



HOT AND COLD CYCLES FOR AFRICAN EMERGING SHARE IPO MARKET EVIDENCE FROM TUNISIA

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ABSTRACT

This paper seeks to detect hot and cold IPO cycles in the Tunisian share market using a Markov regime switching model. Using a set of IPO activity measures (number of IPOs, level of underpricing, market conditions and duration), we establish a model which estimates these activity measures in hot and cold periods respectively. We depict the turning points from 1998 to 2012 for each activity measure. It is found that Tunisian stock market is cold in the major period. As regards to cycles, the segmentation method gives almost the same periods, except for the trading volume which gives a different segmentation.

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Keywords: Hot/cold IPO cycles, Markov regime switching model, Tunisian IPO market, Number of IPOs, Level of underpricing, Market conditions, Duration.

JEL Classification: C58, E37, G17.

Contribution/ Originality

This study has two contributions. First, it is one of few studies detecting IPO cycles and turning points of hot/cold periods for Tunisian share market. Second, with eight IPO activity measures, we use Markov switching models to detect IPOs cycles and test if these cycles are similar for different activity measures.

1. INTRODUCTION

Brealey and Myers (2003) defined an Initial Public Offering as "the original sale of a company's securities to the wider public for the first time in the primary market". It permits to initial owners of a firm to increase capital while transmitting and sharing some of the firm's risk with public investors. So, it facilitates both risk sharing between the investors and capital development by firms. The initial public offering (IPO) market follows a cycle with intense swings,

referred to as hot and cold markets. An information set is used in forming predictions about the future condition of the IPO market (hot or cold IPO market), which includes the current level of underpricing, the number of IPOs currently on issue and the current economic and market conditions when the firm goes public. IPOs made under hot market conditions, which represents substantial interest by investors in the IPO, are expected to yield larger returns in the first few trading days than IPOs made in a cold market. The prices of hot market IPOs reverse as a result of change in beliefs of investors who realize that too much optimism may be attributed to the new issues (over-evaluation) under the hot market conditions after some time elapses following the IPO. This reversion in prices relative to the market generates underperformance of IPOs made in hot markets. On the other hand, cold market IPOs, which might have lower initial returns due to weaker interest by investors than hot market IPOs, tend to maintain their outperforming even in the long term. IPOs in a hot market might also relate to exemplify the signaling hypothesis, which assumes that a firm's stock issue decisions signal management's belief that it is now permissible for the company shares to become overvalued.

It appears so that it is very important to detect IPOs cycles and to distinguish turning points between hot and cold periods in a market. "The most frequently-used concept of "hot" IPO markets is based on issuance volume" [Agrawal \(2006\)](#). [Loughran and Ritter \(1995\)](#) describe the 1980s as "hot" because most of that decade had much higher issuance volume than the 1970s. Hot IPO markets have also been defined based on underpricing. [Lowry and Schwert \(2002\)](#) investigate the statistical relationship between volume and underpricing over hot and cold markets and find that periods of high underpricing are typically followed by high IPO volume. [Ameer \(2012\)](#) seeks to address the question of whether local macroeconomic variables have any influence on the numbers of IPOs in an emerging market. He found that hot IPO market regime evolves when the investors begin experiencing extremely high initial returns and their anticipation about the future interest rate provide an indication about entrepreneur's/manager's willingness to move to the IPO market. On the other hand, when a government pursues monetary tightening, investors believe that future earnings are expected to shrink due to higher interest rate in future, and valuation of shares would be affected due to lower dividend yield, it keeps investors away from the IPO markets causing cold IPO market. [Guo et al. \(2010\)](#) found that, in the Chinese A-share market, a hot period is related with an abundant supply of IPOs, high levels of underpricing, positive market conditions and short waiting time to listing after prospectus issue. Using a Markov regime switching model for each IPO activity measure, the cycles detected by the number of IPOs per month are the benchmark and the robustness of detected cycles is tested by the other observations (underpricing, market conditions and waiting time to listing after prospectus issue). The problem is that these IPO activity measures are generally correlated. So using all IPO activity measures jointly give better information on IPO cycles in order to eliminate cross and contemporary correlations between series.

This paper focuses on detecting hot and cold IPO cycles in the Tunisian share market using a univariate Markov regime switching model. We seek to detect turning points (between hot and cold

IPOs market) using four activity measures: the number of IPOs per month, underpricing, market conditions and waiting time to listing after prospectus issue.

This paper has two contributions. First, we use Markov switching models to detect IPOs cycles and check their efficiency on exploring hot and cold periods. Second, a little investigation was done to detect IPO issuing cycles and turning points of hot/cold periods for Tunisian share market. The Tunisian IPO market attracts increasing attention for its high average initial returns.

2. DATA AND METHODOLOGY

2.1. Data

The sample consists of the entire ordinary Tunisian share IPOs issued from January 1998 to December 2012. There are in total 34 ordinary share IPOs issued in 180 months included in our paper. Closing prices and the market Index are collected from the Tunisian Stock Exchange (TSE) online database (www.bvmt.com.tn). We obtained information on IPO firm characteristics around the listing period and on the operation of introduction itself from hard copies of prospectus published by the issuers (available at the Financial Market Council (FMC) documentary service and from the Bulletin Official of the TSE).

2.2. Methodology

Markov state switching models are a type of specification which allows for the transition of states as an intrinsic property of the econometric model. Such types of statistical representations are well known and utilized in different problems in the field of economics and finance. Also, "Markov regime switching models are a type of specifications of which the selling point is the flexibility in handling processes driven by heterogeneous states of the world. In this section, we give a brief exposition on the subject. Technical details regarding Markov regime switching models can be found in [Hamilton \(1994\)](#), [Hamilton \(1996\)](#), [Kim and Nelson \(1999\)](#). For introductory material on the subject, see [Hamilton \(2005\)](#), [Brooks \(2002\)](#), [Alexander \(2008\)](#) and [Tsay \(2002\)](#) among others" ([Perlin \(2009\)](#)). Consider the following process given by:

$$Y_t = \mu_{S_t} + \varepsilon_t$$

where $S_t=1, \dots, k$ and ε_t follows a Normal distribution with zero mean and variance given by $\sigma_{S_t}^2$. This is the simplest case of a model with a switching dynamic. Note that for the model given in Equation (1), the intercept is switching states with respect to an indicator variable S_t . This means that if there are k states, there will be k values for μ and σ^2 . If there is only one state of the world (S_t), equation (1) takes the shape of $Y_t = \mu_1 + \varepsilon_t$ and it can be treated as a simple linear regression model under general conditions. Assuming now that the model in equation (1) has two states ($k=2$). An alternative representation is:

$$Y_t = \mu_1 + \varepsilon_t \text{ For State 1}$$

$$Y_t = \mu_2 + \varepsilon_t \text{ For state 2}$$

Where: $\varepsilon_t \sim N(0, \sigma_1^2)$ for State 1 and $\varepsilon_t \sim N(0, \sigma_2^2)$ for State 2. This representation (equation 2) clearly implies two different processes for the dependent variable Y_t . When the state of the world for

time t is in state 1 (state 2), then the expectation of the dependent variable is μ_1 (μ_2) and the volatility of the innovations is σ_1^2 (σ_2^2). In this paper, we assume an IPO market (S_t) may undergo two states $S_t=0$ or $S_t=1$ that represent whether the IPO market is in a hot period or in a cold period. Y_t represents a vector of IPO activity measures. We assume also IPO activities are independent and their transitions of states follow a first-order Markov process, which means that the probability of the current state, hot or cold, is only based on the most recent state. The activity Y_t can be denoted as the following equation:

$$Y_t = \mu_1 S_t + \mu_2(1 - S_t) + (\sigma_1 S_t + \sigma_2(1 - S_t))\varepsilon_t$$

For a Markov regime switching model, the transition of states is stochastic (and not deterministic). This means that one is never sure whether there will be a switch of state or not. But, the dynamics behind the switching process are known and driven by a transition matrix. This matrix will control the probabilities of making a switch from one state to the other. It can be represented as:

$$P = \begin{bmatrix} p & 1 - q \\ 1 - p & q \end{bmatrix}$$

The transitions of states are governed by first-order Markov process:

$$P(S_t/Y_{t-1}, S_{t-1}) = P(S_t/S_{t-1})$$

Where:

$$p = P(S_t = 1/S_{t-1} = 1)$$

$$1 - p = P(S_t = 0/S_{t-1} = 1)$$

$$q = P(S_t = 0/S_{t-1} = 0)$$

$$1 - q = P(S_t = 1/S_{t-1} = 0)$$

3. IPO ACTIVITY MEASURES

Consistent with the paper of [Guo et al. \(2010\)](#), and in order to detect the IPO issuing cycles across the 180 month period, four set of variables are used to measure IPO activity:

- The number of IPOs offered in each month (denoted N_t)
- Underpricing measured by initial-day returns of IPOs issued each month. Two calculations are used: the Initial day Return in month t (IR_t) and the adjusted Stock Market Initial day Return in month t (MIR_t)

$$IR_t = \left(\frac{P_{t,i,1st}}{P_{t,i,0}} \right) - 1$$

$$MIR_t = \left[\left(\frac{P_{t,i,1st}}{P_{t,i,0}} \right) - 1 \right] - \left[\left(\frac{M_{t,i,1st}}{M_{t,i,0}} \right) - 1 \right]$$

When there is more than one IPO per month, the average return is calculated as follow:

$$IR_t = \frac{\sum \left[\left(\frac{P_{t,i,1st}}{P_{t,i,0}} \right) - 1 \right]}{N_t}$$

$$MIR_t = \frac{\sum \left[\left(\frac{P_{t,i,1st}}{P_{t,i,0}} \right) - 1 \right] - \left[\left(\frac{M_{t,i,1st}}{M_{t,i,0}} \right) - 1 \right]}{N_t}$$

- Market conditions: four variables are used which reflect market conditions in different aspects:
 - o The trading volume (denoted *tradingvol_t*): tracks the overall stock market and describes market sentiment monthly
 - o The stock market Index change between offering and listing day (denoted *SMR_{t,1st}*): explains stock market sentiment after listing

$$SMR_{t,1st} = \left(\frac{M_{t,i,1st}}{M_{t,i,0}} \right) - 1$$

- o The stock market Index change across 30 working days (denoted *SMR_{t,offering-30}*): it is the stock market return on the offering day compared with the 30th working day before the offering

$$SMR_{t,offering-30} = \left(\frac{M_{t,i,0}}{M_{t,i,-30days}} \right) - 1$$

- o At the same way, the stock market return on the offering day compared with the 60th working day before the offering is:

$$SMR_{t,offering-60} = \left(\frac{M_{t,i,0}}{M_{t,i,-60days}} \right) - 1$$

- Duration (denoted *D_t*) which measures the number of days between prospectus and listing of the stock introduced by IPO.

Table-1. Descriptive statistics of all activity measures

Variable	N	Mean	Std deviation	Min	Max	Median
<i>N_t</i>	180	0.19	0,4200145	0	2	0
<i>IR_t</i>	180	10.115%	0,163788509	-0.13740664	0,556954442	0,030629346
<i>MIR_t</i>	180	-4.107%	0,29375505	-0.60430172	0,56586907	-0,03403398
<i>SMR_{t,1st}</i>	180	-0,00302	0,01777828	-0.07033	0,0390822	-0,00117835
<i>SMR_{t,offering-30}</i>	180	0,013014941	0,03463516	-0.04502856	0,085938214	0.01070343
<i>SMR_{t,offering-60}</i>	180	0,020249052	0,05710012	-0.0743478	0.17402676	0.01257988
<i>Tradingvol_t</i>	180	480.566026	435.526308	68.4210526	3235.75613	366.452858
<i>Duration_t</i>	180	22	11,3613663	4	56	21

Figure-1. The distribution of each activity measure from 1998 to 2012

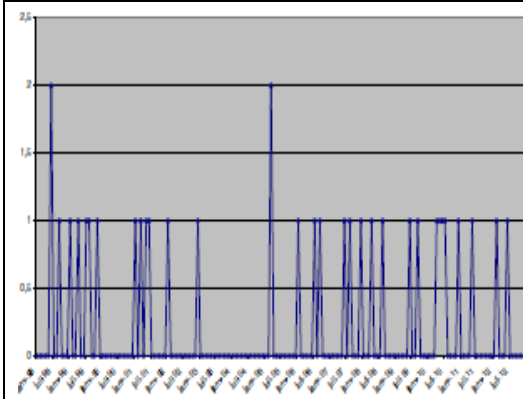


Figure 1.1: N_t

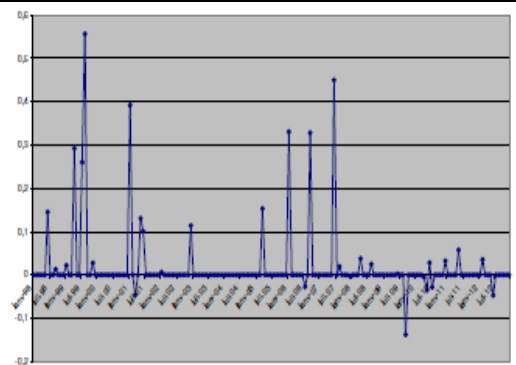


Figure 1.2: IR_t

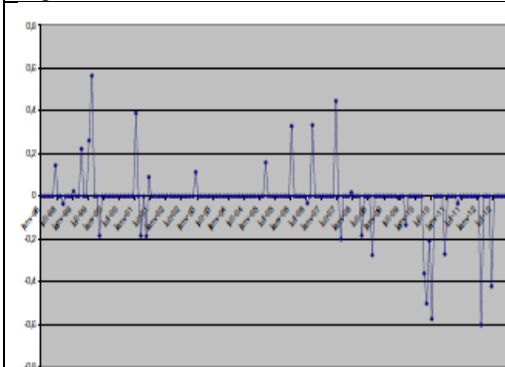


Figure 1.3: MIR_t

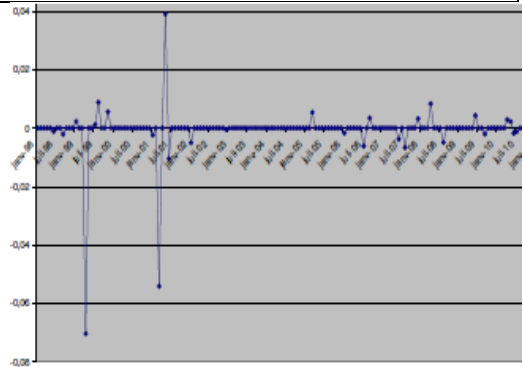


Figure 1.4: $SMR_{t,1st}$

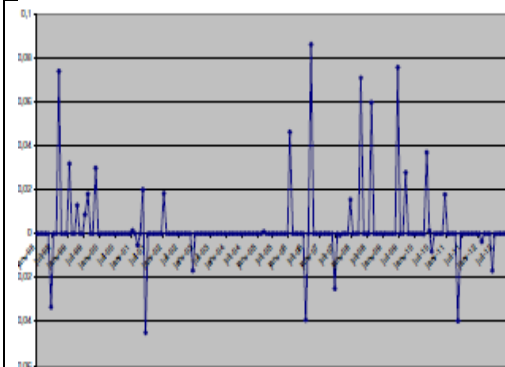


Figure 1.5: $SMR_{t,trading-30}$

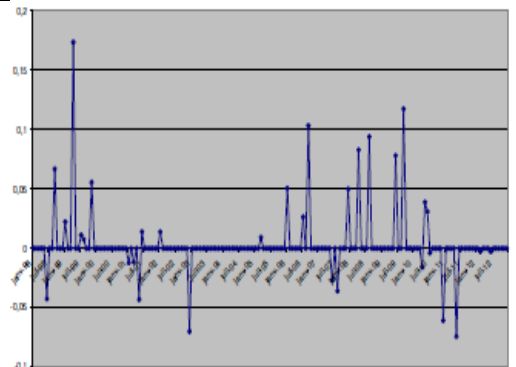


Figure 1.6: $SMR_{t,trading-60}$

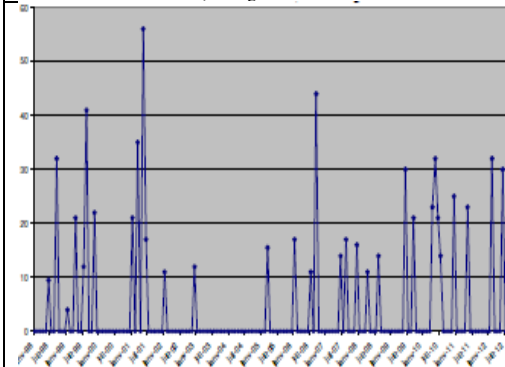


Figure 1.7: D_t

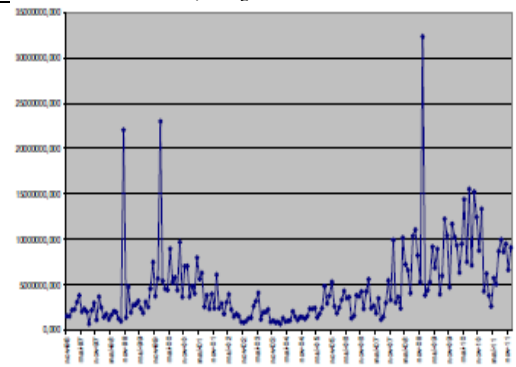


Figure 1.8: tradingvolt

Table 1 presents descriptive statistics for each variable.

- The number of IPOs varies from 0 to 2 IPOs going public in a month with an average number of (0.19) which corresponds to an annual average of 2.26 IPO per year.
- For underpricing, initial return on average (IR_t) is of 1.8%. It ranges from -13.74% and 55.7%, while the market adjusted Initial return (MIR_t) is on average of (-0.73%) and it ranges from -60.43% and 56.59%. The phenomenon of IPOs underpricing has been well documented by anterior researchers. [Miller and Reilly \(1987\)](#) and [Levis \(1990\)](#) reported an average IPO underpricing of 20.6% in the US market and 9.56% in the UK market. [Guo et al. \(2010\)](#) reported an average IPO underpricing of 9.56% in the Chinese share market.
- In the Tunisian market, the average IPO underpricing is of 10.115%, but 50% of the observations have an underpricing little than 3.063% (median), which allows us to expect a "cold" market for most of the studied period. In fact, [Lowry and Schwert \(2002\)](#) investigate the statistical relationship between volume and underpricing over hot and cold markets and find that periods of high underpricing are typically followed by high IPO volume.
- For Stock market returns, the average $SMR_{t,1st}$ is around (-0.302%), $SMR_{t,offering-30}$ is 1.302% and $SMR_{t,offering-60}$ is 2.025%. We can remark that the means increase in an ascending order as do the ranges of these three variables, which reflect that the stock returns as well as the uncertainty and the risk may increase when the time horizon becomes longer, this is confirmed by observing the standard deviations moving from 0,01777828 to 0,03463516 then 0,05710012.
- Finally for the duration, [Guo and Brooks \(2009\)](#) find that IPOs can list faster during positive market sentiment especially in hot periods. [Guo et al. \(2010\)](#) assume that the waiting time from prospectus to listing will be shorter if issuers and investors detect a hot market. For the Tunisian market, duration ranges from 4 to 56 days. The average duration is 22 days between the prospectus and the listing, and 50% of IPOs have a duration less than or equal to 21.

According to table 2, there are two periods that IPOs have to wait for a longer time to see their offering listing: January 1998 - May 2001 and June 2009 - December 2012. In these two periods, the monthly average duration may exceed 25 days. For the period June 2001 - May 2009, the average duration is of 16.625. We notice that the majority of IPOs have duration between 10 and 30 days. Only 7 IPOs have duration of more than 30 days and 2 IPOs have duration less than 10 days.

Table-2. Duration and number of IPOs per period

Period	Average Duration	Average N_t
January 1998 - may 2001	25.35	0.2683
June 2001 – may 2009	16.625 (14,1364)	0.13542
June 2009-december 2012	25.1	0.23256

We note that when the number of IPOs increases, the duration increases. By cons, when the number of IPOs decreases, the duration decreases. It appears that institutional and regulatory features induce lags between the closing subscription date and the listing date.

4. REGIME SWITCHING RESULTS AND HOT AND COLD ISSUING CYCLES

Table-3. The regime switch estimates for each IPO activity measure

IPO activity measure	parameter	μ_1 (cold)	μ_2 (hot)	σ^2 (cold)	σ^2 (hot)	p (cold)	q (hot)	Expected duration of regime cold	Expected duration of regime hot
N_t	Estimate	0.0000	1.0000	0.018765	0.018765	0.85	0.1	6.89	1.11
Likelihood: 48.0307	Standard error (%)	0.01	4.33	0.000	0.000				
IR_t (%)	Estimate	-0.0003	0.2909	0.000424	0.08358	0.88	0.00	8.12	1.00
Likelihood: 164.7679	Standard error (%)	0.27	10.85	0.000	4.22				
MIR_t (%)	Estimate	-2.6922*	0.1154	7.3395*	0.309711	0.84	0.03	6.37	1.03
Likelihood: 988.5674	Standard error (%)	10^{-9}	16.01	10^{-16}	0.000				
$SMR_{t,1st}$ (%)	Estimate	0.0018	0.0088	0.00009	0.001696	0.91	0.6	10.83	2.52
Likelihood: 198.4716	Standard error (%)	0.14	0.97	0.000	0.001				
$SMR_{t,offering-30}$ (%)	Estimate	0.0281	-0.0077	0.001803	0.021246	0.88	0.85	8.56	6.7
Likelihood: 70.5042	Standard error (%)	0.79	2.49	0.0004	0.0043				
$SMR_{t,offering-60}$ (%)	Estimate	0.1209	-0.2478	0.029782	0.015261	0.96	0.84	28.2	6.19
Likelihood: 18.6546	Standard error (%)	2.53	4.69	0.58	0.69				
Duration _t (Days)	Estimate	-1.1842	18.0036	2.396134	43.12774	0.79	0.00	4.84	1.00
Likelihood: 192.4013	Standard error (%)	46.68	2.7916	90.05	999.81				

Table 3 presents the optimal estimates and their standard errors for each IPO activity measure. In general, the means (μ) and the standard errors (σ^2) in cold periods are lower than those in hot periods.

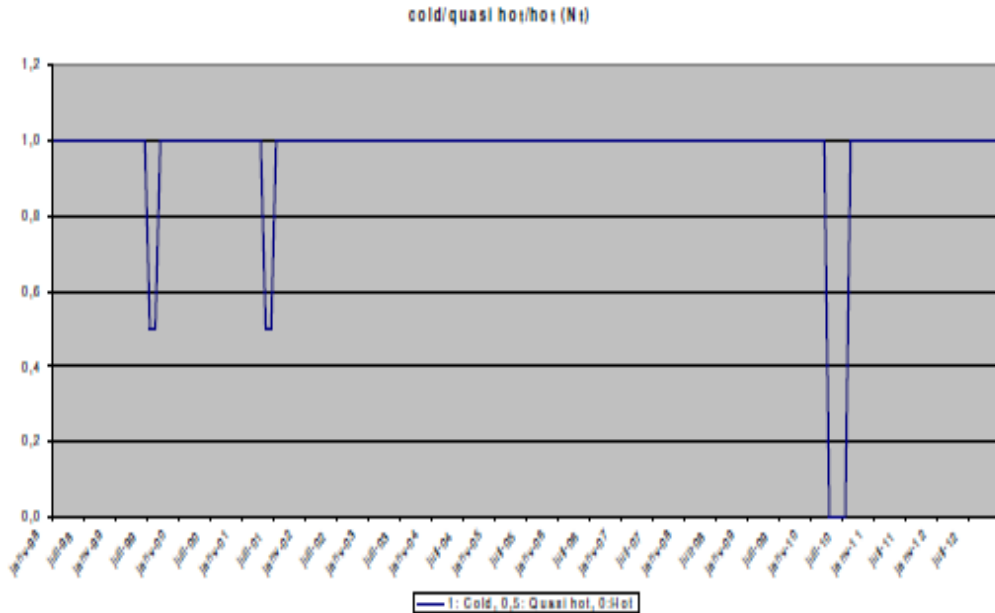
The average number of IPOs issued per month is found to be of great difference between cold and hot periods. During cold period, there is almost no IPO. During hot periods, the average is 1.0624 IPO per month, with a standard error of 0.0429. Furthermore, the estimated probability of staying in a hot market is 0,5 while the estimated probability of staying in a cold market is 0,91. So, the expected duration of a hot regime is only 2 months but the expected duration of a cold regime is approximately around 11 months. Similarly, the levels of underpricing during hot periods (11.08%) are much higher than those in cold periods (-0.00322763%).

The expected duration for a cold period is determined by the rule $(1/1-p)$. In the same way, the expected duration for a hot period is determined by the rule $(1/1-q)$. Brailsford *et al.* (2000) take 6 months as the minimum phase for a real hot or cold period. However, Guo *et al.* (2010) argue that some important phases and fluctuations may be ignored when taking 6 months as the minimum criterion. They so extracts periods which are less than 6 months but longer than three months and name them as “quasi-hot” or “quasi cold” periods.

The Tunisian stock market is cold in the major period, taking a cycle of six months will led to ignoring many fluctuations, since the expected duration of hot periods is in majority between one

and two months. In this paper, we will consider the market in ‘quasi-hot’ or ‘quasi cold’ period if the expected duration is between 2 and 3 months. If the duration is more than 3 months, the market is “cold” or “hot”. We notice that, as regards to cycles, the segmentation method using the number of IPOs or underpricing variables give almost the same periods (hot/cold).

Figure-2. The switching regimes and hot and cold periods using N_t



Period	Jan 98 - June 99	July-Aug. 99	Sept 99 - April 2001	May - June 2001	July -march 2010	April - July 2010	Aug 10 - Dec 2012
Hot/cold market	cold	Quasi hot	cold	Quasi hot	cold	hot	Cold

Figure-3. The switching regimes and hot and cold periods using underpricing variables

Figure-3.1. IR_t

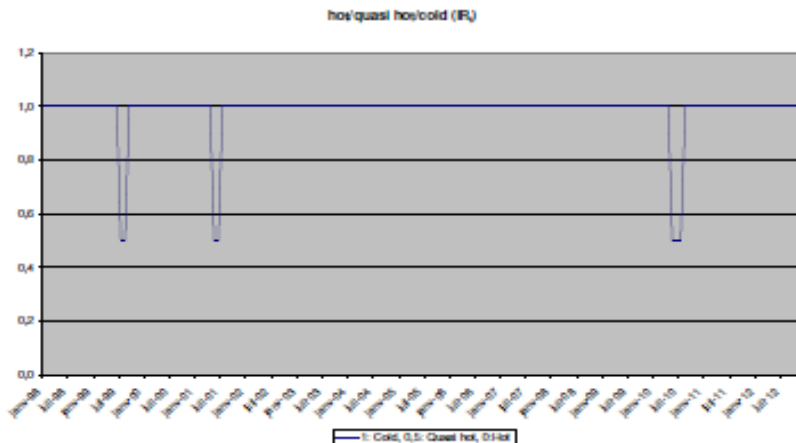
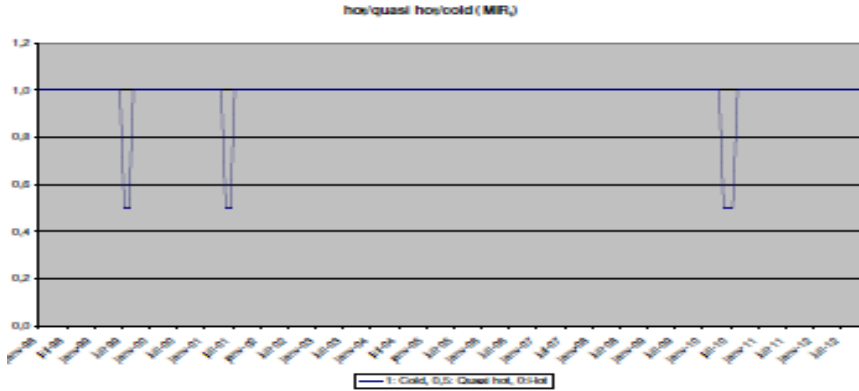


Figure-3.2. MIR_t



Period	Jan 98 - June 99	July - Aug. 99	Sept 99 - April 01	May 01 - June 01	June - July 01	July 01 - March 10	May - July 10	Aug 10 - Dec 12
Hot/cold (IR _t)	cold	Quasi hot	cold	Quasi hot	cold	Quasi hot	Quasi hot	cold

Period	Jan 98 - June 99	July - Aug 99	Sept 99 - April 01	May - June 01	July 2001 - March 2010	May - July 10	Aug 10 - Dec 12
Hot/cold (MIR _t)	cold	Quasi hot	cold	Quasi hot	cold	Quasi hot	cold

For the stock market conditions, the average trading volume in hot periods is about 758 millions of dinars, but in cold periods, about 388 million dinars are exchanged on average in a single month. The market is found to be more active when traders detect a hot stock market. During the hot period October 1999-June 2001, the trading volume is almost twice the trading volume in cold periods. The probability for staying in cold period (0.90) is much bigger than the probability for staying in a hot period (0.12), which is alike with the results using the number of IPOs or underpricing variables.

Figure-4. The switching regimes and hot and cold periods according to market conditions variables

Figure-4.1. tradingvolt

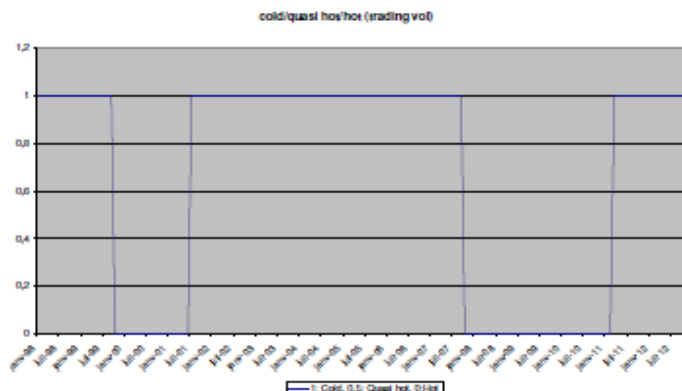


Figure-4.2. $SMR_{t,1}^{st}$

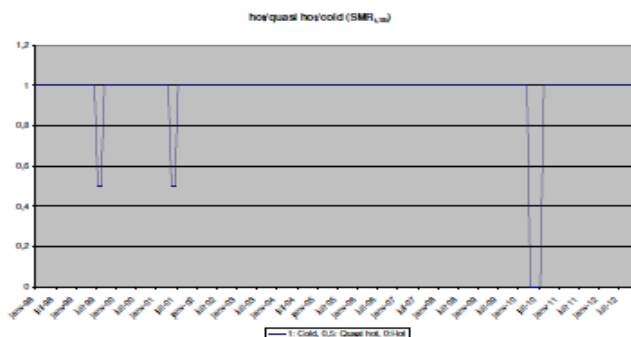


Figure-4.3. $SMR_{t,offering-30}$

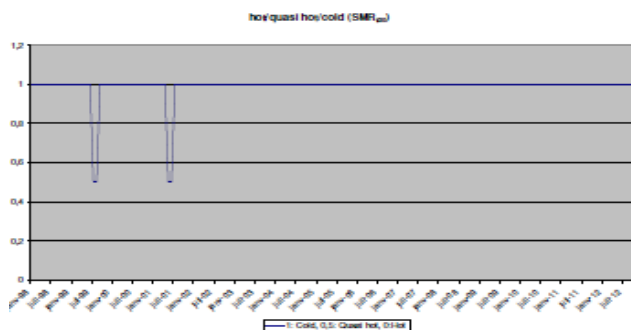
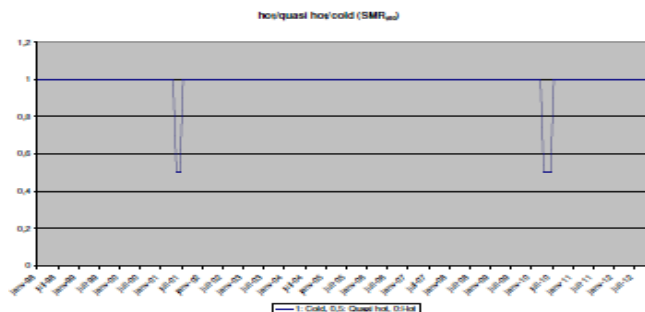


Figure-4.4. $SMR_{t,offering-60}$



Period	Jan 98 - Sept 99	October 99 - June 2001	July 2001 - Sept 2007	Oct 2007 - Feb 2011	March 2011 - Dec 2012
Hot/cold market	Cold	Hot	Cold	Hot	Cold
Average trading volume	293	660	238	857	634

$SMR_{t,1st}$, $SMR_{t,offering-30}$ and $SMR_{t,offering-60}$ indicate significant differences of the stock market returns between hot and cold periods. These three measures show the average means of (-0.3%), 1.51% and 2.33% in hot periods, and much lower means of (-2.6178*10⁻⁵), 0.000117% and 0.000234% in cold periods. When the stock market indices increase, this may reflect an optimistic market sentiment in hot periods.

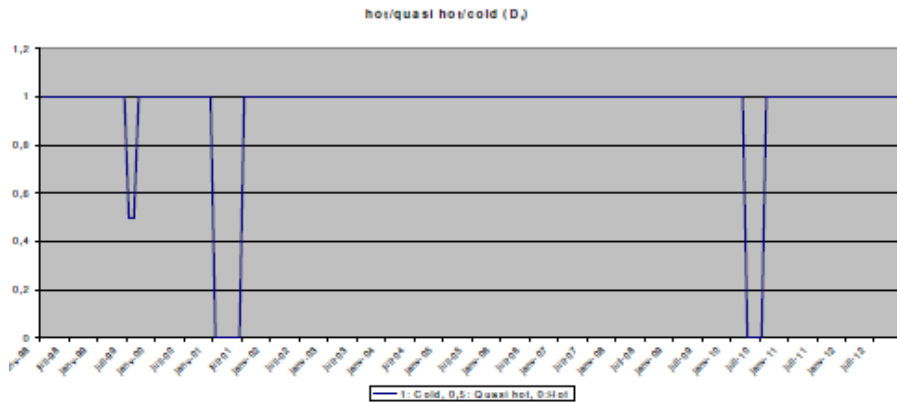
Period	Jan 98 - June 99	July-Aug 99	Sept 99 - April 2001	May - June 2001	July - March 2010	April - July 2010	Aug 10 - Dec. 2012
Hot/cold market	cold	Quasi hot	cold	Quasi hot	cold	hot	cold

Period	Jan 98 - June 99	July-Aug. 99	Sept 99 - April 2001	May - June 2001	July 2001 - Dec. 2012
Hot/cold market	cold	Quasi hot	cold	Quasi hot	cold

Period	Jan 98 - April 2001	May - June 2001	July 2001 - March 2010	April - June 2010	July 2010 - Dec 2012
Hot/cold market	cold	Quasi hot	cold	Quasi hot	cold

For the Duration, we find that in cold periods, the estimated duration is near to zero, but in hot periods, the estimated duration is 23,5 days. Since the Tunisian market is in majority “cold”, and since the monthly average number of IPOs is very little, it appears that institutional and regulatory features induce lags between the closing subscription date and the listing date.

Figure-5. The switching regimes and hot and cold periods using Duration



Period	Jan 98 - June 99	July-Aug 99	Sept 99 - April 2001	Jan - June 2001	July - March 2010	April - July 2010	Aug 10 - Dec. 2012
Hot/cold market	cold	Quasi hot	cold	hot	cold	hot	Cold

5. CONCLUSION

In this paper, four set of variables measuring IPO activity are employed to detect hot and cold cycles and their turning points for the Tunisian share IPO market across 1998 to 2012 (monthly data) using Markov regime switching models. These variables are the number of IPOs issued the

levels of underpricing measured by the Initial Return and the Adjusted Stock Market Initial return, market conditions measured by the trading volume and three stock market returns across different periods and finally the listing speed. As regards to cycles, the segmentation method using all activity measures give almost the same period (hot/cold), except for the trading volume which give a different segmentation. The results show that the levels of underpricing during hot periods are much higher than those in cold periods. For market conditions, our findings demonstrate that the market is more active when traders detect a hot stock market. Furthermore, when the stock market indices increase, this may reflect an optimistic market sentiment in hot periods. Finally the duration to listing is found to be non-informative in addressing IPO hot issues.

As a possible extension of this paper, we can detect turning points using a multivariate setting in which the number of IPOs per month, underpricing, market conditions and waiting time to listing after prospectus issue are modeled jointly. In fact, this paper focuses on detecting hot and cold IPO cycles in the Tunisian share market using a univariate Markov regime switching model employing a set of IPO activity measures. Or, these measures are generally correlated. Then, when the evidence is extended to a multivariate setting in which the number of IPOs per month, underpricing, market conditions and waiting time to listing after prospectus issue are modeled jointly, this multivariate model give better information on IPO cycles since it eliminates cross and contemporary correlations between series.

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