponding to each indicator.

The difference between the synthetic measures proposed is reflected by the degree of compensation of fulfillment and non fulfillment of the aspiration levels. In any case, these measures assess each unit, accounting for their strengths and weaknesses, which can be analyzed together or separately. Interpreting the values of the synthetic indicator is easy, because the results are expressed in terms of proximity to the reference situation defining the goals.

The methodology we develop is not a technique based on statistics for the process of weighting the different indicators that will form our composite index of bankruptcy risk. For its development, we will use some previously established steps. In this case it is not necessary to normalize the data but we will use again the positive or negative effect of the indicator (presented in Table 2). However, it will be necessary to add the concept of neutrality of the indicator (when it reaches a specific value, the desired reference level). We have defined what we consider to be the reference level for every indicator. Nowadays, it makes no sense to fix the average point as the desired level because given the delicate situation of the world economy the average point will be a non-desirable point for the governments. The result is a synthetic indicator vector (called $GPSI^{v}$), composed of a two components vector $(GPSI^{+}, GPSI^{-})$. According to Blancas et al. [2010a, p. 10] "the first component of vector synthetic indicator shows the strengths for each unit while ignoring their weaknesses. The second component quantifies the degree of weakness shown by each unit while ignoring their strengths. Neutral indicators are represented by their weaknesses only, because the deviation of variables indicates weakness only". Thus, given the synthetic indicator vector of goal programming $GPSI^{v}$, we note that the comparison is very complicated. In this way, to make the comparison easy-to-interpret we are going to use the Synthetic Index based on Restrictive Goal Programming (*GPSIR*) and the Synthetic Index based on Net Goal Programming (*GPSIN*). The *GPSIR* is based on the idea of distinction of the units that fulfill the levels of reference and, as opposed to the *GPSIv*, it does not compensate strengths and weaknesses. As for the GPIN, it combines strengths and weaknesses, each with a different weighting. The results obtained by using this method can be seen in the next tables.

Table 7

Net GPSI Synthetic Indicator for 1st and 2nd semester 2009

COUNTRY 2009s1	GPSI +	GPSI –	NET GPSI	COUNTRY 2009s2	GPSI +	GPSI –	NET GPSI
CHINA	4,12	0,46	3,67	CHINA	3,9	0,47	3,43
AUSTRALIA	2,36	1,25	1,11	AUSTRALIA	1,91	1,21	0,7
SWITZERLAND	2,45	2,56	–0,11	SWITZERLAND	2,66	2,3	0,36
SWEDEN	2,87	3,56	–0,69	SWEDEN	2,64	3	–0,36
NETHERLANDS	1,8	3,76	–1,96	NETHERLANDS	1,56	3,25	–1,69
BRAZIL	1	3,71	–2,71	BRAZIL	0,84	3,78	–2,94
GERMANY	1,81	4,59	–2,78	GERMANY	1,7	3,94	–2,24
FRANCE	0,88	4,27	–3,38	FRANCE	0,87	4,41	–3,54
USA	0,76	4,4	–3,64	USA	0,88	4,65	–3,77
UK	0,8	4,44	–3,64	UK	0,71	4,56	–3,86
MEXICO	1,12	5,5	–4,39	MEXICO	0,78	5,6	–4,82
BELGIUM	1,27	7,37	–6,1	BELGIUM	0,95	6,92	–5,97
POLAND	0,63	7,06	–6,43	POLAND	0,45	6,98	–6,53
SPAIN	0,01	7,52	–7,5	ITALY	0,93	8,61	–7,68
JAPAN	1,42	9,06	–7,64	JAPAN	1,43	9,72	–8,29
ITALY	1,17	8,88	–7,71	SPAIN	0,03	10,25	–10,22
PORTUGAL	0,49	12,29	–11,8	PORTUGAL	0,39	12,39	–12,01
IRELAND	0,28	16,89	–16,61	IRELAND	0,08	17,07	–16,99
GREECE	0,41	22,57	–22,16	VENEZUELA	0,4	26,16	–25,75
VENEZUELA	0,74	28,01	–27,27	GREECE	0,35	26,18	–25,83

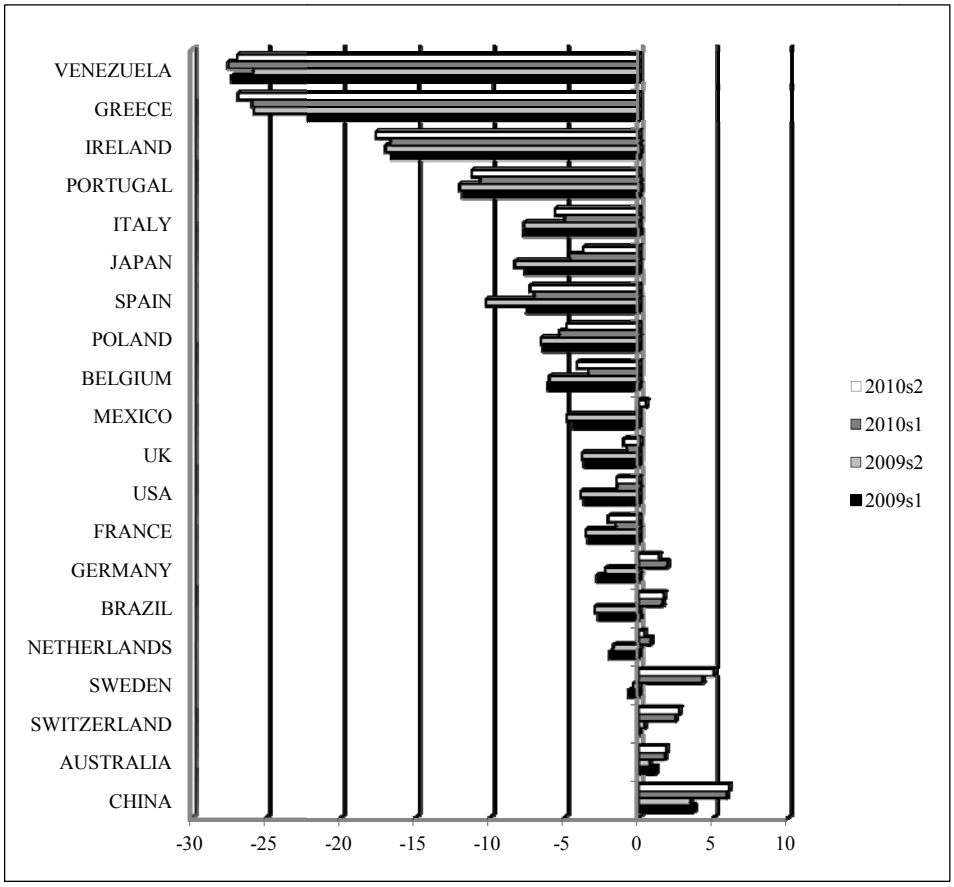
Table 8

Net GPSI Synthetic Indicator for 1st and 2nd semester 2010

COUNTRY 2010s1	GPSI+	GPSI –	NET GPSI	COUNTRY 2010s2	GPSI +	GPSI –	NET GPSI
CHINA	6,36	0,47	5,89	CHINA	6,47	0,47	6
SWEDEN	4,39	0,13	4,26	SWEDEN	5,16	0,14	5,02
SWITZERLAND	2,99	0,58	2,41	SWITZERLAND	3,27	0,58	2,69
GERMANY	3,05	1,18	1,87	AUSTRALIA	2,29	0,49	1,8
AUSTRALIA	2,18	0,49	1,69	BRAZIL	4,18	2,5	1,67
BRAZIL	4,06	2,5	1,55	GERMANY	2,55	1,21	1,34
NETHERLANDS	1,61	0,84	0,76	MEXICO	2,67	2,21	0,46
MEXICO	2,34	2,2	0,13	NETHERLANDS	1,31	0,97	0,34
UK	1,1	1,87	–0,77	UK	0,98	1,99	–1,01
USA	1,21	2,65	–1,44	USA	1,19	2,65	–1,45
FRANCE	0,98	2,52	–1,53	FRANCE	0,79	2,81	–2,02
BELGIUM	1,48	4,83	–3,35	JAPAN	3,28	6,97	–3,69
JAPAN	2,25	6,87	–4,62	BELGIUM	0,82	4,96	–4,13
ITALY	0,89	5,84	–4,95	POLAND	1,85	6,66	–4,81
POLAND	1,22	6,53	–5,31	ITALY	0,88	6,48	–5,6
SPAIN	0,03	7,02	–6,99	SPAIN	0,03	7,3	–7,26
PORTUGAL	0,27	10,89	–10,63	PORTUGAL	0,28	11,47	–11,19
IRELAND	0,03	16,67	–16,64	IRELAND	0,03	17,63	–17,61
GREECE	0,12	26	–25,88	GREECE	0,1	26,95	–26,85
VENEZUELA	0,45	27,96	–27,51	VENEZUELA	0,79	27,68	–26,89

Table 9

Net GPSI Synthetic Indicator Graph



We can clearly state that the situation has improved for almost all the countries. That could mean that we are getting over the economic crisis. Once again, we have the same economies at the top, at the bottom and in the middle of the table. Venezuela is again penalized by the highest CDS price. As we can see, it has much more strengths (0,79 in 2010s2) than the rest of the countries at the bottom but also more weaknesses. The case of China is also striking. Nobody is surprised to see China at the top of this table. The point is that they can keep improving its situation because its problems are not the strengths but the weaknesses. Once again, Switzerland is situated in a very

comfortable situation. That is explained by the combination of high public incomes, low deficit, low unemployment and low debt. The tables show that Portugal's situation is very dangerous; it is just behind some countries that have already been rescued. It might be the next if it does not carry out restrictive policies and economic cuts.

3.3. Discusion of results

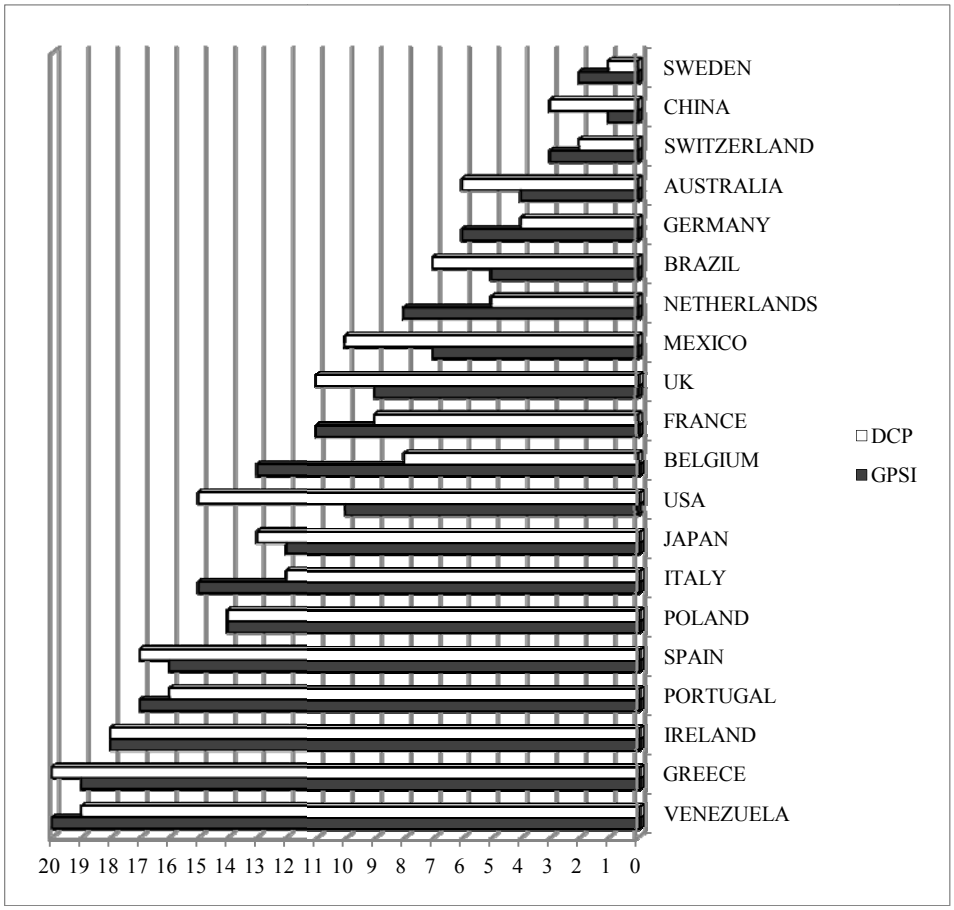
Once the results have been analyzed using both methods, one based on statistical techniques (Distance-Principal Components method), and one based on non-statistical techniques (Goal Programming Synthetic Indicator and its variants) in this section we will discuss the advantages and disadvantages of each by trying to compare the results, in order to find common patterns of behavior among different countries.

Some advantages of the DPC method come from the fact that it represents most of the information provided by the system with a limited number of variables, uncorrelated [Blancas et al. 2010b]. Moreover, comparative analysis is very simple and intuitive. Furthermore, as we said above, the method itself is responsible for providing the weights, without any interference by expert groups (which always brings subjectivity to the analysis).

As regards the GPSI method, and following Blancas et al. [2010a], it has a number of advantages over statistical methods. The first one is that it does not require prior normalization of the data. Moreover, this technique admits a number of indicators lower than the number of observations. Furthermore, there is no a lack of information, since all indicators from the initial system are used to build the synthetic indicator. There are a number of drawbacks, since the analyst is obliged to make decisions, both in the setting of weights and in the aspiration levels for each indicator. Below, we try to summarize and compare the results we have obtained by using each method. We will only focus on the 2010 second semester rankings because they are the most recent information we can analyze.

Table 10

Comparison between DPC and GPSI methods 2010s2 (positions)



Thus, from the information above we can see a number of similarities. Therefore, despite some differences, both methods show reasonably similar results. The two indicators can help to develop a global classification. As we can see, it does not matter which method we use, the countries will keep similar positions. PIIGS (Portugal, Ireland, Italy, Spain and Portugal) present a high bankruptcy risk. It is also remarkable to see the evolution of Japan. Semester by semester, it is improving its average position. Benelux countries remain in a comfortable position in the first half of the table.

As a conclusion from these data, it seems clear which countries are likely to default. 'Piigs' and Venezuela are in a very dangerous situation. However, the causes of this harmful situation depend on the countries. For instance, Venezuela is affected by high prices for the variables negotiated in the financial markets due to its political system, Spain is penalized by the highest unemployment in the UE27 and Greece and Ireland have enormous problems with their bank system and their public debt. The case of Portugal is also complicated. It combines a political problem and a difficult economic situation. As long as politicians do not carry out restrictive policies Portugal will be more vulnerable to default.

Conclusions

Throughout this paper we have analyzed the current problem of bankruptcy risk for the main economies in the world. Before the financial crisis originated in the United States in the summer 2007, it was difficult to imagine that countries such as Greece or Ireland might have to ask for external help. However, this crisis has uncovered the shortages of all economies. As we can see, some countries have been able to recover their GDP and employment rate at the same level as before the crisis. However, countries that already had a structural problem in their economies have been strongly hit by the crisis. Such are the cases of Spain and the property bubble, Ireland and the bank system crisis or Greece. Crisis has only accelerated the process of adjustment.

Thus, throughout this paper we have carried out an assessment of the situation in the EU-27 based on data from Eurostat [2010], by constructing a synthetic index of bankruptcy risk through different methods (the Distance-Principal Components, based on statistical techniques, and goal programming techniques which are not based on statistics), each of them with its pros and cons, keeping in mind that the indicator is not an end in itself but an instrument available to the researcher for better analysis of the situation. Despite the great subjectivity that underlies the construction of such indicators, we have tried to be as explicit as possible in the methodological aspects with intent to make our analysis objective and give it validity and scientific rigor.

To sum up, not only is it important to have a stable economy but it is equally important to convince people that your country has a powerful economy. Otherwise, if there is uncertainty about the economic situation, the

financial market will punish that economy. As we have seen, economic stability depends on actual economic variables and those negotiated in the financial markets.

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