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Investigaciones Europeas de Dirección y Economía de la Empresa (IEDEE)

Provided in Cooperation with:

European Academy of Management and Business Economics (AEDEM), Vigo (Pontevedra)

Suggested Citation: San-Martín-Albizuri, Nerea; Rodríguez-Castellanos, Arturo (2012) : Globalisation and the unpredictability of crisis episodes: An empirical analysis of country risk indexes, Investigaciones Europeas de Dirección y Economía de la Empresa (IEDEE), ISSN 1135-2523, Elsevier, Amsterdam, Vol. 18, Iss. 2, pp. 148-155, [https://doi.org/10.1016/S1135-2523\(12\)70005-9](https://doi.org/10.1016/S1135-2523(12)70005-9)

This Version is available at:

<https://hdl.handle.net/10419/191031>

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Globalisation and the unpredictability of crisis episodes: An empirical analysis of country risk indexes

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HISTORIA DEL ARTÍCULO:

Recibido el 7 de noviembre de 2011
Aceptado el 10 de enero de 2012

JEL classification:

G01
F36

Keywords:

Globalisation and uncertainty
Financial crises forecast
Country risk indexes
Representative variables

ABSTRACT

The ongoing globalisation process has not put an end to international financial crises. On the contrary, it seems to have contributed to their appearance and to accentuating their degrees of unpredictability. In this context, the main objective of the present study is to establish whether the values of the best-known and most widely used country risk indexes, namely, the *Euro money* index and the International Country Risk Group (ICRG), and the values of their representative variables could have forecasted well in advance the crises that took place between 1994 and 2002, a period which is herein termed the 'globalisation era'. The results show that, although the selected indexes and their representative variables were able to identify certain vulnerabilities, they could not accurately identify the political, economic, and/or financial factors that developed prior to these crisis episodes.

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La imprevisibilidad de los episodios de crisis: un análisis sobre los índices de riesgo país en la era de la globalización

RESUMEN

Aunque la actual crisis muestra entre los factores causantes de su desencadenamiento ciertas propiedades únicas, no puede obviarse el hecho de que comparte algunas características con las crisis anteriores que se produjeron especialmente a partir de 1994. Y una de estas características es la imprevisibilidad.

El objetivo del presente trabajo es contrastar si los índices más conocidos y utilizados (el índice de *Euro money* y el ICRG) y las variables más representativas incluidas en su configuración fueron capaces de anticipar las crisis que tuvieron lugar entre 1994 y 2002, esto es, las crisis de la "era de la globalización". Los resultados obtenidos son negativos, por lo que se concluye que el valor de los índices y el valor de las variables en ellos contenidas se muestran incapaces de reflejar con suficiente antelación —a medio plazo— las vulnerabilidades que se desarrollaron previamente al surgimiento de los episodios de crisis.

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1. Introduction

Financial and monetary crises have been parts of the evolution of economic cycles from time immemorial. Thus, for several decades now, the intensification of the globalisation process, particularly its

economic aspects, has affected this relationship to the point that nearly all experts agree that economic globalisation has increased the market's vulnerabilities. These include the volatility of key financial data and the uncertainty associated with economic events. Moreover, some experts even argue that the intensity and severity of these crises have increased because of the distortions resulting from this process.

This line of reasoning implies that globalisation has also heightened the unforeseeable nature of such episodes, as

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demonstrated by the current crisis. Even though imbalances were causing alarm to financial authorities, neither the supervisory nor the multilateral entities were capable of foreseeing the form, the time, or the place in which they were developing, and, even less so, their impact on the real economy. However, this unpredictability does not only seem to be characteristic of the current crisis, but rather a common factor of previous episodes during the globalisation era, and that despite the existence of warning instruments, such as country risk indexes, credit risk ratings, or early warning systems.

The main objective of the present paper is to consider whether the values of the *Euromoney* index and International Country Risk Guide (ICRG) —the best known and most widely used country risk indexes in the industry— and the values of the most representative variables contained in them were capable of forecasting the crises that occurred between 1994 and 2002, which are considered to be the forerunners of the current crisis.

This study uses a sample of 13 countries that suffered an external financial crisis episode during that time interval and 50 countries that despite having similar financial and economic characteristics did not. Furthermore, we only use the results of a previous factorial analysis that determined which of the variables contained in each index are the most representative.

Based on this analysis, a logistic regression analysis is applied in order to establish whether or not the values of the indexes and the values of their most significant variables are capable of distinguishing between both groups in advance. Thus, if they could distinguish between any of the cases, the conjectures would be confirmed about their poor forecasting capacity in the medium term and it could be concluded that they do not reflect the financial, economic, and political vulnerabilities that develop prior to the emergence of these crisis episodes.

The remainder of this paper is structured as follows. The second section analyses two of the main negative consequences of the globalisation process: the increased volatility of the financial markets and the growing uncertainty and unpredictability of events. The third section sets out the country risk indexes considered in this paper: the index of the *Euromoney* magazine and the ICRG. The hypotheses put forward as well as the methodology used to compare them are described in the same section. The fourth section presents the obtained results and the fifth concludes.

2. Globalisation and the Unpredictability of Financial Crises

In any evolutionary process, moving from a local order to a more complex global one leads to certain disorder, which can create instability and tensions and even lead to conflicts (Nieto de Alba, 2008). Furthermore, in most cases, the phenomena that emerge from this process do not have clear historical precedents, which stresses the need for an in-depth analysis in order to establish the reasons for their emergence and to predict their future evolution patterns.

A clear example of this is the globalisation process¹ over recent decades. This complex and diverse process is linked to the growing economic, political, and environmental integration and interconnection between national economies whose impact is reflected in the current situation (IMF, 2002). Specifically, the most important changes have been caused by the globalisation of financial markets² inasmuch as this is where greatest progress

towards integration has been made (Pedrosa, 2003; Ferreiro et al., 2007). This has been mainly driven by financial liberalisation processes, the development of advanced information and communication technologies, the creation of increasingly more complex and efficient financial instruments, and the increased involvement in the market of institutional investors, which enjoy better information and financial resources (Anchuelo and García, 2009).

Thus, financial globalisation has been in the spotlight because of not only its extraordinary expansion but also its direct impacts on the markets themselves, among the parties trading on them, and on general economic development. Cutting costs of capital, increasing economic efficiency, and eliminating barriers to economic activity are some examples of the possible benefits of this process. However, in the opinion of many experts, these benefits have not managed to offset the threats, such as greater speculative pressures, increased systemic risk, and the growing vulnerability to which emerging economies are exposed (Fernández de Lis and Ontiveros, 2009). Furthermore, it is precisely among these negative aspects of globalisation where we find three related and particularly concerning issues (Bustelo et al., 1999; Mishkin, 2005; Reinhart and Rogoff, 2008; De la Dehesa, 2009): the increased volatility of key financial data, the growing uncertainty associated with economic events, and their unpredictability.

Leaving on one side the lack of consensus regarding the direct relation between progressive financial globalisation and increased volatility (Kose et al., 2006), the majority of experts do agree that the distortions caused by the first exacerbate and increase the second (Hermalin and Rose, 1999; Wagner and Berger, 2004). This cause/effect relationship occurs because of various factors: information asymmetries, which cause moral hazard and adverse selection problems; the use of increasingly more complex derivatives, which multiply the opportunities to speculate on international capital markets; and the greater stake of institutional investors, because this type of agent handles huge amounts of capital and has access to insider information (Gabaix et al., 2005; Mishkin, 2005; De la Dehesa, 2009; Manconi et al., 2010). Moreover, many authors note that the free international mobility of capital, without the relevant supervision and control by economic authorities, increases volatility (Bekaert and Harvey, 2000; Stiglitz, 2004), and this, in turn, increases the number and severity of the crises (Bordo, 2006; Edwards, 2008).

The second negative effect of globalisation refers to the growing uncertainty faced by economic stakeholders who, forced by the need to internationalise, must confront the risks inherent in operating in unknown or little known environments. This situation has been aggravated by the financial crises that have occurred from Mexico 1994/95 to the present one (Reinhart and Rogoff, 2008; IMF, 2009; Torres, 2009). Furthermore, global uncertainty leads to the unpredictability of the events that occur in those increasingly more uncertain social, political, and economic settings.

Thus, volatility, uncertainty, and unpredictability are harmful, because the need to proceed with internationalisation and its risks not only affects international companies and major institutional investors, which tend to have the necessary resources to offset them, but also spreads to smaller companies, financial entities, and even individual investors (Hoti, 2005; Rodríguez et al., 2006).

An example of the link between the globalisation process and the aforementioned negative effects is the current international financial crisis, which can be considered to be the first 'global crisis'. It started in the US halfway through 2007 as a local imbalance arising from the problems with sub-prime mortgages, but subsequently became an unprecedented recession owing to its severity and rapid spread (the contagion effect; Rose and Spiegel, 2009) and to the fact that it has affected the majority of countries. Some authors believe that this global crisis can be defined as a set of

¹ See IMF (1998), Bordo et al. (2003), Ferreiro et al. (2007), and Rossi (2008), among others.

² The globalisation of financial markets is, along with production capital and goods capital, one of the three types of markets tackled by economic globalisation. In general terms, the latter is taken to be the growing integration and interconnection between national economies that enables, by means of the elimination of the geographical frontiers for any types of flows, the more efficient use of the available resources (Uriónabarrenetxea, 2007).

local crises (Ruiz, 2010), that has occurred as a natural consequence of the economic cycles³, but with the characteristic that those cycles are currently synchronised because of the globalisation process (Calderón et al., 2007; Kose et al., 2010). This explains why the imbalances emerged almost simultaneously throughout the global economy.

The development and final outbreak of the crisis is not the result of a single event; quite to the contrary, the majority of experts model this scenario using complex interactions among a large number of factors (De la Dehesa, 2009). Thus, the ones that are most referred to in the literature can be found in Young (2008), Brunnermeier (2009), De Gregorio (2009), De Long (2009), Feldstein (2009), Haldane (2009), and IMF (2009). These include the ‘macro’ context prior to the crisis, characterised by major global expansion that leads to the taking of risky decisions – also known as Great Moderation or feelgood factor; excessive indebtedness by financial institutions; the concentration of systemic risk; price bubbles; the asymmetry in the available information for participants; errors in measuring country risk; and the lack of regulation and supervision by public authorities and central banks. As Kane (2009) points out, those can be summarised as a double failure: on one hand, the very failure of the market and, on the other, the lack of supervision that enabled such a failure to occur.

Leaving the origins of the current crisis to one side, what is also of interest is why it was not headed off. Despite the numerous warnings, nobody was able to foresee the form it would take, its intensity, and the timing of its onset (Besley and Hennessy, 2009). However, this unpredictability does not seem to be a characteristic inherent to the current crisis; to the contrary, it presents as a common factor to the external financial crises that have occurred during the globalisation era⁴.

Therefore, the relation between external financial and monetary crises and country risk analysis should be considered to be an area of study. In particular, it is important to analyse why despite there being so many methods that assess country risk and, therefore, the risk of a financial crisis occurring –credit risk ratings, country risk indexes, and early warning systems, among others– neither the current crisis nor previous globalisation era crises have been anticipated. Consequently, more and more experts are questioning the effectiveness of the existing methods and their capacity to foresee financial and monetary crises in an uncertain environment characterised by unpredictability (Goldstein et al., 1998; Oetzel et al., 2001; Reinhart, 2002; Gorfinkiel and Lapitz, 2003; De Gregorio, 2009; Anchuelo and García, 2009; Fernández de Lis and Ontiveros, 2009; Demyanyk and Hasan, 2010; McAleer et al., 2010), and they are advocating new and improved techniques (Danielsson, 2008; White, 2008; Girón and Chapoy, 2009).

The present paper follows this line of research. Based on the renewed interest driven by the current global episode, the approach chosen is to focus on the external financial crises that occurred between 1994 and 2002, so-called ‘globalisation era crises’. This is in order to check whether during that period, the most used and best-known country risk indexes –the mixed type indexes published by the *Euromoney* magazine and by the Political Risk Services (PRS) group (i.e. the ICRG)– were capable of discriminating beforehand between the countries in crisis and the countries that

belonging to the same ‘country risk group’ did not develop crisis episodes.

3. Hypotheses and Methodology

3.1 Country Risk Indexes

Of the existing methods to assess country risk, country risk indexes are possibly the most widespread (Rodríguez and San Martín, 2011). They are used to rank countries according to their greater or lower levels of risk. There are different types of indexes, but the majority of agencies publish indexes that consist of the sum by subjectively weighting certain variables for a reference period. The majority are also mixed type because they include observational and opinion (subjective), which enables them to analyse both historical and objective data as well as the appraisals of the experts involved in the consultation (Bascomb, 1993; Gorfinkiel and Lapitz, 2003).

As has already been indicated, two mixed country risk indexes were selected for the purpose of this study: the index published by the *Euromoney* magazine and the ICRG. There are various reasons for this choice: they are the most widespread and best known in international financial circles and both include variables that synthesise the information collected using other methods, such as the sovereign ratings prepared by major international agencies (Ramacharran, 1999; Iturralde et al., 2010). Furthermore, the fact that they are published over a relatively extensive time period and use a large sample of countries makes them highly reliable and enables certain statistical techniques to be applied to the data that they contribute. Their characteristics are considered in detail below.

The *Euromoney* index, which is published half-yearly (in March and September), during the selected period consisted of 9 variables grouped into three categories of indicators (Gorfinkiel and Lapitz, 2003; www.euromoney.com): an ‘analytical’ indicator comprising two opinion-based variables and seven variables divided between the ‘external debt’ and ‘market’ indicators. As shown in Table 1, the highest weighting is for the analytical and external debt indicators. It can thus be deduced that the assessment of country risk performed by this index was mainly based on the subjective opinions of experts –contained in the Economic Performance and Political Risk variables– and on debt-related measurements⁵.

Table 1
Components and weightings of the *Euromoney* index.

Variable	Weighting (%)
<i>Analytical indicators</i>	50
Economic performance	25
Political risk	25
<i>External debt indicators</i>	30
Synthetic indicator	10
Unpaid or renegotiated debt	10
Credit ratings	10
<i>Market Indicators</i>	20
Access to bank lending	5
Access to short-term finance	5
Access to capital markets	5
Access and discount on <i>forfeiting</i>	5

Source: Own preparation using data obtained from www.euromoney.com (September 2010).

³ One of the first and most comprehensive tests of the relationship between economic cycles and the outbreak of crises is the Minsky model, widely covered in Kindleberger (1978).

⁴ Crises can be considered to be unpredictable by their very natures to a certain degree, because they have unique characteristics. Thus, there is a long tradition in the economics literature of studying efforts to anticipate these crises, such as analysing economic cycles and their relationships with the emergence of imbalances and vulnerabilities. The First Generation models (Krugman, 1979; Flood et al., 1996), in the analysis of external financial crises, conceptualise them as unavoidable and foreseeable in an economy that shows a constant deterioration in its fundamentals.

⁵ Today, the methodology used by the index to perform their measurements has varied considerably. Specifically, it now contains seven variables (which are subdivided into more specific) and has increased the importance of the opinion-based variables. More information in www.euromoney.com.

The PRS group publishes the ICRG every month. This guide contains an individual index for three sub-categories: *political risk*, which is broken down into 12 subjective variables established by a group of analysts regarding social and political factors; *economic risk*, whose main objective is to indicate the degree of soundness or weakness of an economy; and *financial risk*, which reflects the capacity of a country to finance its debt. These final two sub-indexes each contain five variables, scored by means of the objective analysis of quantifiable data. In total, the ICRG thus consists of 22 variables integrated into the composite index. In both indexes, the higher the score obtained by a country, the lower its risk is.

3.2. Hypotheses

As has already been stated, the degree of social, political, and economic uncertainty associated with the participation of the agents in the international market has increased in the past three decades to such an extent that the increased difficulty in measuring and foreseeing the inherent risks (including, in particular, country risk) has emerged as the main concern among the financial and economic community (Zopounidis et al., 1998; Oetzel et al., 2001; Hoti and McAleer, 2005). Moreover, this concern remains despite the existence of instruments, such as the aforementioned country risk indexes, that should have a certain degree of accuracy when measuring the risk levels of different countries.

Given the doubts raised by different authors about the prediction capacity of the methods to foresee external financial crises and in order to determine that prediction capacity, or lack of it, for the indexes chosen, we put forward the following hypotheses:

$H_{1,1}$: the value immediately prior to the outbreak of the crisis of the Euromoney index and its two lags have the capacity to discriminate between countries in crisis and countries not in crisis.

$H_{1,2}$: the value immediately prior to the outbreak of the crisis of the ICRG and its two lags have the capacity to discriminate between countries in crisis and countries not in crisis.

The failure of these hypotheses implies, therefore, that the indexes have no discriminating capacity beforehand, namely, that by means of their lag values, they do not manage to distinguish between countries suffering from a crisis episode and countries not. However, this conclusion is not at all definitive. Even though it is true that the 'final' data of the index are usually valued, this is constructed on the weighted sum of a series of variables, which really contains the relevant information. Therefore, a comprehensive analysis regarding the predictive suitability of the selected indexes requires the capacity of their variables to be studied. Therefore, we put forward another two hypotheses to complete the analysis as follows:

$H_{2,1}$: the values immediately prior to the outbreak of the crises of the most representative variables contained in the Euromoney index and its two lags have the capacity to discriminate between countries in crisis and countries not in crisis.

$H_{2,2}$: the values immediately prior to the outbreak of the crises of the most representative variables contained in the ICRG and its two lags have the capacity to discriminate between countries in crisis and countries not in crisis.

Failure to comply with these hypotheses implies that the lagged values of the most significant variables that the Euromoney index contains and/or the variables contained in the ICRG are not capable of distinguishing between countries. In the same way as in the previous, this incapacity would indicate a priori that the variables

included in these indexes do not sufficiently predict changes in the economic fundamentals that lead to crisis episodes.

Using methodologies that have been applied in previous studies (Demirgüç-Kunt and Detragiache, 1998; Fiess, 2003; De Smet and Montano, 2004; Canbas et al., 2005; Beckmann et al., 2006; Iranzo, 2008), a procedure was selected to compare both hypotheses, namely, logistic regression analysis. In order to compare the significance of the function, we used the Wald statistics (Uriel and Aldás, 2005). We constructed the function based on the forward selection method (Silva and Barroso, 2004). Finally, we observed the classification table or confusion matrix that provides the logistic regression in order to assess the accuracy of the model's predictions. In order to affirm that the effectiveness of the model is acceptable, the correct classification of the logistic model must be at least 25% higher than is that calculated using the proportional randomness criterion (Hair et al., 2005).

Thus, given the high number of variables included in each index, if the chosen statistical technique were to be applied directly, problems of co-linearity could emerge and distort the result. In order to avoid this, the results of a factorial analysis performed by San Martín (2010) were used. For each index, this only selects the variables that are significant, thereby maintaining a sufficient level of independence between them.

Following the analysis, we can draw some conclusions. On one hand, if the indexes or the most representative variables contained therein effectively discriminate between countries in crisis and those not in crisis in the chosen time interval, the previously raised doubts about their capacity to foresee economic vulnerabilities and, therefore, to anticipate crisis episodes would lose validity. On the other hand, the conjectures regarding their low forecasting capacity would be corroborated and we could conclude that they do not anticipate economic vulnerabilities that lead to crisis episodes.

Table 2
Components and weightings of the ICRG index.

Variables	Score	% Individual Index	% Composite Index
<i>Political risk</i>	100	100	5
Government stability	12	12	6
Socio-economic conditions	12	12	6
Investment profile	12	12	6
Internal conflicts	12	12	6
External conflicts	12	12	6
Corruption	6	6	3
Military in politics	6	6	3
Religious tension	6	6	3
Law and order	6	6	3
Ethnic tension	6	6	3
Democratic accountability	6	6	3
Quality of the bureaucracy	4	4	2
<i>Economic risk</i>	50	100	25
GDP per head	5	10	2.5
Real GDP growth	10	20	5
Annual inflation rate	10	20	5
Budget balance as a % of GDP	10	20	5
Current account balance as a % of GDP	15	30	7.5
<i>Financial risk</i>	50	100	25
Foreign debt as a % of GDP	10	20	5
Foreign debt service as a % of the exports of goods and services	10	20	5
Current account balance as a % of the exports of goods and services	15	30	7.5
Net international liquidity as months of import cover	5	10	2.5
Exchange rate stability*	10	20	5

*Exchange rate stability is defined as the fluctuation rate of the value of the local currency with respect to the US dollar. In the case of the latter, its fluctuation is measured in terms of the euro.

Source: Own preparation using data obtained from www.prsgroup.com (September 2010)

3.3. Sample design

The sample used in this paper included two groups. Thirteen countries that during the studied period⁶, that is, between 1994 and 2002, experienced an external financial crisis and 50 countries that even though they belong to the same ‘risk group’ as the first did not. Three countries⁷ were assessed using both the *Euromoney* index and the ICRG.

Thus, although classifying countries into homogeneous groups according to the perception of their country risks is a widely accepted assumption in the literature (Zopounidis and Doumpos, 2002; De Smet and Montano, 2004; Yim and Mitchell, 2005; Tomic-Plazibat et al., 2010) and grants greater consistency to the empirical results from a methodological point of view, neither the *Euromoney* index nor the ICRG explicitly offers these groupings. In order to solve this drawback and with respect to the countries assessed using the variables included in the *Euromoney* index, we used the results of the study conducted by Rodríguez et al. (2006), where the countries are classified into risk groups using a cluster analysis and checked using a discriminant analysis. In the case of the ICRG, these conglomerates were obtained from the cluster analysis performed by San Martín (2010)⁸.

Table 3 sets out the countries in crisis and not in crisis that make up the final sample. The ‘t’ date refers to the publication of the index immediately prior to the moment when a country defaults or seeks a moratorium on its external debt. Should that circumstance not occur, the start of the crisis is identified as the renegotiating of the debt, serious imbalances in the banking system (banking crisis), serious liquidity crisis, or when there is a devaluation of the local currency by over 15%.

The selected independent variables to contrast the first hypothesis are⁹:

- The value of each index at moment ‘t’ associated with each country.
- The value of each index with one and two lags with respect to moment ‘t’ (i.e. the value at ‘t-1’ and ‘t-2’).
- The difference between the value of the index at ‘t’ and its lags.

In order to contrast the second hypothesis, the value will be used of the most significant variables contained in each of the indexes, both at moment ‘t’ and with one and two lags¹⁰. For both cases, the expounded variable takes a value of one for the group of countries in crisis and zero otherwise.

4. Results

4.1. Euromoney Index

Logistic Regression Analysis of the Value of the Euromoney Index

The statistics in Table 4 and the Hosmer-Lemeshow statistic (0.64) indicate that the quality of global fit is adequate. Taking the results of previous studies into account, the logistic regression analysis was performed by means of the forward selection method, which, stopped in the first step, obtains the following model that includes a single variable, namely, the value of the index with two lag periods:

$$P(\text{Crisis}) = \frac{e^{-3.656+0.044 \text{ Euromoney}_{t-2}}}{1 + e^{-3.656+0.044 \text{ Euromoney}_{t-2}}}$$

Pursuant to the value of the Wald statistics, the variable is significant (individually) enough to establish differences between the sample groups. However, its sign is not congruent. With β positive and $e^{\beta} > 1$, an increase in the value of the index with two half-yearly lags –that is, one year prior to date ‘t’– implies a greater probability of belonging to group 1, namely, to the group of countries in crisis. This contradicts previous approaches, because a high value for the index denotes lower country risk and, in theory, a lower probability of suffering a crisis. Table 5 summarises the statistics for the variable included in the function.

Table 4
Odds Ratio, Cox and Snell R², and Nagelkerke R².

Step	-2 odds log	Cox and Snell R ²	Nagelkerke R ²
1	58.427	0.087	0.136

Table 5
Variables in the equation.

Step 1	B	E.T.	Wald	gl	Sig.	Exp(B)
<i>Euromoney</i> _{t-2}	0.044	0.020	5.050	1	0.025	1.045
Constant	-3.656	1.143	10.231	1	0.001	0.026

¹⁰ In order for the total number of independent variables not to be excessive, the differences between the value of the variables and their lags were not considered.

Table 3
Final sample of countries in crisis and not in crisis.

Countries in crisis			Countries not in crisis			
Country	Date broke out	‘t’ date	Same group according to ICRG variables		Same group according to <i>Euromoney</i> variables	
Mexico	December 1993	Sept. 1993	Cameroon	Algeria	Nicaragua	Bulgaria
Venezuela	June 1994	March 1994	Syria	Zambia	Vietnam	Peru
Rumania	Halfway through 1996	March 1996	Bolivia	Guyana	Papua	Paraguay
Thailand	July 1997	March 1997	Trinidad and Tobago	Israel	Philippines	Poland
Malaysia	July 1997	March 1997	Libya	Kenya	India	Sudan
Indonesia	August 1997	March 1997	Iran	Honduras	Czech Republic	Egypt
South Korea	November 1997	Sept. 1997	Saudi Arabia	Jamaica	Greece	Hungary
Russia	August 1998	March 1998	Dem. Rep. Congo	Angola	Gambia	Morocco
Brazil	January 1999	Sept. 1998	Oman	Malta	Colombia	Panama
Ecuador	August 1999	March 1999	Gabon	Nigeria	El Salvador	Ethiopia
Turkey	November 2000	Sept. 2000	Latvia	Lithuania	Slovakian Rep.	South Africa
Argentina	December 2001	Sept. 2001	Croatia	Estonia	Chile	China
Uruguay	July 2002	March 2002	Zimbabwe	—	Tunisia	—

With respect to the ratings results¹¹, if the global percentage of success achieved by the model (82.5%) were to be compared with what would be obtained by applying the proportional randomness criterion (67.24%), the success increase in the classification would be lower than would the minimum stipulated for the ratings capacity of the regression function to be considered significant. Furthermore, the classification error only occurs in countries in crisis¹². Therefore, sub-hypothesis H_{1,1} is rejected.

Logistic Regression Analysis of the Value of the Most Representative Variables

The results of the factor analysis performed by San Martín (2010) identify the political risk and unpaid or renegotiated debt¹³ as more representative within the *Euromoney* index. Based on these results, the logistic regression analysis was applied to six independent variables: the values of both variables at moment 't' associated with each country and their values with one and two lags with respect to moment 't'¹⁴.

First, the total sample was divided into two groups, randomly taking 90.5% of the observations (57) for the analysis sample and using the other countries (six) in order to validate the results. Using the results of the Hosmer-Lemeshow test and the statistics contained in Table 6, we confirmed that the quality of global fit is appropriate¹⁵.

Table 6
Odds Ratio, Cox and Snell R², and Nagelkerke R².

Step	-2 odds log	Cox and Snell R ²	Nagelkerke R ²
1	54,225	0.075	0.117
2	44,558	0.219	0.341

As can be seen, the logistic regression model only includes the value of political risk at the approximate moment of the outbreak of each crisis episode, and the datum of that same variable with 12 months' lag.

$$P(\text{Crisis}) = \frac{e^{-3.690+20.523PR_{t-2} - 16.374PR_t}}{1 + e^{-3.690+20.523PR_{t-2} - 16.374PR_t}}$$

Table 7 sets out the statistics of each variable.

Table 7
Variables in the equation.

Step 2	B	E.T.	Wald	gl	Sig.	Exp(B)
PR _{t-2}	20.523	6.552	9.810	1	0.002	818131286.230
PR _t	-16.374	5.887	7.736	1	0.005	0.000
Constant	- 3.690	1.328	7.719	1	0.005	0.025

In accordance with the *p*-values of the Wald statistics, both variables are individually significant enough to discriminate between the selected groups. Thus, the interpretation of the signs of the estimated coefficients differs according to the variable. On one hand, with negative β and e^β<1, the PR_t variable has a lower value in the countries in crisis, which is coherent both with the data and with the previous hypothesis. On the other hand, however, the positive coefficient and an odds ratio greater than the unit of the PR_{t-2} variable do not seem reasonable, because they indicate

that this has greater value in the countries in crisis and, as has already been mentioned, the contrary should be true. This result might be because of the correlation existing between PR_{t-2} and PR_t. Because co-linearity exists between the variables, their signs may show contradictory significance in the function, and in this case, the negative effect of PR_t seems to be offset by the positive effect of the PR_{t-2} variable.

With regard to the capacity of the model to rank the cases observed accurately, and taking the proportional random criterion as a reference, the success increase in the ratings achieved for the analysis sample is 19.24% and 11.08% for the validation sample. In both cases, this does not exceed the stipulated minimum increase to be able to ensure that the regression function is capable of rating correctly. Even though it is true that the percentage of hits in the case of the countries not in crisis is high, this is considerably reduced when it comes to rating the countries in crisis accurately, which are, in general, those that are of interest for us to identify¹⁶. Based on these results, the H_{2,1} sub-hypothesis should also be rejected.

4.2. ICRG

Logistic Regression Analysis of the Value of the ICRG Index

Following the same procedure, a logistic regression analysis was performed on the sample of 63 countries using the ICRG data and the process showed no results¹⁷. In other words, no logistic function is capable of discriminating between countries that will develop a crisis episode and countries that have similar financial, economic, and political characteristics, but are not in crisis. This solution should enable the H_{1,2} sub-hypothesis to be rejected definitively.

Logistic Regression Analysis of the Value of the Most Representative Variables

In this case, the factorial analysis extracted four factors and the most correlated variables in each case are the current account balance as a percentage of GDP; GDP per head; the exchange rate stability variable; and the budget balance as a percentage of GDP. Thus, taking the value at moment 't' of each of them and their respective two lags, we have 12 variables. The sample was divided randomly into two groups: the analysis sample, formed by 55 countries (87.3%), and the other 8 countries that make up the validation sample.

The statistics that contrast the quality of the final tuning of the model show that the available data make feasible the application of a logistic regression analysis, which is here completed in two steps. The resulting model includes two variables: the value of GDP per head with a delay of 12 months with respect to moment 't' and the depreciation rate at moment 't'.

$$P(\text{Crisis}) = \frac{e^{-2.897+0.083PIB_{perhead_{t-2}} - 0.038Exchange_t}}{1 + e^{-2.897+0.083PIB_{perhead_{t-2}} - 0.038Exchange_t}}$$

The data in the function of both variables are summarised in Table 8.

¹¹ In the analysis of the values of both indexes, validation samples could not be extracted because, when doing so, the analysis sample did not provide sufficiently conclusive results.

¹² Only Malaysia and South Korea were correctly rated by function.

¹³ This result concurs with the one obtained by Ayala et al. (2000).

¹⁴ Even though the variables as such have little correlation –because they were obtained from the factorial analysis– there is co-linearity among the lags. However, we deemed that, even so, they can be used for the logistic regression analysis, because we do not seek to obtain a model with the maximum discriminating capacity, but rather one that has the maximum ratings capacity.

¹⁵ With a significance of 1% in both cases.

¹⁶ Specifically, Argentina, Brazil, Ecuador, Malaysia, South Korea, Thailand, and Venezuela are appropriately classified.

¹⁷ The same procedure was performed by means of the RV contrast and the results likewise show the non-existence of an appropriate logistic function. Therefore, and taking into account that one of the drawbacks of the method is the possibility of excluding variables from the regression that, either theoretically or conceptually, are important, the analysis was again performed using the introduce method (formed based on each of the selected independent variables) to definitively confirm that the inconsistent results of the logistic regression are not because of the modelling method used.

Table 8
Variables in the equation.

Step 2	B	E.T.	Wald	gl	Sig.	Exp(B)
GDP_perhead_t-2	0.083	0.045	3.323	1	0.068	1.086
Exchange_t	-0.038	0.014	7.701	1	0.006	0.963
Constant	-2.897	0.721	16.146	1	0.000	0.055

Although the function does not offer a logical interpretation, the coefficients indicate an inconsistent relation and this is contrary to previous assumptions. With respect to the predictive capacity of the model, as the confusion matrix shows, this has a low percentage of success, both for the analysis sample and for the validation¹⁸. In fact, when the results obtained in both are included, only Ecuador, Russia, Turkey, and Venezuela are correctly rated. These results show that the $H_{2,2}$ sub-hypothesis can also be rejected.

4.3. Synthesis of the Results

The logistic regression analyses performed on the values of the selected indexes and of their most significant variables do not show the appropriate results. The regression functions obtained show, in all cases¹⁹, coefficients that are difficult to interpret and inconsistent with previous assumptions. Furthermore, as shown by the results summarised in Table 9, these functions have little classification power, erring mainly on the forecast of the most interesting cases to be detected, that is, the countries in crisis.

Table 9
Summary of the ratings results

Index	Value analysed	Hits in the analysis sample (%)	Hits in the validation sample (%)	Total number of hits in the ratings of countries in crisis
Euromoney	Index	82.5%	∅	2
	Variables	86.0%	83.0%	7
ICRG	Index	∅	∅	∅
	Variables	81.8%	87.5%	4

In light of the foregoing, we reject the H_1 and H_2 hypotheses, because it seems proven that the values of the *Euromoney* index and of the ICRG, along with those of their most representative variables, are not capable of discriminating, within the sample selected, between the cases identified as countries in crisis and those not.

5. Conclusions

Although the current international financial crisis has certain unique characteristics among the factors that underpinned its outbreak, it shares some processes similar to previous crises that have occurred in the globalisation era, particularly from 1994 onwards. One of these characteristics is its unpredictability. As demonstrated in the present paper, efficient instruments still do not seem to exist that can forecast in advance the form, the moment, or the place of its outbreak. Corroborating this statement, the results described herein indicate that both the *Euromoney* index and the ICRG, along with their most representative variables, are incapable of forecasting with sufficient notice—in the medium term—the financial, economic, and/or political vulnerabilities that can trigger

a crisis. Furthermore, this incapacity is particularly relevant insofar as the two selected indexes for the present analysis are the best known and most widely used by the international financial community.

Considering the results achieved and taking into account that this unpredictability seems to be a common factor to 'globalisation era' crises, we have reached some conclusions.

First of all we come to the main conclusion that the *Euromoney* and ICRG indexes, along with the variables with greater representation within them, do not foresee—in the medium term—the negative changes or vulnerabilities that emerge in a specific economy, which can lead to episodes of external crises. Although the results are not favourable to the acceptance of the presented hypotheses, they imply that the *Euromoney* index and its significant variables have a greater discriminating capacity and greater hit rate in terms of classification compared with the ICRG and its variables, even though its coefficients must be interpreted in the opposite way to that expected. But, in any event, these results do not imply that the selected indexes are unusable. First, the *Euromoney* and ICRG indexes are both acceptable for markets and analysts to reflect on the perceived risk of a country insofar as they include a series of variables that consider the opinions of different experts regarding country risk. Second, despite the ongoing criticism of their inability to forecast accurately, they continue to have a great degree of widespread acceptance in financial markets and they are consulted by numerous companies as well as individual and institutional investors.

Lastly, we have observed that the growing interrelation, integration, and globalisation of financial markets has increased their degree of complexity and, likewise, their instability, meaning that risk management has become the main area of interest of the international community. Therefore, in this new global economic framework, there is no room for the 'easy prediction' assumption of crisis episodes. Quite to the contrary, it seems to be necessary to develop new methods that, from the prism of uncertainty and unpredictability, measure and manage country risk in the most appropriate way.

In this context, and taking into account the aforementioned consequences arising from an increasingly globalized environment, we estimate a new approach to country risk is essential.

That is, given that the absolute control of risk seems to be impossible, it needs to be anticipated ab initio by identifying its sources and investigating its underlying causes. Therefore, controlling the evolution of less sustainable economic phenomena would thus be necessary by leaving forecasting models to one side and focusing attention on the potentially unfolding scenarios of an economic system marked by uncertainty and unpredictability.

Finally, we discuss the limitations found that, in general, have been with respect to the sample of selected countries. First, the final sample that has been prepared, that is, assessments issued by *Euromoney* and ICRG indexes, for a given time period (between 1994 and 2002) and for a set of countries, has been reduced. The reason is the small number of countries that during the selected period suffered an episode of crisis. In fact, not to unbalance the equilibrium between countries and, therefore, to prevent biased results, we could not expand the number of cases in the final sample. Also, the type of sample data has enabled the application of certain statistical techniques that otherwise would have been of particular interest (e.g. panel data).

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¹⁸ Only the validation sample seems to achieve a sufficient hit percentage (with an effectiveness indicator higher than the random criterion of around 25%) in order for the classification to be taken to be adequate. However, for this matrix, the hit percentage is only 50% for the group of countries in crisis, which is very poor. Furthermore, this result might be inconsistent because of the reduced number of observations in the validation sample.

¹⁹ Except for the analysis performed on the value of the ICRG, where no result was obtained.

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