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# Does the Index Futures Destabilize the Underlying Spot Market? Some Evidence from Frensh Stock Exchange

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## Abstract

This paper examines the dynamic relationship between the futures and the spot frensh market. It aims to contribute in the literature by controlling for possible disturbances in the long-run equilibrium relationship between these two markets. The univariate analysis indicates that the stock prices evolve according to two different regimes: a low volatility regime and a high volatility regime. Our contribution is to determine the dynamics of the relationship which exists between spot and futures markets using the Markov-switching model. This econometric technique provides empirical and graphic evidence allowing of whether and of how the introduction of a futures market changes the variability structure of stock prices in the underlying spot market, it allows precisely to demonstrate the variabilities regimes shifts and reveals if the variability changes transitory or permanently. Our evidence from Markov switching approach suggests that futures have influence on spot market during both calm and turbulent periods, and that the introduction of the index futures has an effect of stabilizer on the stock market.

**Keywords:** Long term relathiship; Stock index futures; Cointegration; Markov-switching; Spot French market

## Introduction

Although derivatives were present in almost all the bad shots of finance and especially when they were responsible for the appearance, of tripping and the spread of some global crises but their usefulness was never questioned. These products have been associated with a number of events that have roiled financial markets modiaux and despite that contributed significantly to the efficiency of financial markets. And it is in this perspective that they have been considered as perfect revealing mechanisms and their introduction on spot markets improves the process of price discovery and leads to his efficiency.

Researches on the relationship between spot and futures markets are voluminous, and different strands of arguments exist in the theoretical literature. Some studies has assumed that futures markets have a stabilizing effect on the underlying spot market because the integration of these products absorbs the underlying market voltaility, and that their use is associated with increasing efficiency [1-5] had supposed that the introduction of futures trading reduces the volatility of the underlying spot market, improves price discovery, enhances market efficiency, increases market depth as well as information flows and contributes to market completion. Zhong, et al. [6] investigated the case of the Mexican stock market and found that the stock index futures contracts contribute to the price discovery process, while the introduction of stock index futures had a destabilization effect on the corresponding spot indices. Kavussanos, et al. [7] had investigated the price discovery process between spot and futures markets using the FTSE/ATHEX-20 and the FTSE/ATHEX Mid-40 financial indices. They concluded that the futures markets contribute substantially to the price discovery process, the informational efficiency and the transmission mechanism of information. Moreover, there exist significant spillover effects from the futures markets to the corresponding spot, especially in the case of the FTSE/ATHEX-20 index. Others assume that this introduction leads to a rise in the spot market volatility and the futures trading destabilize the underlying spot market by increasing its volatility due to the existence of uniformed investors. Because of high leverage badly informed investors induce noise in the price discovery process and lower the information content of prices. This implies higher spot market volatility compared to the situation without a futures market [8-12].

Some others researchs couldn't not find a significant impact between the derivatives and the underlying assets, such as, those of [13,14] and others such as Dennis and Sims [15], Jeanneau and Micu [16].

We retain in this study that the futures have a stabilizing effect on the underlying spot market because the futures contain valuable information for modeling and forecasting stock returns. they produce the means for price discovery as leading indicators in the transmission of new information, the informational value of futures markets contributes to the efficiency and completeness of financial markets, mainly because the futures yields represent unbiased predictors and the expectations of futures spot yields.

This paper is organized in the following way. In section 1, we provide a brief overview of the literature. Section 2 focuses on the nature of the data and provides details on methodology. Section 3 contains all the result related discussions. The last section concludes highlighting possibility of further research in this area. All results are reported in accompanying figures.

## Literature Review

A large body of research on modeling and forecasting stock returns has investigated the relationship between spot and futures prices in stock index markets.

Many analysts have investigated the long run equilibrium relationship between the spot and the derivatives yields and considering the informational efficiency of these products they have deduced that very often the derivatives markets contribute substantially to the price discovery process.

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A large number of studies analyzes the relationship between the spot market and its futures market and mostly focuses on the short-run relationships by applying the Granger Causality tests with the intraday data. Since our focus is the long-run interactions between these two markets a review of the earlier studies here is attempted to get a comprehensive picture on this long run relationship.

Usually, the price linkage between futures market and spot market would be examined by using cointegration analysis [17] that has several advantages. This analysis reveals an extent to which the two markets have moved together towards to the long run equilibrium, and the fact that the cointegrating vector identifies the existence of long run equilibrium; the error correction dynamics describes the price discovery process that helps the markets to achieve equilibrium [18].

We will just give a review on studies which using cointegration techniques most of which employ Error Correction Models (ECM) and Granger causality tests after they find the evidence of cointegration [19].

A number of empirical studies have focused on the persistence of deviations and have investigated the relationship between the spot and futures prices in the context of vector autoregressions using the cointegration model, or equilibrium correction models [20,21].

Ghosh [22] applies Engel and Granger cointegration test to analyze the long-term equilibrium relationship between S and P 500 index prices and futures prices covering the time period from June 12, 1986, through December 31, 1989. He finds that there exists a cointegration relationship between the futures and spot markets, in addition he estimates a short-run relationship between them and argues that future prices according to Granger cause cash prices in the case of the S&P 500 index.

Tse [23] examines the relationship between the spot and futures price of the Nikkei stock exchange by using daily data from December 1988 through January 1993 and find that the series are cointegrated. Wahab and Lashgari [24] examine the long-run relationship between the futures and spot markets of S&P 500 and FTSE 100 over the period from 1988 to 1992 by using daily closing prices and applying the same methodology and find that they are cointegrated.

Nieto, et al. [25] apply the Johansen cointegration test's to examine the relationship between Spanish stock index and its futures by using daily data from March 1, 1994 through Sep 30, 1996. They find a long-run relation between them indicating that the cost of carry model holds in the long run.

Hakkio and Rush [26] used monthly data, from 1975 to 1986 to test for market efficiency by examining the cointegration of forward and spot rates within United Kingdom and Germany, and have found the results consistent with market efficiency. But no evidence of cointegration within and across the countries has been detected.

Pattarin and Ferretti [27] have studied the relationship between the Italian MIB30 index and futures log-prices, with a bivariate ECM and have applied the cointegration test of johansen by using daily observations beginning from November 28, 1994 to September 19, 2002 and have finded that the long-run relationship was held.

Chai and Gou [28] have examined five International stock index and futures data including S&P 500 index futures, Dow Jones index futures and NASDAQ 100 index futures in the USA, Nikkei 225 index futures in Japan, Hang Seng index futures in Hong Kong of China, to verify whether there exists long-term steady relationship between the index spot and the futures prices. They have applied the Engel and Granger's

cointegration method based on the cointegration theory and ECM, conclusions have drawn that the index spot and futures are cointegrated in most cases and it is possible to do the corresponding short term dynamic adjustment for reaching new equilibrium in the next. Ayadi [19] had examined a long term relationship between CAC40 index and future, based on the cointégration theory with applying cointegration method of Engel and granger, and ECM, and had noticed that the target of the long term relationship converges towards to a partially stable situation, since the strength of the relationship is negative and statistically insignificant in an error correction model. Concluding that introducing of derivatives on the volatility of the CAC40 index can correct and restore the efficiency of the financial market.

Pizzi, et al. [29] investigated the informational efficiency of the spot and the derivatives products of the S&P500 index. Using high frequency data and applying the econometric methodology of Engel and Granger, they concluded that the futures market contributes substantially to the price discovery, since futures contracts play the key role in the aforementioned relationship. Some authors have criticized the role of cointegration in the market efficiency tests and have demonstrated that the cointegration doesn't imply necessarily the market inefficiency. Among them, Dwyer and Wallace [30], and Engel [31] wuich have demonstrated that there is no connection between market inefficiency and the cointegration of spot exchange rates or, for that matter, a lack of cointegration. Also Crowder [32] has presented weak evidence of cointegration among different nominal spot exchange rates, the British pound, German Deutsche mark, and Canadian dollar, all relative the US dollar, over the period 1974 to 1991. He has claimed that lack of cointegration does not imply efficient markets and the exchange rate could be predictable because of the properties of the risk premium in an efficient market.

Chow [33], however, has concluded that the spot and future prices remain cointegrated and, therefore, supported the efficient market hypothesis once a regime switching model of spot prices is employed to capture infrequent changes in regime.

To overcome econometric shortcomings of the existing literature we employ a Markov-switching approach to endogenously identify distinct regimes of price's variability. This model is one of the most popular non linear time series models in the literature; it involves multiple structures that can characterize the time series behaviors in different regimes. This model can provide us empirical evidence to whether the introduction of a futures market changes the structure of stock prices in the underlying spot market. The Markov-switching technique allows defining the endogenous regime shifts and more to reveal if the structure of prices changed transitorily or permanently.

This model had been widely applied to analyze economic and financial time series; Hamilton [34,35], Engel and Hamilton [36], Diebold, et al. [37], Engel [36], Ghysels [38], Sola and Driffill [39], Kim and Yoo [40], and Kim and Nelson [41], among many others. Recently, this model has also been a popular choice in the study of Taiwan's business cycles; see Huang, et al. [42], Huang [43], Hsu and Kuan [44] and Rau. Chen and Lin [45], Hung and Kuan [46] also apply these models to analyze Taiwan's financial time series.

The Markov switching model of conditional mean is a highly successful; we consider incorporating this switching mechanism to the stochastic volatility model. A leading class of conditional varaiance models is the GARCH model introduced by Engel [31] and Bollerslev [47], Cai [48], Hamilton and Susmel [49] and Gray [50] studied various ARCH and GARCH models with Markov switching. Chen and Lin

[45] Lin, et al. [46] have also applied these models to analyze Taiwan's financial time series.

These papers mentioned above have provided a solid evidence feasible methodologies I needed in my paper which has choosen to use in its methodologie the model mentioned before (Markov-switching) to prove the long term relationship between the indexes spot prices and indexes future prices.

## Methodology and Data Description

The dataset comprises time series of the daily closes price's observations on the futures and the stock price frensh indices. In order to control for influence on the Frensh stock market, we further include daily close prices of the futures in our dataset. The time series for the futures is obtained from the french Stock Exchange. Data for the CAC 40 index are taken from Thomson Financial Data. The sample period starts from 3 January 2000, which is the first complete month with five trading days per week, and covering 4174 trading days ending on 31 December 2015.

In the next sub-sections we present our methodology in the following ways: First, to authenticate the stationarityprocess, werely on three types of unit root tests. Second, we estimate our appropriate model with: i) Ordinary Least Squares (OLS, hereafter) method, and OLS with structural change breakpoints. Third, according to the number of regimes detected by the used structural change breakpoints test, we apply the Markov-switching technique. Finally, we estimate our model through the ARCH-GARCH method in order to detect the nature of volatility.

### Basic univariate unit root tests

The first step of our analysis consists to examine the stationary properties of the time series in a univariate framework through conventional linear or non-linear methodologies. We start by testing the stationarity in the spot and futures series using three different test statistics: Augmented Dickey-Fuller test statistic (ADF) of Dickey and Fuller, Phillips-Perron test statistic (PP) of Phillips and Perron, and Ng-Perron test statistic (NP) of Ng and Perron.

### ADF unit root test

The ADF test is implemented trough the following equation:

$$\Delta Y_t = \alpha + \beta.t + (\rho - 1)Y_{t-1} + \sum_{i=1}^{q} \phi_i \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

Where, $Y_t$ stands for the prices in the spot and futures markets and the order $q$ is estimated through the AIC and BIC criteria. The pair of the null and the alternative hypothesis:

$H_0$: The $X_t$ time series has a unit root on the characteristic polynomial or $|\rho| = 1$

$H_1$: The $X_t$ time series is stationary or $|\rho| <= 1$

### PP unit root test

The PP test developed a generalization of the ADF test procedure that allows for fairly mild assumption concerning the distribution of errors. The test of regression for the PP test is AR (1) process. This test is implemented trough the following equation:

$$\Delta Y_t = a + b Y_{t-1} + \mu_t \qquad (2)$$

The ADF test corrects for higher order serial correlation by adding lagged differenced terms on the right hand side, in PP test makes a correction to the t-static of the coefficient $b$ from the AR(1) regression to account for the serial correlation in $\mu_t$. In this test also the null hypothesis is that unit root exists. If the test statistics is smaller than the corresponding critical values, the null hypothesis may be rejected.

### Ng-Perron unit root test

Recently, Ng and Perron construct four test statistics that are based upon the GLS detrended data $Y_t^d$. These test statistics are modified forms of Phillips and Perron $Z_\alpha$ and $Z_t$ statistics, the Bhargava $R_1$ statistic, and the Elliot, Rothenberg and Stock Point Optimal statistic. First, define the term:

$$\kappa = \sum_{t=2}^{T} (Y_{t-1}^d)^2 / T^2 \qquad (3)$$

And the GLS-detrendedmodifiedstatistics are written as

$$MZ_\alpha^d = (T^{-1}(Y_T^d)^2 - f_0) / (2\kappa)$$
$$MZ_t^d = MZ_\alpha \times MSB$$
$$MSB^d = (\kappa / f_0)^{1/2} \qquad (4)$$
$$MP_T^d = \begin{cases} (\overline{c}^2\kappa - \overline{c}T^{-1}(Y_T^d)^2) / f_0 & if \quad x_t = \{1\} \\ (\overline{c}^2\kappa + (1-\overline{c})T^{-1}(Y_T^d)^2) / f_0 & if \quad x_t = \{1,t\} \end{cases}$$

Where $\overline{c} = \begin{cases} -7 & if \quad x_t = \{1\} \\ -13.5 & if \quad x_t = \{1,t\} \end{cases}$ \qquad (5)

The unit root tests are done in presence of constants and linear trends, as it has been found that both the spot and futures price series in 15 years contain linear trends and support affine transformations in their logarithmic forms.

Then we estimate, the long-run equilibrium relationship between spot and futures market by using OLS regression. After and considering of structural changes we reestimate our model by testing Bai and Perron allowing a live detection of breakpoints.

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Then we test the proportional relationship between the prices series of spot and futures. First, the parameters $\beta_1$ and $\beta_2$ need to be estimated from the following equation:

$$CAC40 = \beta_1 + \beta_2.DM + \varepsilon_{it} \qquad (6)$$

Where, CAC40, is the actual spot price, $DM$ is the futures price at time t, $\varepsilon_{it}$ is the error term with the usual assumptions of zero mean and constant variance, $\beta_1+$ is the intercept term and $\beta_2$ is the slope coefficient.

The above equation is estimated using ordinary least squares (OLS) method, since the spot and futures prices series are stationary. Then, and although that time series of spot and futures, have witnessed multiple structural breaks over the period of study, the Bai-Perron [51] structural break test is implemented to identify the multiple shifts regime in the data.

The observed dates of discrepancies can be determined by the fact that all structural breaks identified are captured by Bai and Perron tests. So our aim is to identify the durability of the detected structral break, we thus used the Markov Switching model based on the number of regime detected by the Bai and Perron test. Using this model, we

are able to identify distinct non-permanent variability regimes that governed by futures. This precise identification could not have been achieved by a simple dummy variable approach.

## Bai and Perron test

This research considers the Bai and Perron [51-53] procedure for regime shift identification in the first moment of both series. Bai and Perron [51] suggest the linear model with m breaks (or m+1 regimes) as follows:

$$Y_t = X_t^{'}\beta + Z_t^{'}\delta_j + \eta_t \;\; ; \;\; t = T_{j-1} + 1, ...., T \;\; ; \;\; j = 1, ..., m+1 \qquad (7)$$

Where $Y_t$ denotes the dependent variable at period $t$, while $X_t$ and $Z_t$ denote vectors of covariates with dimension (p × 1) and (q × 1), respectively. Note that $\beta$ and $\delta_j$ are the corresponding coefficients for $X_t$ and $Z_t$ respectively. Here, $\eta_t$ represents the residuals at period $t$. The break points are treated as unknown with the convention that $T_0=0$ and $T_{m+1=}T$ are being used. Based on the overall Bai-Perron test result we can identify if there is a structural change in both the spot and futures series or not.

## Markov-Switching technique

We denote $S_t$ an unobservable state variable assuming the value one or zero. A simple Switching model for the variable $z_t$ involves two AR specifications:

$$Y_t = \begin{cases} \alpha_0 + \beta Y_{t-1} + \varepsilon_t S_t = 0 \\ \alpha_0 + \alpha_1 + \beta Y_{t-1} + \varepsilon_t S_t = 1 \end{cases} \qquad (8)$$

Where $|\beta| < 1$ and $\varepsilon_t$ are i.i.d random variables with mean zero and variance $\sigma_\varepsilon^2$. This is a stationary AR (1) process with mean $\alpha_0/(1-\beta)$ when $S_t=0$ and it switches to another stationary AR (1) process with mean $(\alpha_0+\alpha_1)/(1-\beta)$ when $S_t$ changes from 0 to 1. Thn provided that $\alpha_1 \neq 0$, this model admits two dynamic structures at different levels, depending on the value of the state variable $S_t$. In this case, $z_t$ are governed by two distributions with distinct means, and st determines the switching between these two distributions (regimes).

## General autoregressive conditional heteroskedastistic model (GARCH)

This model differs to the ARCH model in that it in corporates squared conditional variance terms as additional explanatory variables. This allows the conditional variance to follow an ARMA process. If wewrite the residual as:

$$u_t = v_t \sigma_t^2 = v_t \sqrt{h_t} \qquad (9)$$

Where $\sigma_t^2$ is written as $h_t$ and $v_t$ has a zeromean and variance of one. Wecanthemwrite the conditional variance as:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i u_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i} \qquad (10)$$

For instance a GARCH (1, 1) processwouldbe:

$$h_t = \alpha_0 + \alpha u_{t-i}^2 + \beta h_{t-1} \Rightarrow ARCH_t = \alpha_0 + \alpha RESID_{t-i}^2 + \beta ARCH_{t-1} \qquad (11)$$

## Emprical Results

The empirical results start with the graphic representation of price's variability, for our sample (spot and futures market) as shown in Figures 1-3.

These figures above show separately the variability of spot prices of CAC 40 index and of the futures prices of the CAC 40 index. We observe and during our study period the peaks and the falls in these 2 markets, and that the variability of prices of our two series is changed proportionnaly.

We observe in the following figure the joint variability of the two series on one graph to demonstrate that the two markets have the same deviations (peaks and falls) and moving in the same direction. These deviations that characterize the price series are due to the events that severely affected the financial markets since the 2000 until to 2015.

If we return through the theorical history of the financial french market, we can explain The price vulnerability by important historical peaks and falls related to the durable speculative bubble.Several factors explain the volatility variation until our days several events marked the disasters days of the french market namely suicide bombings of September 11th, 2001 for new York and Washington. We observ the speculative bubble on the value of telecom, media and technology when the CAC 40 reached its highest September 4, 2000, then collapsed until 12 March 2003, its lowest level in session since 1997, due to excess production capacity in Europe and the United States. Also the
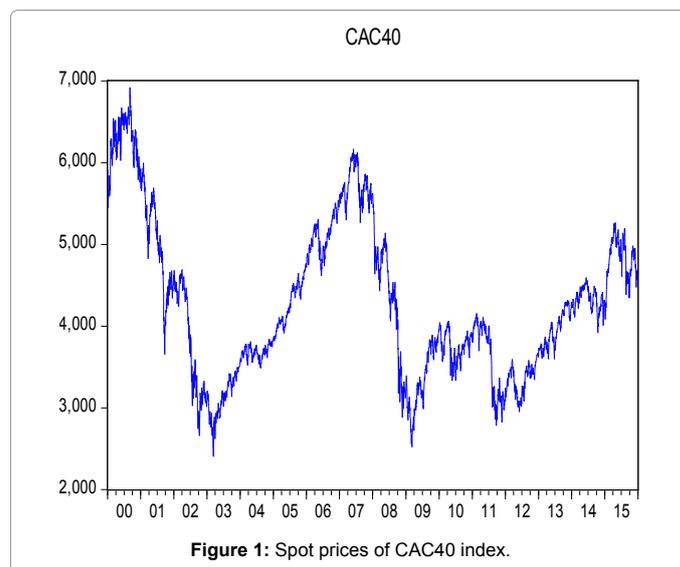


**Figure 1:** Spot prices of CAC40 index.
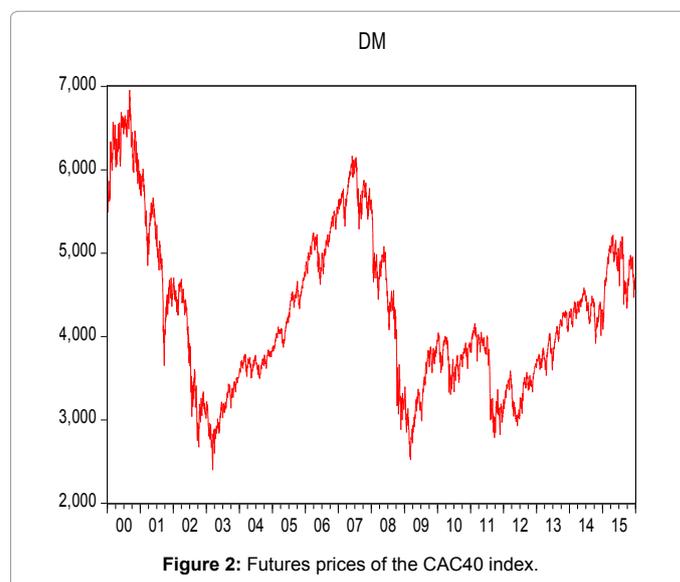


**Figure 2:** Futures prices of the CAC40 index.
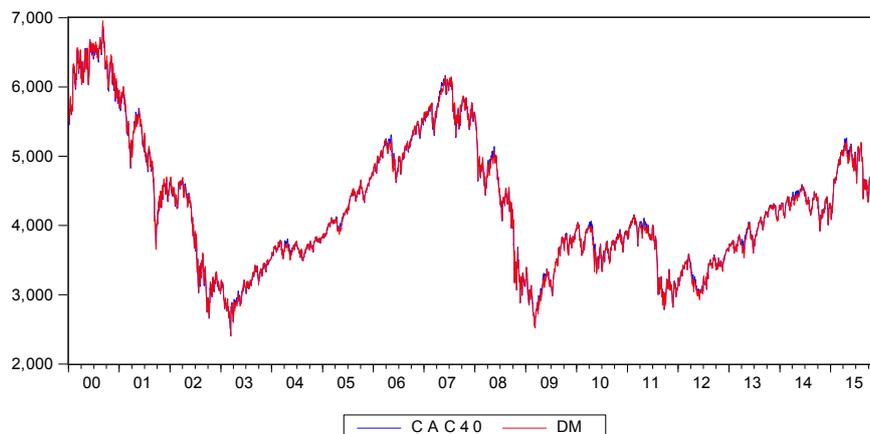
**Figure 3:** Spot and Futures Prices for 15 years' time Horizon.

subprime crisis (the famous crisis of the real estate credits in the U.S.A in September 2008,) has severely beaten the stability of the financial French market when the CAC40 index lost more than 14%, and others. The financial market have been several storms in July, August and September 2011, leading to a one of more severe declines in the history of stock markets caused by fears that the global economic recovery falter after only one year growth, which would have exacerbated public deficits,while the economic crisis of 2008, the deepest for 70 years, had already dug.

After having observed on the above graphs and explain deviations falls and peaks that characterize our spot and future series, and to study the long-term relationship between the spot and the futres, we start to test the stationarity in the spot and future series, the results of these tests are observed in the following table (Table 1).

We have applied ADF; PP and Ng-Perron unit root test to examine the integrating properties of the variables. The results of three tests reported in Table 1 reveal that all series appear to have a unit root in their levels, while they are stationary in their first differences form. Thus, we conclude that all variables are integrated of order one, i.e. I(1).

Then, we estimate and with OLS technique the long-term relationship between the two variables and we get the results shown in the following table (Table 2).

This table above shows a good adjusted model (R – squared tends to 1) and that the two variables are related and change proportionally through the time, this to deduce that the relationship between spot prices and futures is positive and highly significant. In addition the variability of the index prices during our period study is significantly and proportionally high when the variability of futures is high.

After and due to the detection of structural changes (break points in graphs) we re-estimate the model by testing Bai and Perron allowing for direct detection of structural breakpoints (Table 3).

From the Table 3 we can detect that four structural breaks were located at 01/04/2004 to 07/06/2007, 28/01/2011, and 24/06/2013. In order to verify the changes of mean that took place during these four break dates, we divide the observation into five sub-periods – 03/01/2000 to 31/03/2004 (SB 1), 01/04/2004 to 06/6/2007 (SB 2), 07/6/2007 to 27/01/2011 (SB 3), 28/01/2011 to 21/06/2013 (SB4) and, finally 24/06/2013 to 31/12/2015 ( SB5).

We can here verify the existence of long term relationship between

|  |  | CAC40 | DM ( futures) |
|---|---|---|---|
| **ADF** | Level (intercept and trend) | 0.000210 (0.7926) | 0.000202 (0.8012) |
|  | Level (intercept) | -0.002372 (0.1395) | -0.002354 (0.1417) |
|  | Δ(intercept and trend) | -1.037655 (0.0000)* | -1.038319 (0.0000)* |
|  | Δ(intercept) | -1.037476 (0.0000)* | -1.038136 (0.0000)* |
| **PP** | Level (intercept and trend) | -1.999394 (0.6009) | -1.968551 (0.6177) |
|  | Level (intercept) | -2.201699 (0.2058) | -2.180248 (0.2137) |
|  | Δ(intercept&trend) | -67.94673 (0.0000)* | -68.08496 (0.0000)* |
|  | Δ(intercept) | -67.92394 (0.0001)* | -68.05772 (0.0001) |
| **Ng-Perron** | Level (intercept and trend) |  |  |
|  | MZa | -5.70684 [-23.8000] | -5.70087 [-23.8000] |
|  | MZt | -1.61681 [-3.42000] | -1.61463 [-3.42000] |
|  | MSB | 0.28331 [0.14300]* | 0.28323 [0.14300] |
|  | MBT | 15.8443 [4.03000] | 15.8573 [4.03000] |
|  | Level (intercept) |  |  |
|  | MZa | -1.90924 [-13.8000] | -1.89474 [-13.8000] |
|  | MZt | -0.92378 [-2.58000] | -0.92004 [-2.58000] |
|  | MSB | 0.48384 [0.17400] | 0.48558 [0.17400*] |
|  | MBT | 12.2135 [1.78000] | 12.2987 [1.78000]* |
|  | Δ(intercept and trend) |  |  |
|  | MZa | -756.333 [-23.8000]* | -867.527 [-23.8000]* |
|  | MZt | -19.4406 [-3.42000]* | -20.8215 [-3.42000]* |
|  | MSB | 0.02570 [0.14300] | 0.02400 [0.14300] |
|  | MBT | 0.12928 [4.03000] | 0.11262 [4.03000] |
|  | Δ(intercept) |  |  |
|  | MZa | -241.578 [-13.8000]* | -288.814 [-13.8000]* |
|  | MZt | -10.9829 [-2.58000]* | -12.0103 [-2.58000]* |
|  | MSB | 0.04546 [0.17400] | 0.04159 [0.17400] |
|  | MBT | 0.11079 [1.78000] | 0.09242 [1.78000] |

Δ is the first difference term. The optimal lag length stands for the lag level that maximizes the Schwarz Information Criteria (SIC). P-values are in parentheses and Asymptotic critical values are in brackets. ˙Significance at the 1% level.

**Table 1:** Unit root test results for spot and futures prices series.

the series of CAC 40 index and futures, also and from the evidence of regime shifts presented in Table 3 we can infers that the series of CAC 40 index has undergone five regime shifts reflecting the effect of the impact of futures on the variability of the CAC40 index.

Our aim being to know the durability of the impact of changes regimes, currently detected by [51], so we used the Markov switching model of based on the number of regimes detected by OLS Estimation with breaksbased on the test of Bai and Perron [50] (Table 4).

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| DM | 0.993155 | 0.000372 | 2667.839 | 0 |
| C | 31.58987 | 1.630703 | 19.37193 | 0 |
| R-squared | 0.999414 | Meandependent var | | 4279.26 |
| Adjusted R-squared | 0.999414 | S.D. dependent var | | 940.4667 |
| S.E. of regression | 22.76568 | Akaike info criterion | | 9.088865 |
| Sumsquaredresid | 2162249 | Schwarz criterion | | 9.091901 |
| Log likelihood | -18966.46 | Hannan-Quinn criter. | | 9.089939 |
| F-statistic | 7117367 | Durbin-Watson stat | | 0.122028 |
| Prob(F-statistic) | 0 | | | |

**Table 2:** Ordinary least squares estimation.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| 1/03/2000 - 3/31/2004 -- 1108 obs | | | | |
| DM | 0.993174 | 0.0005 | 1988.18 | 0 |
| C | 20.73431 | 2.33935 | 8.863276 | 0 |
| 4/01/2004 - 6/06/2007 -- 830 obs | | | | |
| DM | 0.999869 | 0.001012 | 988.3418 | 0 |
| C | 3.538025 | 4.705506 | 0.751891 | 0.4522 |
| 6/07/2007 - 1/27/2011 -- 951 obs | | | | |
| DM | 0.990439 | 0.000766 | 1293.091 | 0 |
| C | 43.15621 | 3.220925 | 13.3987 | 0 |
| 1/28/2011 - 6/21/2013 -- 626 obs | | | | |
| DM | 1.009316 | 0.002485 | 406.1828 | 0 |
| C | -19.29789 | 8.747672 | -2.20606 | 0.0274 |
| 6/24/2013 - 12/31/2015 -- 659 obs | | | | |
| DM | 1.013857 | 0.002385 | 425.0689 | 0 |
| C | -52.4504 | 10.69964 | -4.90207 | 0 |
| R-squared | 0.999491 | Meandependent var | | 4279.26 |
| Adjusted R-squared | 0.99949 | S.D. dependent var | | 940.4667 |
| S.E. of regression | 21.24674 | Akaike info criterion | | 8.952677 |
| Sumsquaredresid | 1879729 | Schwarz criterion | | 8.967858 |
| Log likelihood | -18674.24 | Hannan-Quinn criter. | | 8.958047 |
| F-statistic | 908002.2 | Durbin-Watson stat | | 0.140359 |
| Prob (F-statistic) | 0 | | | |

**Table 3:** Bai and Perron multiple structural break tests on sample.

In other terms, EViews offers specialized tools for examining the regime transition results and predicted regime probabilities.

Concerning the transition results, the default summary display shows a table (Table 5) containing both the transition matrix and the expected durations (Kim and Nelson, 1999, p. 71-72) implied by the transition matrix (Table 5).

The transition probabilities point to a possible explanation of the difficulty in estimating the model. The high transition probability is detected in the regime 1 with approximately 0.626, while the low transition probability is detected in the regime 4 with approximately 0.037. The corresponding expected durations in a regime are approximately 3 for the first regime and 2 for the rest.

The effect of shocks of the futures on the series prices is strong during the first regime and will be negligible during the 4 the regime with a recovery for the 5th regime

Lastly, we display the filtered and full sample estimates of the probabilities of being in the five regimes. We will display the results only for the fifth regimes. Then repeat the procedure choosing the smoothed results. After saving the two views as graphs, we see that the predicted probabilities of being in the low CAC 40 index state coincide nicely with the commonly employed definition of derivatives markets changes:

We can see the variation in the time-varying probabilities by examining graphs of the transition probabilities for each observation (Figure 4).

Looking at Figure 4 for the CAC40 index, the regime-1 of probability indicates five periods during which the process is in the high and in the low variability regime, this appears have been induced by a sequence of crises with worldwide impact of financial market. The first of these five periods begins around 2000 when the high variability regime can be related to the worldwide bear market following the burst of the 'dot-com bubble'. So and although the existence of an important impact of chocs of futures during this periode that is about (0.626105) but the high variability of prices existe. These changes can not be caused by index futures but appears to have been driven by other events such as financial turmoil. The high variability period of regime 1 ends in March 2004. The second regime covers a period between (01/04/2004 to 06/6/2007) demonstrated that the impact of futures on the variability of the underlying stock market index, has decreased substantially compared to the first regime (0.113154) although that we observe the existence of high variability regime wuich have been induced by the subprime crisis (the famous crisis of the real estate credits in the U.S.A,). In the 3rd regime (07/6/2007 to 27/01/2011) the process remains in the low variability regime, it is low as compared to the high-volatility regime in 2000-2004, and the impact of futures becomes negligible

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| Regime 1 | | | | |
| DM | 0.993219 | 0.000256 | 3886.557 | 0 |
| C | 22.37637 | 1.098182 | 20.37583 | 0 |
| Regime 2 | | | | |
| DM | 0.976308 | 0.000641 | 1522.524 | 0 |
| C | 104.1562 | 3.412089 | 30.52563 | 0 |
| Regime 3 | | | | |
| DM | 0.994897 | 0.001147 | 867.0314 | 0 |
| C | 70.60254 | 6.013694 | 11.74029 | 0 |
| Regime 4 | | | | |
| DM | 1.008142 | 0.001234 | 817.1964 | 0 |
| C | 38.17971 | 5.00317 | 7.631104 | 0 |
| Regime 5 | | | | |
| DM | 1.006052 | 0.000697 | 1444.243 | 0 |
| C | -21.27687 | 2.82509 | -7.531397 | 0 |
| Common | | | | |
| LOG(SIGMA) | 2.15727 | 0.016098 | 134.0118 | 0 |
| Probabilities Parameters | | | | |
| P1-C | 1.410534 | 0.107972 | 13.06389 | 0 |
| P2-C | -0.300235 | 0.113392 | -2.647774 | 0.0081 |
| P3-C | -0.771135 | 0.118255 | -6.520937 | 0 |
| P4-C | -1.409846 | 0.17192 | -8.200608 | 0 |
| Mean dependent var | 4279.26 | S.D. dependent var | | 940.4667 |
| S.E. of regression | 22.81425 | Sumsquaredresid | | 2166800 |
| Durbin-Watson stat | 0.121824 | Log likelihood | | -17417.56 |
| Akaike info criterion | 8.352927 | Schwarz criterion | | 8.375699 |
| Hannan-Quinn criter. | 8.360982 | | | |

**Table 4:** Switching Regression (Markov Switching).

Constant transition probabilities:
P(i, k)=P(s(t)=k | s(t-1)=i)
(row=i/column=j)

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0.626105 | 0.113154 | 0.070658 | 0.037305 | 0.152778 |
| 2 | 0.626105 | 0.113154 | 0.070658 | 0.037305 | 0.152778 |
| 3 | 0.626105 | 0.113154 | 0.070658 | 0.037305 | 0.152778 |
| 4 | 0.626105 | 0.113154 | 0.070658 | 0.037305 | 0.152778 |
| 5 | 0.626105 | 0.113154 | 0.070658 | 0.037305 | 0.152778 |

Constant expected durations

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| | 2.674548 | 1.127591 | 1.07603 | 1.038751 | 1.180328 |

**Table 5:** Switching transition probabilities and expected durations.

(0.070658). The financial market has several storms in July, August and September 2011, leading to one of more severe declines in the history of stock markets caused by fears that the global economic recovery falter after only one year growth, in this conditions we continue to observe in the 4th regime which covers the period between (28/01/2011 to 21/06/2013) a low variability with more negligeable choc effect on the prices variability (0.037305), after a period of low variability we observe a jump of the high variability regime around the period which covers a 5th regime 24/06/2013 to 31/12/2015. The effect of the futures on the variability prices remains more important in this period and regained (0.152778).

All of these results are consistent with the hypothesis that the frensh index futures market should have decreased spot market variability. Therefore, we conclude that, instead of being governed by index futures, the observed switches to high-variability periods are
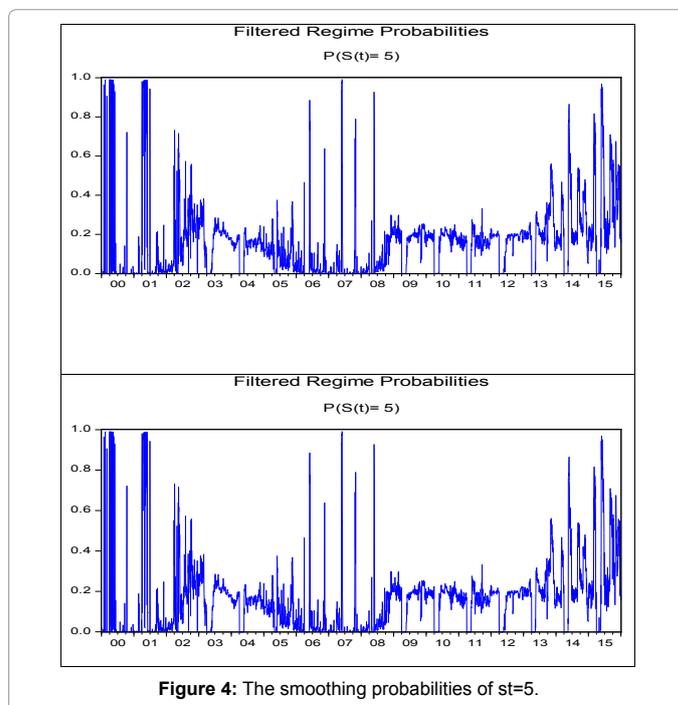


**Figure 4:** The smoothing probabilities of st=5.

more likely to have been caused by other events. The observed switches between variability regimes have not been caused by index futures, but rather appear to have been driven by other events such as financial turmoil (Table 6).

By default, the estimation output header describes the estimation

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| DM | 0.991788 | 8.50E-05 | 11667.42 | 0 |
| C | 29.18722 | 0.34354 | 84.96011 | 0 |
| | Variance Equation | | | |
| C | 19.78379 | 0.611028 | 32.37788 | 0 |
| RESID (-1)^2 | 0.657698 | 0.026192 | 25.11079 | 0 |
| GARCH (-1) | 0.297488 | 0.021172 | 14.05089 | 0 |
| R-squared | 0.999335 | Meandependent var | | 4279.26 |
| Adjusted R-squared | 0.999335 | S.D. dependent var | | 940.4667 |
| S.E. of regression | 24.24982 | Akaike info criterion | | 7.764986 |
| Sumsquaredresid | 2453361 | Schwarz criterion | | 7.772576 |
| Log likelihood | -16200.53 | Hannan-Quinn criter. | | 7.767671 |
| Durbin-Watson stat | 0.107487 | | | |

**Table 6:** ARCH-GARCH estimation.

sample, and the methods used for computing the coefficient standard errors, the initial variance terms, and the variance equation. Also noted is the method for computing the presample variance, in this case backcasting with smoothing parameter $\lambda=0.7$.

The main output from ARCH estimation is divided into two sections—the upper part provides the standard output for the mean equation, while the lower part, labeled "Variance Equation", contains the coefficients, standard errors, z-statistics and p-values for the coefficients of the variance equation.

The ARCH parameters correspond to "$\alpha$" and the GARCH parameters to "$\beta$" in equation (10). The bottom panel of the output presents the standard set of regression statistics using the residuals from the mean equation. Note that a measure such as $R^2$ is very meaningful because it is very close to be one.

In this example, the sum of the ARCH and GARCH coefficients ($\alpha + \beta$) is approximately close to one, indicating that volatility shocks are quite persistent. This result is often observed in high frequency financial data. We obtain from the Table 5, a significant estimation that detect à presence of impact of choc (ARCH=0.65, GARCH=0.29), this impact is significant but very low, or to the impact of the shock exist but it is not sustainable (quitepersistent).

By default, the estimation output header describes the estimation sample, and the methods used for computing the coefficient standard errors, the initial variance terms, and the variance equation. Also noted is the method for computing the presample variance, in this case backcasting with smoothing parameter $\lambda=0.7$.

## Summary and Conclusion

The aim of this paper is to investigate the impact of the futures on the variability of the underlying stock index of french market over the sample period starting from January 03, 2000 to December 31, 2015. However, the indexes futures trading have a stabilising effect on the french stock market. The introduction of index futures therefore might lead to the better flows of informations into the spot market and hence to a more efficient spot market. This evidence justifies the regulation of futures, which stabilises the cash market.

We can deduce from our work and after using the Markov-switching approach which allows the endogenous variability regime shifts and reveals if the variability of underlying prices following the impact of futures has changed transitorily or permanently, and that the effect of the impact of futures is significant but it is very small, the impact of the shock exists but is unsustainable (quite persist), and the

observed switches between variability regimes have not been caused by index futures, but rather appear to have been driven by other events such as financial turmoil. Therefore, we conclude that, instead of being governed by index futures trading, the observed switches to high-volatility periods are more likely to have been caused by other events. To overcome econometric shortcomings of the existing literature we employ a Markov-switching-approach to endogenously identify distinct regimes. Using this model, we are able to identify distinct non-permanent volatility regimes that governed by derivatives trading. This precise identification could not have been achieved by a simple dummy variable approach.

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