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Do Financial Crises Occur in Advanced Economies at Regular Intervals?

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Abstract

Financial series, particularly stock exchange indices, often fluctuate immensely during financial crises. This phenomenon indicates regime changes or structural breaks that cannot be represented by simple linear models or time series.

In this study we will use first-order autoregressive Markov switching models in the (MS (2)-AR(1)) to test the hypothesis that international financial crises occur in advanced economies at regular intervals. We have therefore chosen the main stock exchange indices of ten developed OECD countries during the period January 1985-May 2013. Our results allow us, first, to show that there is a strong relation between stock market bear regimes and periods of financial crisis, and second, to validate the hypothesis of recurring periodicity of international financial crises in financial markets, given that these crises happen at regular time intervals: namely, every decade.

Keywords: financial crises, markov models, regime changes

1. Introduction

In the last three decades, the global economy has been marked by a series of international financial crises varying both in type (monetary crises, bank crises, market crashes...) and magnitude, affecting both developed and developing countries. These crises generally occur unpredictably and regularly, and are frequently detrimental to the whole financial and economic system, particularly to the interbank lending and stock markets, on a national, as well as international, scale.

An increasing proliferation of these crises, notably the astronomical losses generated in terms of financial and socioeconomic costs by the 2007–2008 international crisis, generated new trends of both theoretical and empirical work, all of it directed towards discerning and understanding the mechanisms that most profoundly contribute to the occurrence of this kind of economic disturbance. The aim of these works is to find ways to address effectively the management and prevention of the phenomenon, before it attains a catastrophic scale.

While closely studying the financial crisis history of the last thirty years, we note that even if each crisis has a unique nature, these crises sometimes display shared causes. According to Rojas-Suarez and Weisbrod (2008), even if each crisis has a unique origin and progression, detailed analysis of all crises reveals the existence of a series of basic mechanisms, which are very similar in nature, even if they differ in intensity and/or occurrence from each other.

In fact, even if, on one hand, the 1929 and 1987 crises, or the 2000 Internet bubble, were due to imbalances on the stock markets (a sharp decline in stock prices or the technology stock market) following speculative bubble bursts, on the other hand, the 1997 Asian crisis and the 2007 subprime crisis derived from dysfunctions in the financial and banking systems (massively unrecoverable debts, excessive risks and depositors' panic...). Nevertheless, detailed analysis of these crises show that these latter two were only results of financial globalization. In effect, financial liberalization has favored the integration of financial markets, the free circulation of capital flows, credit boom, as well as the increased proliferation of financial innovations, which bestows a tremendous power to markets and speculation. This has strongly contributed to the financial and economic system's vulnerability and fragility to various endogenous and exogenous disturbances.

Furthermore, not even the countries that had completely sustainable fundamentals were spared by the major

crises of the last decades, owning to the simple principle of contagion. We can cite, by way of example, the 1997 Asian crisis.

Quite a few works—both in the theoretical and empirical modeling fields—have studied the financial crisis and more specifically the identification of factors or warning indicators of financial crisis (Note 1); the connections between financial liberalization (Note 2) and financial crises, the role played by contagion (Note 3) in propagating financial crises, and moreover the connection between financial crises and stock market volatility (Note 4).

Using-as starting point observation-the fact that the major global financial crises that have shattered the global economy during the last three decades (i.e., in 1987, 1997 and 2007) appear to resurge cyclically, this study brings-as a new element to the existing literature - the use of autoregressive Markov switching models in an effort to answer the question: Do international financial crises emerge in advanced markets periodically?

This study follows the following structure: the 2nd section of the study is an overview of the existing literature. The 3rd section presents our data. In section 4, we present our methodology: construction of the financial crisis variable and presentation of our empirical model. In section 5 we give the results of our estimations. Our conclusions are in the 6th section.

2. Overview of Previous Theoretical Literature

2.1 Definition of International Financial Crises

Guido (2013, p.2) defines international financial crises as "*episodes of financial turbulence in which the international dimension plays an important role*".

Relying on this definition and on different definitions present in the literature (Note 5), we define the international financial crisis as a serious dysfunction in the financial sector that can affect either the financial markets (a sharp decline in asset prices), or the financial and banking systems (very irrecoverable debts, excessive risks and depositor panic...), leading to the collapse of stock markets and the paralysis of the global financial system.

2.2 Origin of International Financial Crises

2.2.1 The Crash of 1987

According to Carlson (2007), the stock market crash of 1987 was a major systemic shock. He asserts that the crash not only led to the collapse of financial asset prices, but also seriously undermined the operation of the financial market.

At the origin of this crash was the 1986–1987 development of a speculative bubble on the U.S. stock markets (figure 1) that generated a dizzying rise in stock prices and in the Price-Earning ratio. In October 1987, the growing difference between equity and bond returns (equity returns dropped sharply relative to bond returns) along with interest rate growthserved to trigger the crisis. The combined effect of these two factors led to abrupt, massive equity sales, from which originated the stock market crash.

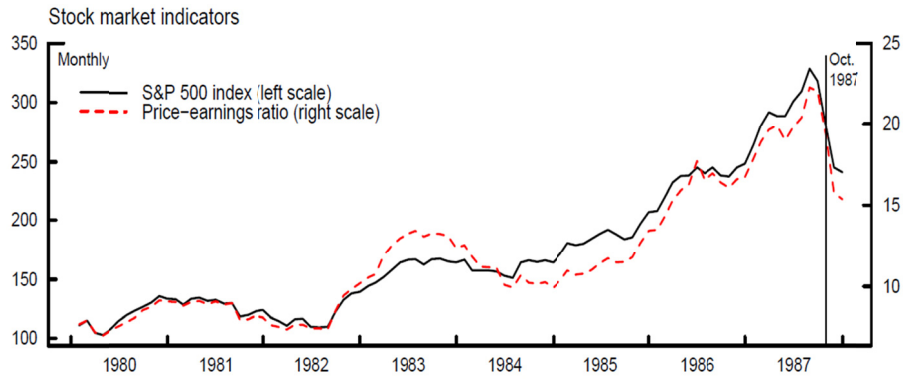

Figure 1. Evolution of the S&P500 indicator and price-to-earning ratio in the 1980–1987 time frame

Source: Carlson (2007), P.3.

This crisis prompted the simultaneous collapse of the world's financial markets. In fact the Dow Jones index (New York stock market) dropped by 22%; the Hong Kong stock market saw its Nikkei stocks index diminish by 43.8%; the FTSE index (London stock market) went down by 26.4%; the Australian stock market's SPI index recorded a drop of 41.8%; while Toronto's Stock Exchange composite dropped by 11.3%, resulting in a whopping 37 billion dollars of loss.

Despite the global magnitude of the 1987 stock market crash, which led some to compare the crash to that of 1929, the 1987 financial crisis did not lead to a global economic crisis. The economic and financial damages of the 1987 financial crisis were limited. The stock market crash affected mainly brokers, such as LF Rothschild in the U.S., whose losses were estimated at 44 million dollars.

2.2.2 The 1997 Asian Crisis

The Asian crisis officially started the 2nd July 1997, when the central bank of Thailand found itself unable to defend its currency and was obliged to let the Baht float. Soon after, in the wake of Thailand's crisis, the Filipino peso, the Indonesian rupiah, and the Malaysian ringgit dropped in value relative to the U.S. dollar in a domino effect; the values of these currencies dropped by over 75 percent.

Corsetti, Paolo and Nouriel (1998), and Goldstein (1998) attribute the cause of the emergence of the 1997 Asian financial crisis to financial liberalization, which led to the appearance of problems in the financial sector. In effect, financial liberalization brought about a credit boom, which was fed by the massive inflow of foreign capital. According to these authors, the rate of credit growth in the Asian countries affected by the crisis became much higher than the rate of GDP growth, and the amount of incoming capital was estimated to be around 75 million dollars from 1993 to 1996. The credit boom led to the deterioration of bank balance sheets. In the countries affected by the Asian crisis, the ratio of non-performing loans grew from 15 to 35% (see for example, Goldstein, 1998).

This crisis also spread beyond Asia. It especially affected the emerging economies of Latin America and Eastern Europe. Investors' fear of a global economic slowdown led to a sharp decrease in the capital flow to developing economies. According to Lozado (1999), the Asian crisis led to a decreased flow of foreign capital to Latin America, which dropped from 100 billion dollars in 1996 and 1997, to 85 billion dollars in 1998.

The 1997 Asian crisis also brought about market capitalization losses on advanced economies' stock markets estimated at 1,700,949 million dollars (see table 1 below).

Table 1. Stock market losses, in millions of dollars

Country	Market capitalization on September 30	Market capitalization on October 27/28 (1)	Market capitalization loss(2)
United States	9.275.445	8.638.568	-636.877
Tokyo	2.834.178	2.570.327	-263.851
United Kingdom	2.103.076	1.984.598	-118.478
Germany	821.893	730.691	-91.202
France	649.363	582.562	-66.801
Total			-1.177.209

Source: Pousin (1998, p.12).

Additionally, the Asian crisis was the source of a global economic slowdown. According to the World Bank (1998), global production dropped by 0.5 percent in 1998, and economic growth in the Middle East, North Africa, Latin America, and the Caribbean dropped by a further 1.0 percent. However, with the exception of Japan, the crisis had less of an impact on the main industrialized countries.

2.2.3 The 2007–2008 Crisis

The global financial crisis of 2007–2008 is the 21st century's first systemic crisis. The crisis started in 2007 following the collapse of the U.S. subprime mortgage market. According to several theorists (Note 6), the 2007–2008 crisis is the result of overly permissive monetary policies, a lack of regulation and supervision of the financial and interbank markets, excessive reliance on the leverage effect, as well as of worldwide macroeconomic imbalances.

The subprime mortgage crisis had negative effects on the entire global economy. The crisis led to the collapse of several stock markets in the early 2008, such as: developing country stock markets (Note 7), which dropped 8%

on average; the London stock market registered a 5.48% stock index decline; the Australian stock market index (SPI 200) dropped by 41.8%; the Parisian stock market index (CAC 40) dropped by 15.5%; the U.S. stock index (Dow Jones) dropped by 4.02% and the Nasdaq dropped 4.10%; the Hong Kong and Chinese stock indices dropped by 6.20% and 5.55%, respectively.

Similarly, the 2007–2008 crisis caused significant production losses, a high tax cost, as well as a sharp increase in public debt in several countries, notably in the large industrialized economies (see table 2 below) and the Asian ones. The International Monetary Fund (2010) has estimated the bank losses at around 2300 billion dollars, almost 16% of the United States' GDP.

Table 2. Costs of the 2007–2008 crisis in percent of GDP

Country	Production loss	Tax cost	Public debt growth
United States	31.0	4.5	23.6
Greece	43.0	27.3	44.5
Ireland	106.0	40.7	72.8
Spain	39.0	3.8	30.7

Source: Laeven and Valencia (2012), P. 24–26.

2.3 Stock Markets and Regime Changes

During periods of financial distress, stock indices are frequently subject to dramatic fluctuations. This phenomenon indicates regime changes or structural breaks that cannot be represented by simple linear time-series models.In order to observe the effects of regime changes on stock markets, several studies have made use of Markov switching models introduced by Hamilton (1989).

Turner, Startz and Nelson (1989) were the first to use these models to capture stock market regime changes. They emphasized the utility of these models in capturing the behavior of regime changes on the mean and variance. Cheu and al. (1994) studied the relation between stock market returns and stock market volatility by using the autoregressive Markov switching model. Their study highlighted the existence of an asymmetric relationship between market returns and market volatility. Maheu and McCurdy (2000) used the Markov Switching autoregressive Model (MS-AR) to identify different regimes (bull/bear) on the U.S. stock market. They concluded that MS-AR models were useful for for allowing regime shifts to happen in mean and in variance. Laha (2006) used a Bayesian Markov switching model to capture and predict bull and bear markets on the Indian stock market. Laha concluded that the regime changes regarding themarket were highly correlated to national and international financial events, particularly the 1997 Asian crisis. Similarly, Ismail and Zaidi (2008) used the Markov switching model (MS-AR) in a univariate case to capture the behavior of regime changes of four Main stock indices in Malaysia; namely, the Composite, industrial, financial, and property indices. They emphasized the utility of MS-AR in identifying regime changes in financial time-series. Additionally, Ismail and Zaidi have demonstrated the existence of a strong correlation between bear markets and global economic and financial crises, such as the 1974 spike in gasoline prices, the 1987 stock market crash, and the 1997 financial crisis.

3. Data

The study is based on monthly frequency data from the period January 1985–May 2013 (341 observations). The data is from the Bloomberg database and relates to the chief stock indices of ten main industrialized countries in the OECD (table 3).

Table 3. Data

Country	Stock indices
Belgium	BEL 20
Canada	S&P/TSX
Finland	HEX
France	SBF250
Germany	DAX
Ireland	ISEQ
Japan	TOPIX
Spain	IGBM
United Kingdom	FTSE 100
United States	S&P500

All our data sets are analyzed in terms of returns. Thus, for each country, we calculate R_{it} stock returns. R_{it} is given by:

$$R_{it}=100*ln\left(\frac{P_{it}}{P_{it-1}}\right) \quad (1)$$

Where P_{it} is the stock index of country i during date t.

According to the results in our descriptive statistics (table 4), we observe that for the group of countries used in our study, the data set is asymmetrical, has a heavy left tail, and is leptokurtic. Similarly, the results of the Jarque-Bera test require the rejection of the normality hypothesis for the group of our data set. Furthermore, the standard unit root tests show that our ten data sets are stationary (table 5).

Table 4. Descriptive statistics

	BEL20	S&P/TSX	HEX	SBF250	DAX	ISEQ	TOPIX	IGBM	FTSE100	S&P500
Mean	0.5	0.49	0.67	0.52	0.45	0.61	0.09	0.7	0.5	0.64
Median	0.86	1	1.4	1.34	1.35	1.33	-0.08	1.02	0.84	0.99
Maximum	14.13	11.16	26.13	18.39	13.07	15.54	13.41	24.51	9.97	11.97
Minimum	-27.19	-25.02	-25.68	-27.63	-27.51	-39.09	-24.82	-27.08	-24.12	-25.48
Std. Dev.	4.54	4.16	6.88	5.33	5.14	5.84	4.93	5.64	3.98	3.78
Skewness	-1.02	-1.5	-0.22	-0.85	-1.31	-1.66	-0.41	-0.36	-1.38	-1.56
Kurtosis	7.85	9.6	4.11	6.12	7.05	11.42	4.44	5.54	8.95	10.59
Jarque-Bera	389.54	746.31	20.45	178.88	331.16	1164.57	38.9	98.9	610.67	956.96
Observations	337	341	341	341	341	341	341	340	341	341

Table 5. Unit root test

0	ADF
BEL 20	-12.86852
S&P/TSX	-14.34462
HEX	-12.16578
SBF250	-14.71746
DAX	-13.2026
ISEQ	-13.16018
TOPIX	-12.98411
IGBM	-12.5866 (i)
FTSE 100	-15.0648
S&P500	-13.42092

Note:The regressions of the majority of data sets include only an intercept. The symbol (i) indicates that the data sets include a trend and an intercept. The critical value of 95% for the regressions is -3.44 with trend and -2.88 without trend.

4. Construction of the Financial Crisis Index and Econometric Specification

4.1 Construction of the Financial Crisis Index

A key element of our study is the construction of binary variables of both national and international financial crises.

To this end, having as principal reference LaevenandValencia's list (2008, 2012), we have identified and dated the phases of banking crises (Note 8), currency crises (Note 9), and theSovereign debt crises (Note 10) during the time period of 1985–2013 for each country in our sample (table 6).

Table 6. Dates of financial crises according to Laeven and Valencia's list (2008, 2012)

Country	Banking crisis	Currency Crisis	Sovereign Debt Crisis
Belgium	2008–2011	-	-
Canada	-	-	-
Finland	1991–1995	1993–1995	-
France	2008–2011	-	-
Germany	2008–2011	-	-
Ireland	2008–2011	-	-
Japan	1997–2001	-	-
Spain	1977–1981 2008	1983	-
United Kingdom	2007–2011	-	-
United States	1988 2007–2011	-	-

Let thus NCI_{it} be the dummy variable of national financial crises, which will have a unit value when a banking or monetary crisis or debt is observed in a country i at a given time t–and 0 otherwise.

$$NCI_{it} = \begin{cases} 1 & if crisis \\ 0 & otherwise \end{cases} \quad (2)$$

In addition, we have created a binary variable for international financial crises. Let ICI_t be the dummy variable for international financial crises (See section 2), which has a unit value when an international financial crisis occurs at a given time t, and 0 when it does not.

$$ICI_t = \begin{cases} 1 & if crisis \\ 0 & otherwise \end{cases} \quad (3)$$

4.2 Econometric Specification

In this study, we will attempt to identify different regimes on the stock markets of 10 main OECD advanced economies during the time period January 1985–May 2013, in order to test the hypothesis of periodic occurrence of international financial crises.

In order to accomplish this, we have chosen Markov switching models, introduced by Hamilton (1989). These models allow us to take into account the asymmetric evolution of the expansion/contraction phases of the cycle, in contrast to the linear models, which require the different phases of the cycle to have identical duration and amplitude.

4.2.1 Hypotheses of the Autoregressive Markov Switching Model

To implement the Markov switching model, the following hypotheses will be needed:

H1). The autoregressive order will be assumed to be (p=1).

With the principle of parsimony, we observe that the first-order autoregressive Markov switching model (MS-AR (1)) is the best suited to identify the various regimes in the stock markets of the countries in our work sample.

H2). We posit that two regimes exist (K=2).

In this study, we identify the number of states based on a visual examination of the data. From this moment on, we will limit our work to a two-regime Markov switching model.

H3). The density of the conditional distribution is in this process the general error distribution (GED) law with two different variance for each of the two regimes σ_1^2 and σ_2^2.

The normal density function (iid) could be out of place here, since it does not reflect the thickness characteristic of the distribution tail "fat-tail", which is notably one of the main characteristics of stock returns. By referring to Darrat& al. (2002), we estimate the errors with the law of general error distribution (GED) in order to capture the characteristic too-thick tail distribution (k) and the degree of flatness in our data sets.

H_4). Transition probabilities remain constant over time

The classic definition of Hamilton's (1989, 1990, and 1994) Markov switching model is based on the hypothesis that transition probabilities remain constant over time.

4.2.2 Autoregressive Markov Switching Model

In this study, we will consider a univariate first-order, two-regime Markov switching (MS(2)-AR(1)). The Hamilton model (1989) is defined as follows: We say the process $(y_t)t$to be an MS(2)-AR(1) process if it satisfies the following equations:

$$y_t = \mu_{S_t} + \alpha_1 y_{t-1} - \mu_{S_{t-1}} + \mu_t$$

$$\mu_t \sim GED(o, \sigma_i^2(S_t), \text{ k}) \quad (4)$$

$$S_t = j \ , \ S_{t-i} = i \quad i,j \in 1,2$$

Where,

y_t: is the variable for which we want to determine the evolution in time as a function of past realizationsy_{t-1} , i =1,…, N.

μ_t: follows the *law* of general error distribution (GED) of variance $\sigma_i^2(S_t)$ (Note 11) and parameter$k$.

k: is a parameter allowing us to show in our model the fatness of the tail distribution (k being constant in time)

For any t, the unobservable variable S_t will be 1 when the state is in regime 1, and 2 when it is in regime 2, respectively. In Hamilton's model (1989), S_t follows a first-order Markov chain. This means the current regime S_t depends solely on the previous (S_{t-1}.) state's regime. Thus, the S_t state follows a first-order Markov chain characterized by the following property:

$$p_{ij} = P(S_t = j | S_{t-1} = i), \sum_1^N p_{ij} = 1 \ \forall i,j \in \{1,2\} \quad (5)$$

Where $(p_{ij})i,j$ are the transition probabilities. These last ones allow us to measure the probability of transitioning from one regime to another.

Estimating the model is maximizing the log-likelihood (Note 12) function, this allow us to determine the model's parameters $(k, \alpha, \mu_1, \mu_2, {\sigma_1}^2, {\sigma_2}^2, p_{11}, p_{22})$ and the smoothed and filtered probabilities of the unobserved variabless_t of the MS(2)-AR(1).

5. Empirical Results

We recall that the goal of this study is to identify, by means of the Ms(2)-AR(1), the different regimes on the stock markets of ten main advanced OECD economies during the period January 1985–May 2013, in order to test the hypothesis that international financial crises occur periodically. The results of estimations for each of our data sets are given by table 7.

Table 7. Maximum likelihood estimates for the MS model (2)-AR (1)

		BEL 20	S&P/TSX	HEX	SBF250	DAX	ISEQ	TOPIX	IGBM	FTSE 100	S&P 500
	Coefficient	0.45	0.47	0.37	0.42	0.44	0.47	0.48	0.47	0.33	0.39
α	Std Error	0.05	0.08	0.04	0.09	0.04	0.08	0	0.19	0.08	0.07
	p. value	0	0	0	0	0	0	0	0.02	0	0
	Coefficient	0.32	0.11	2.94	0.3	0.36	0.36	0.6	1.41	0.1	1.37
μ_1	Std Error	0.08	0.07	0.37	0.08	0.1	0.07	0.11	0.68	0.01	0.19
	p. value	0	0.12	0	0	0	0	0	0.05	0.19	0
	Coefficient	-0.31	-0.26	-0.89	-0.22	-0.32	-0.27	-0.23	0.19	-0.08	-1.54
μ_2	Std Error	0.09	0.09	0.66	0.08	0.07	0.05	0.08	0.41	0.02	0.33
	p. value	0	0.01	0.18	0	0	0	0	0	0.05	0
σ_1^2	Coefficient	7.31	14.58	10.97	12.96	12.42	17.36	8.44	11.87	3.11	4.92
	Std Error	2.27	4.7	4.87	4.59	4.22	4.39	2.53	5.27	0.67	1.59
	p. value	0	0.01	0.02	0.01	0	0	0	0.05	0	0
σ_2^2	Coefficient	23.8	9.38	56.13	21.16	14.89	19.27	30.29	18.56	6.72	11.38
	Std Error	18.71	7.68	20.02	10.63	6.72	9.33	4.62	8.99	2.82	2.12
	p. value	0.2	0.22	0.01	0.05	0.03	0.04	0	0.04	0.02	0
	Coefficient	0.55	0.52	0.55	0.53	0.54	0.67	0.46	0.45	0.52	0.54
k	Std Error	0.12	0.15	0.09	0.13	0.09	0.08	0.08	0.1289	0.12	0.11
	p. value	0	0	0	0	0	0	0	0	0	0
p_{11}		0.96	0.98	0.89	0.97	0.96	0.96	0.85	0.96	0.9	0.94
p_{22}		0.89	0.95	0.93	0.96	0.97	0.95	0.89	0.98	0.9	0.8
E(Regime 1)		25.95	40.49	9.37	29.8	26.04	25.33	6.63	42.36	9.87	16.87
E(Regime 2)		9.32	18.62	13.78	28.07	30.87	18.34	9.26	59.25	9.75	5.07
Log likelihood		-933.17	-930.5	-1104.83	-1012.85	-998.77	-1026	-998.4	-1042.88	-924.2	-882

Note: E ( ) expected duration of the regime.

According to the results of table 7, we note that for the majority of our data sets, the coefficients AR(1) et k aresignificant. Similarly, expected averages of regime 1 (μ_1) are greater than the expected averages of regime $2(\mu_2)$. Thus, regime 1 allows us to capture the behavior of stock markets during their growth or bull phases, and conversely, regime 2 allows us to capture the fluctuations of stock markets during their recession or bear phases.

For the majority of our data sets, recession phases are characterized by significant volatility and expected mild average growth in stock returns. In effect, we note that the volatility of the bullish regime 1 $(\sigma^2{}_1)$ is less than thevolatility of the bearish regime 2 $(\sigma^2{}_2)$, except for the S&P/TSX index, where the volatility of the bull regime $(\sigma^2{}_1 = 14.58)$ exceeds that of the bear regime ($\sigma^2{}_2$=*9.38*).

Similarly, for most of our data sets, the conditional averages of the bear regime (μ_2) are characteristically negatives, except for the IBGM index (μ_2=*0.19*). This indicates that for most of the countries in our sample, the average monthly stock returns during recession phases (regime 2) tend to decrease at around 0.08 and 1.54. Reciprocally, the average monthly stock returns during growth phases (regime 1) tend to increase at around 0.10 and 2.94.

Moreover, the probability of staying in the bullish regime 1 $(p_{11})$is higher than that of staying in the bearish regime $2(p_{22})$ for the majority of our data sets, except for the HEX, DAX, TOPIX, and IBGM indices, which are less likely to stay in the bullish regime than in the bearish regime. For the other data sets, the p_{11}values are between 0.90 and 0.98, while $p_{22}$is around 80 and 95. Thus, the duration expectancy of the bullish regime is around 9.87 and 40.49 months, and the duration expectancy of the bearish regime is around 5.07 and 28.07 months. This means that the majority of our data sets remains in a bullish regime longer than in a bearish regime. We can thus come to the conclusion that only an extreme event or a shock can shift stock markets from a bullish to a bearish regime.

In addition to the expected average, volatility, and duration of each regime (Bull/Bear), Ms(2)-AR(1) has the advantage of being able to provide smoothed and filtered values of the unobserved variable $s_t$associated with each of the two regimes (high or low regimes) at a given time t. This also allows us to identify and date the tipping points from one regime to another in our data sets, i.e. the peaks and troughs.

With the aim of testing the hypothesis of international financial crises' periodicity, in this study we will focus solely on bear markets (regime 2) in stock markets of the countries in our sample. Therefore, we have, on one hand, illustrated on the same graph the probabilities curve—smoothed to be in regime 2—and the national (NCI) and international (ICI) financial crisis indices during the time period of January 1985 to May 2013 (figure 2); on the other hand, we have identified and dated the different turning points and the duration of regime 2 (Note

13)for each of our data sets (table 8).

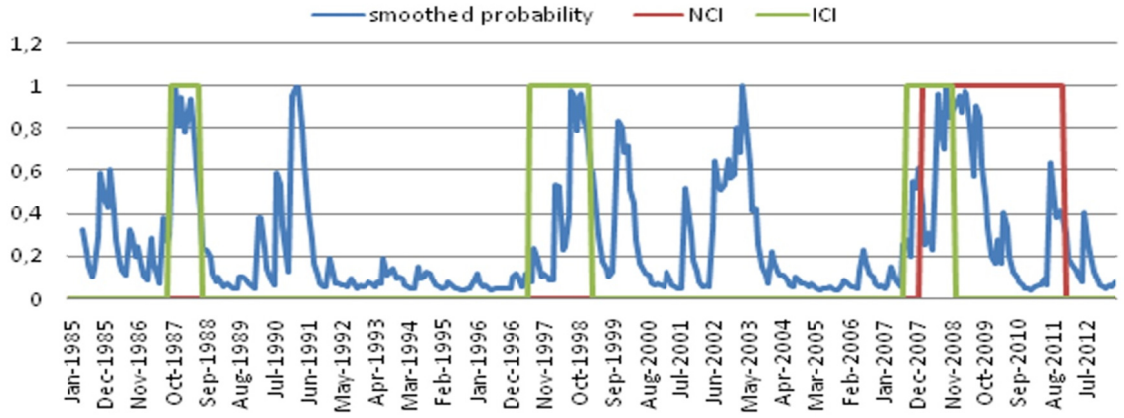

Figure 2a. BEL 20

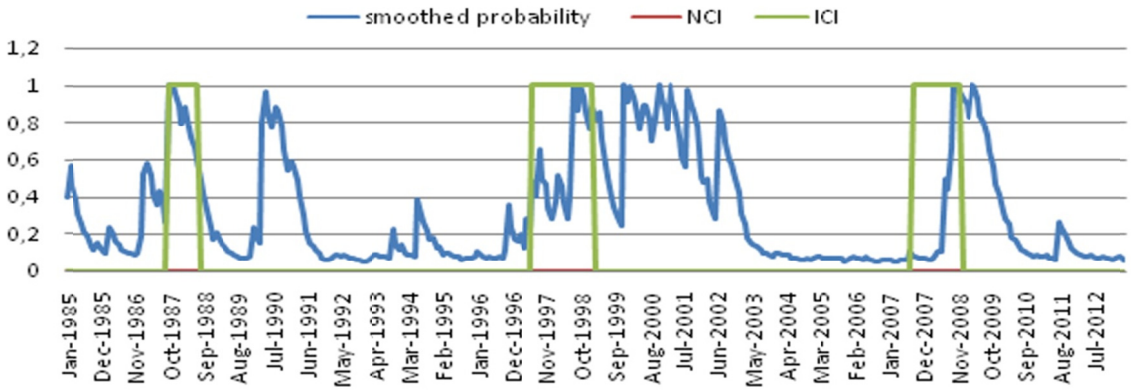

Figure 2b. S&P/TSX

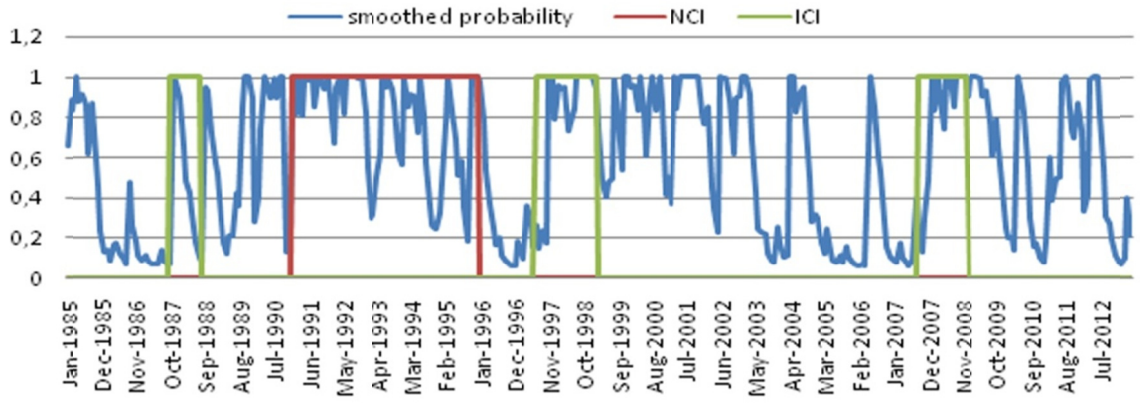

Figure 2c.HEX

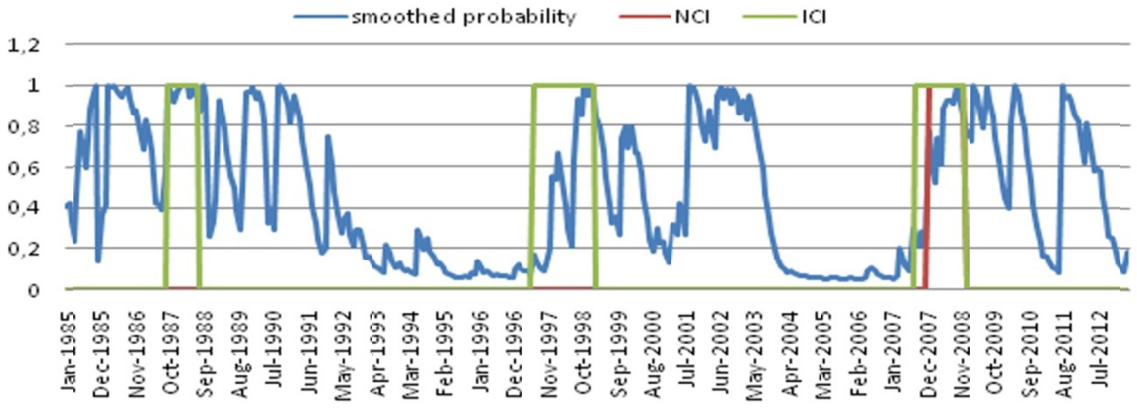

Figure 2d. SBF 250

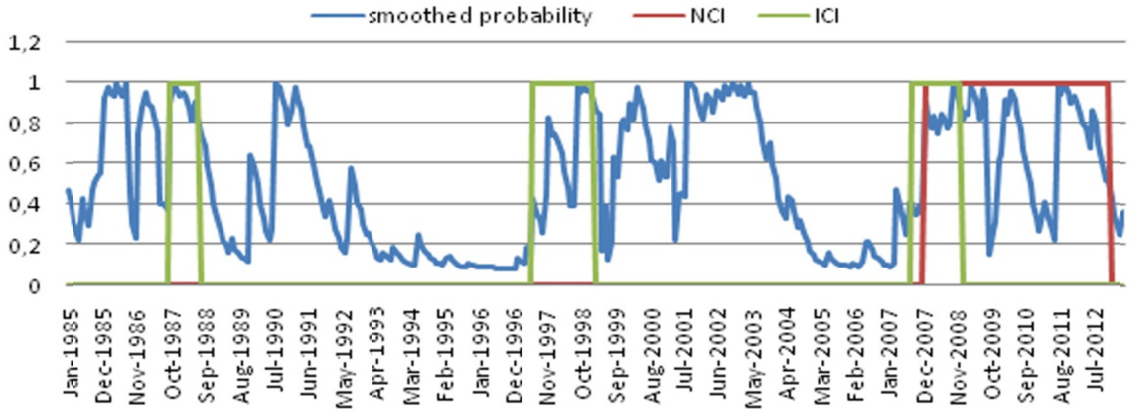

Figure 2e. DAX

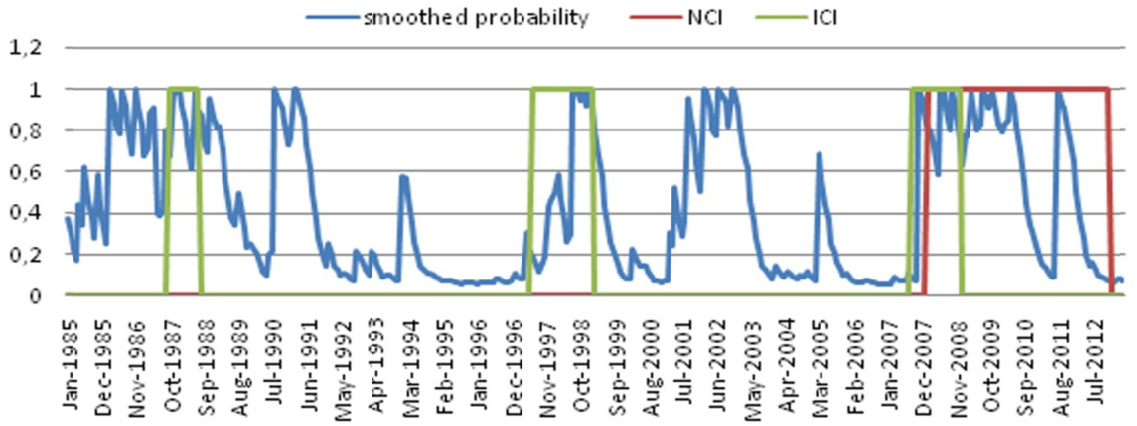

Figure 2f. ISEQ

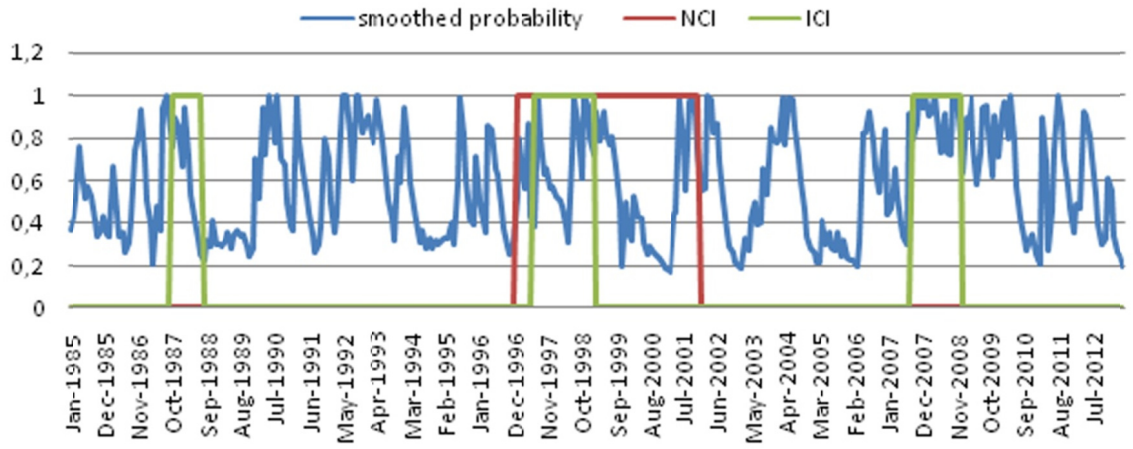

Figure 2g. TOPIX

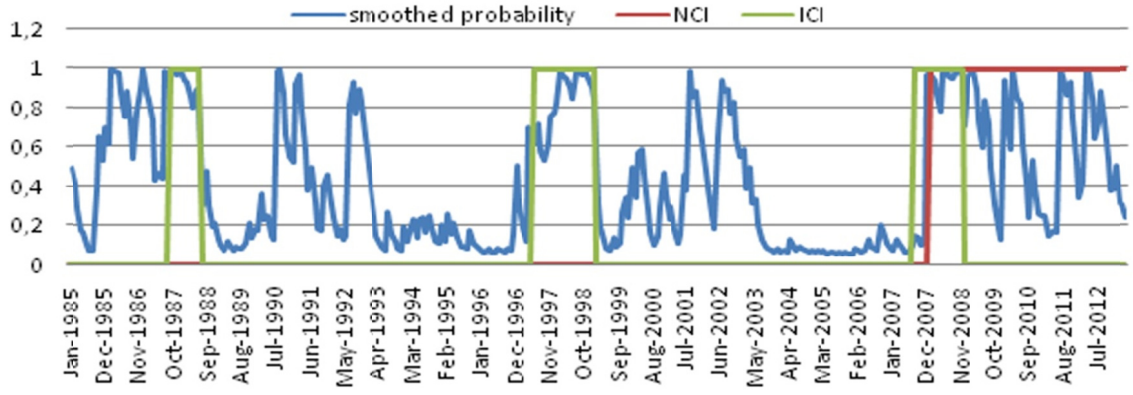

Figure 2h. IGBM

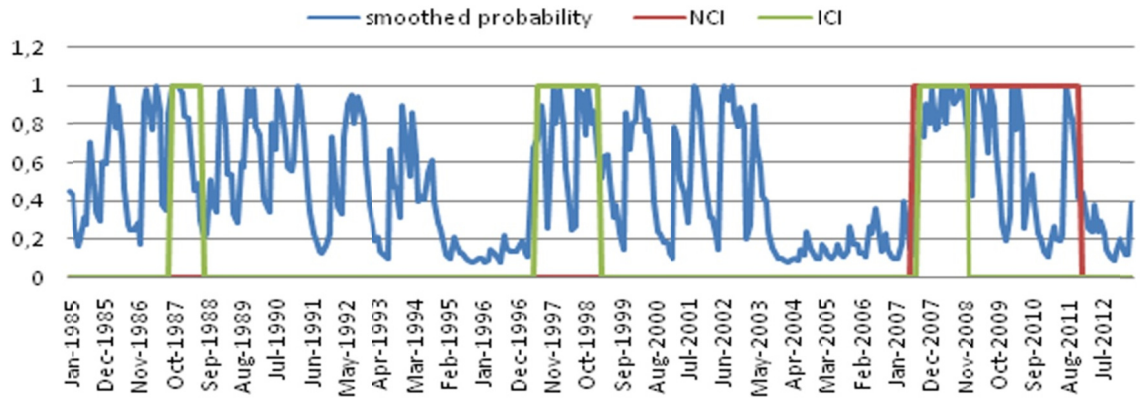

Figure 2i. FTSE 100

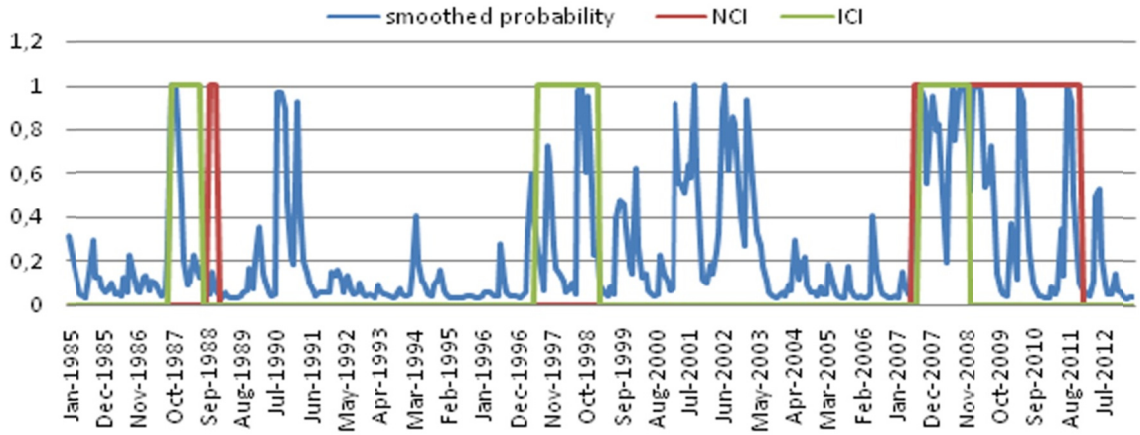

Figure 2j. S&P 500

Figure 2. Evolution of the smoothed probabilities during the periods of financial crises over the period of January 85–May 2013

According to chart 2, we can conclude that for the majority of stock markets in our sample the plots of smoothed values for the second regime are greater than or equal to 0.5 during the phases of financial crisis, with the exception of the 1988 U.S. savings and loan crisis. This implies the existence of a strong correlation linking the peaks of the bear regime to the periods of national financial crises. This observation is consistent with the hypothesis of efficient markets exempt from regulatory distortion (Fama, 1970). According to this hypothesis, the variation in asset prices should reflect the evolution of the fundamental economic variables, and allows the confirmation of the hypothesis of a strong correlation between asset price cycles and real activity cycles.

Likewise, considering table 8, we note that most of the sampled stock markets have shared bull phases. These phases notably correspond to the international financial crises of 1987, 1997–1998, and 2007–2008. Infact in the case of the 1987 stock market crash, most of our data sets registered highs approximately 1 and 4 months before the official start date of this crisis. The average duration of these bear markets varies from 3 to 20 months. However, in the case of the 1997–1998 Asian crisis, we note that only the TOPIX, S&P/TSX, IGBM and FTSE 100 indices registered highs between 1 and 4 months before the official start date of the crisis in Thailand (July 1997), unlike other indices that registered highs approximately 1 to 6 months after the start date. The average duration of bear markets is around 1 and 22 months. Finally, in relation to the 2007–2008 crisis, with the exception of the BEL 20 and S&P/TSX indices (which registered peaks 10 and 12 months, respectively, after the official start date of the U.S. crisis (July 2007), we note that most of the data sets registered highs approximately 1 to 4 months after the start of this crisis. The average duration of these cycles varies between 9 to 36 months.

Our results are consistent with the literature. Roll (1989) shows the international transmission mechanisms of the 1987 crash throughout the world's main stock markets. According to Hamao and al. (1991), during periods of tranquility the correlation of stock returns in different international stock markets is difficult to demonstrate. This correlation becomes very important during crises. According to these authors, the strong interdependency between financial markets during periods of crisis can be explained by a change in investors' perception of the significance of financial information from foreign markets (shift-contagion). Forbes and Rigobon (2002), and Rogers (1990) also refer to the phenomenon of "shift-contagion". According to them, the shock and its spread cause a structural break in the shock transmission mechanism between stock markets. Because of this, shocks can travel through channels that did not exist during periods of tranquility.

In conclusion, we can confirm the hypothesis of periodic recurrence of international financial crises in financial markets. In effect, from the results of our study, international financial crises happen at regular time intervals, namely every decade.

Table 8a. Identification of the bear regime periods

	BEL 20	S&P/TSX	HEX	SBF250	DAX
1	Oct 85 : Dec 85 : 1	Jan 85 : May 85 : 1	Jan 85 : Nov 85 : 10	May 85 – Dec 85 : 6	Sep 85 : Sep 86 : 11
2	Jan 85 : Feb 86 : 1	Jan 87 : May 87 : 3	Oct 87 : Mars 88 : 4	Feb 86 : Jun 87 : 15	Nov 86 : Jul 87 : 7
3	Sep 87 : Jul 88 : 9	Sep 87 : Aug 88 : 10	Aug 88 : Feb 89 :5	Aug 87 : Nov 88 : 14	Sep 87 : Nov 88 : 12
4	Jul 90 : Oct 90 : 2	Mar 90 : Mar 91 : 11	Aug 89 : Nov 90 : 8	Jan 89 : Aug 89 : 6	Nov 89 : Mars 90 : 3
5	Dec 90 : Jun 91 : 5	Aug 97 : Oct 97 : 1	Dec 90 : Feb 93 : 25	Oct 89 : May 90 : 6	Jul 90 : Oct 91 : 11
6	Feb 98 : May 98 : 2	Feb 98 : Apr 98 : 1	Apr 93 : Sep 94 : 16	Aug 90 : Aug 91 : 11	Jul 92 : Sep 92 : 1
7	Aug 98 : Mars 99 : 8	Jul 98 : Jul 99 : 11	Feb 95 : Aug 95 : 6	Dec 91 : Mars 92 : 2	Nov 97 : Jun 98 : 6
8	Oct 99 : Aug 00 : 5	Nov 99 : Mars 02 : 18	Sep 95 : Apr 96 : 6	Dec 97 : May 98 : 4	Aug 98 : May 99 : 8
9	Aug 01 : Oct 01 : 1	Jun 02 : Dec 02 : 5	Oct 97 : Apr 99 : 17	Jul 98 : Jul 99 : 11	Aug 99 : May 01 : 20
10	Jun 02 : Jul 03 : 13	Aug 08 : Dec 09 : 15	Jul 99 : Dec 00 : 16	Oct 99 : Jun 00 : 7	Aug 01 : Feb 04 : 29
11	Oct 07 : Feb 08 : 3		Feb 01 : Feb 02 : 11	Aug 01 : Sep 03 : 24	Dec 07 : Oct 09 : 21
13	Jun 08 : Oct 09 : 16		May 02 : May 03 : 11	Dec 07 : Jan 10 : 24	Dec 09 : Nov 10 : 10
14	Jun 11 – Sep 11 :1		Mars 04 : Oct 04 : 6	Apr 10 : Nov 10 : 7	Jul 11 : Janv 13 : 17
15			Apr 06 : Oct 06 : 5	Jul 11 : Sep 12 : 13	
16			Dec 07 : Dec 09 : 22		
17			Apr 10 : Sep 10 : 4		
18			Feb 11 : Apr 11 : 1		
19			Jun 11 : Feb 12 : 7		
20			Apr 12 : Sep 12 : 5		

Table 8b. Identification of the bear regime periods (continued)

	ISEQ	TOPIX	IGBM	FTSE 100	S&P500
1	Jun 85 : Aou 85 : 1	Feb 85 : Sep 85 : 6	Feb 85 : Oct 85 : 18	Jul 85 : Sep 85 : 1	Sep 87 : Jan 88 : 3
2	Oct 85 : Dec 85 : 1	Feb 86 : Apr 86 : 1	Jul 87 : Aug 88 :12	Nov 85 : Jul 86 : 7	Jul 90 : Nov 99 : 3
3	Feb 86 : Jun 87 : 1	Sep 86 : Mars 87 : 5	Jul 90 : Jun 91 : 10	Dec 86 : Jul 87 : 6	Janv 91 : Mars 91 : 1
4	Aug 87 : May 89 : 20	Jun 87 : May 88 : 10	Jun 92 : Feb 93 : 7	Aug 87 : May 88 : 8	Apr 97 : Jun 97 : 1
5	Jul 90 : Aug 91 : 12	Dec 89 : Nov 90 : 10	Dec 96 : Feb 97 : 1	Sep 88 : Nov 88 : 1	Sep 97 : Dec 97 : 2
6	Dec 93 : Mars 94 : 2	Jan 91 : Jun 91 : 4	Apr 97 : Mars 99 : 22	Jan 89 : Jun 89 : 5	Jul 98 : Jan 99 : 5
7	Jan 98 : Apr 98 : 2	Oct 91 : Jun 91 : 4	Mars 00 : Jun 00 : 2	Jul 89 : Mars 90 : 7	Jan 00 : Mar 00 : 1
8	Jul 98 : Jun 99 : 10	Oct 91 : Jan 92 : 2	Aug 01 : Feb 02 : 5	May 90 : Apr 91 : 11	Feb 01 : Nov 01 : 8
9	Apr 01 : Jun 01 : 1	Mars 92 : Sep 93 : 17	May 02 : Mars 03 : 9	Dec 91 : Feb 92 : 1	Mar 02 : Dec 02 : 6
10	Aug 01 : May 03 : 20	Oct 93 : Apr 94 : 5	Dec 07 : Oct 09 : 21	Apr 92 : Jan 93 : 8	Jan 03 : Apr 03 : 2
11	Feb 05 : May 05 : 2	May 95 : Oct 95 : 4	Jan 10 : Sep 10 : 7	Jul 93 : Sep 93 : 1	Jun 07 : Apr 08 : 9
13	Oct 07 : Oct 10 : 35	Nov 95 : Feb 96 : 2	Oct 10 : Dec 10 : 1	Nov 93 : May 94 : 5	Jun 08 : Sep 09 : 15
14	Jul 11 : Mars 12 : 7	Mars 96 : Aug 96 : 4	Jul 11 : Feb 12 : 6	Jul 95 : Oct 94 : 2	Apr 10 : Aug 10 : 3
15		Dec 96 : Jun 97 : 5	Mars 12 : Dec 12 : 8	May 97 : Oct 97 : 4	Jul 11 : Oct 11 : 2
16		Jul 97 : Apr 98 : 8	Jan 13 : Mars 13 : 1	Nov 97 : May 98 : 5	May 12 : Jul 12 : 2
17		Jun 98 : Oct 99 : 15		Jul 98 : Jul 99 : 11	
18		Feb 00 : Apr 00 : 1		Oct 99 : Aut 00 : 9	
19		May 01 : Sep 02 : 15		Feb 01 : Jun 01 : 3	
20		Aug 03 : Oct 04 : 13		Jul 07 : Jul 09 : 17	
21		Apr 06 : Jan 07 : 8		Feb 09 : Nov 09 : 8	

22	Feb 07 : May 07 : 2	Feb 10 : Jul 10 : 4
23	Jul 07 : Aug 10 : 36	Aug 10 : Oct 10 : 1
24	Feb 11 : May 11 : 2	Jul 11 : Dec 11 : 4
25	Jun 11 Dec 11 : 5	
26	Mars 12 : Sep 12 : 5	
27	Nov 12 : Feb 13 : 2	

6. Conclusion

During the last four decades, the global economy has been punctuated by a series of financial crises varying in type and intensity. Some of these crises had global impact and caused enormous losses in terms of financial, economic, and socioeconomic costs.

Starting from the premise that, during the last three decades, major international financial crises that undermin the global economy (i.e., the crises in 1987, 1997, and 2007), seem to occur periodically, we have attempted in this study to provide a framework for the understanding of market behavior dynamics in different regimes (bear/bull). More specifically, on one hand, to emphasize the harmony between bear market peaks and periods of financial crisis, and, on the other hand, to test the hypothesis of the periodicity of international financial crises in financial markets.

Stock market returns are often subject to large fluctuations during financial crises. These fluctuations indicate regime changes or structural breaks that cannot be represented by simple linear models or time series, which is why we have used Markov switching models. These models allow us, moreover, to observe the evolution of stock markets during their bull and bear phases.

We have thus analyzed the monthly behaviors of ten advanced economies in the OECD, monitored during the interval between January 1985 to May 2013; we relied on first order autoregressive Markov switching models in theunivariatecase MS (2)-AR(1).

Our results allowed us, first, to demonstrate, the existence of a strong correlation linking the peaks of the bear regime to the periods of financial crises occurring at a national level; this observation is consistent with the hypothesis of efficient markets exempt from regulatory distortions (Fama, 1970). Second, we were able to conclude that the main economic events that were happening around the world heavily impacted stock market behavior. In fact, the vast majority of the stock markets in our sample database share the same downturns. These downturns match the international crises of 1987, 1997–1998 and 2007–2008, allowing us to a certain extent, to validate the concept of regular cyclic recurrence of financial crises in the world's economically advanced markets.

So will we see a financial crisis in 2017? it is recommended that the used of GARCH Markov switching models —MS-GARCH—on a larger sample, comprising both advanced and emerging economies, in order to make the generalization of our results possible.

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Notes

Note 1. For more details, see, for example, Frankel & Saravelos (2010); Kaminsky & Reinhart (1998); Demirguc-Kunt & Detragiache (1998a, 2005); Babecky et al. (2012).

Note 2. For more details, see, for example, Kinnon & Pill (1996); Demirguç-Kunt & Detragiache (1998); Ranciere, Tornell & Westermann (2006).

Note 3. For more details, see, for example, Eichengreen; Rose & Wyyplosz (1996); Eichengreen and Rose (1999); Masson (1998); Kaminsky and Reinhart (1999).

Note 4. For more details, see, for example, Schwert (1989, 1990); Hamao et al. (1990); Caporale et al. (2006); Al Rjoub (2009).

Note 5. For more details, see, for example, Kindleberger and Aliber (2005); Boyer and Mistral (1985).

Note 6. For more details, see, for example, Taylor (2008), Brunnermeier (2009); Adrian and Shin (2010).

Note 7. The Russian RTS dropped by 11.2% and Turkish stocks by 11.4%.

Note 8. A banking crisis is defined as systemic if two conditions are met: "(1) Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations); and (2) Significant banking policy intervention measures in response to significant losses in the banking system." Policy interventions in the banking sector are considered significant if at least three out of the following six measures have been used "(1) extensive liquidity support 5 percent of deposits and liabilities to nonresidents) (2) bank restructuring gross costs (at least 3 percent of GDP) (3) significant bank nationalizations (4) significant guarantees put in place (5) significant asset purchases (at least 5 percent of GDP) (6) deposit freezes and/or bank holidays". Leaven and Valencia (2012, p.4).

Note 9. "We define a "currency crisis" as a "nominal depreciation of the currency (the value will be measured in a given reference currency) of at least 30 percent in a year that is also at least a 10 percent increase in the rate of depreciation compared to the year before". Leaven and Valencia (2008, p.6).

Note 10. Leaven and Valencia (2008) identify and date the episodes of sovereign debt default [and restructuring] by relying on information from Beim and Calomiris (2001), World Bank (2002), Sturzenegger and Zettelmeyer (2006), and IMF Staff reports.

Note 11. The variability of variances from one regime to another allows us to take into consideration the heteroskedasticity of Markov switching.

Note 12. For more details, see, for example, Krolzig (2001); Hamilton (1989, 1993, 1994).

Note 13. For more details, see the previous section.