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MACROECONOMIC FACTORS AND INITIAL PUBLIC OFFERINGS (IPOs) IN MALAYSIA

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ABSTRACT

This paper seeks to address the question of whether local macroeconomic variables have any influence on the numbers of IPOs in an emerging market, Malaysia over the period of 1990 to 2008. The evidence of a significant negative relationship between interest rate and the numbers of IPOs, and a significant positive relationship between industrial production and the numbers of IPOs are found. A long-run equilibrium relationship between interest rate, industrial production and numbers of IPOs using cointegration and Vector Error Correction models is found. The impact of interest rate on the numbers of IPO numbers is far greater in the cold IPO regime than during IPO hot regime using Markov regime switching regression model are also found. The empirical finding seems to detect direction of the IPO market reasonably. The results show that hot IPO market regime evolves when the investors begin experiencing extremely high initial returns and their expectation 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.

Keywords: interest rates, IPOs, Markov regime switching regression, Malaysia

INTRODUCTION

Companies go public to access pools of investor funds to finance their growth. This process allows existing owners to sell their shares at competitive prices. Initial public offerings (IPOs) have been extensively researched in the finance literature, and it has been well documented that IPOs exhibit three types of anomalous behaviour: initial underpricing, clustering and long-term underperformance (Ritter, 1991; Schultz, 2003; Loughran & Ritter, 2004). Stimulated by research conducted by Chen, Roll and Ross (1986) on the association between macroeconomic factors and stock returns, recent studies have shown that macroeconomic factors influence IPOs (see: Tran & Jeon, 2011; Chen, 2009, 2007; Jovanovic & Rousseau, 2004; Campbell, Lettau, Malkiel, & Xu, 2001). These studies argue that macroeconomic variables are excellent candidates for examining those factors that influence the number of IPOs because macroeconomic changes simultaneously affect the cash flow of many firms and influence risk-adjusted discount rates. Despite disagreements over the reliability and consistency of these factors in predicting future stock returns, it has been argued that the magnitude of the time-varying response of stock prices to expected (or unexpected) changes in macroeconomic policies has economic implications for market participants (Tran & Jeon, 2011; Ameer, 2007).

From a theoretical viewpoint, macroeconomic variables such as interest rates contain useful information for stock market participants (Chen et al., 1986). In an emerging market, the central bank influences private capital flows and related asset price bubbles through monetary policy. In its efforts to keep the stock market from 'heating up', the central bank intervenes to curb inflation. Institutional investors and fund managers seeking the highest risk-adjusted returns become concerned about the increase in inflation, as it increases the likelihood of high interest rates. Because market participants are anxious about future monetary policies, they expect to be rewarded for risk. Increases in the risk premium raise the "hurdle rate" that managers use to evaluate new investments. Jensen and Johnson (1993) find that stock prices react negatively to increases in discount rates. A high risk-adjusted discount rate could cancel many investments already planned and reduce the number of feasible business investments (Fuerst, 2006).

This paper seeks to address the question of whether local macroeconomic variables have any influence on the number of IPOs in the emerging market of Malaysia. The removal of investment restrictions in this emerging market has led to the market's diminishing segmentation from global capital markets. According to Goetzmann and Jorion (1999), emerging markets may go through several phases during their "emergence" and 'integration with global capital markets'. A well-known consequence of this integration is that the importance of local information increases for international investors. The availability of local information improves the allocation of funds across different types of assets. This research focuses on Malaysia for the following reasons: (1) the primary equity market has benefited from the government's privatisation efforts, (2) there has been foreign direct investment and (3) there have been operational developments in the Securities Commission Malaysia (SC), which is responsible for regulating the primary equity and debt markets (Ang, 2008; Paudyal, Saadouni, & Briston, 1998). The Malaysian capital market development plan streamlined the listing process, which was benchmarked on the international rules and regulations.

Increased regulatory effectiveness reduced the time-to-market and broadened the capital markets from their narrow equity base into a landscape with debt securities, unit trust and an Islamic capital market. Furthermore, growth in underwriting and the government's efforts to provide consumer loans for share purchases and investor protection matched the demand for new securities with a supply of new shares by IPO firms (Ghazali, Said, & Low, 2007).

IPO activity in Malaysia over the past 18 years highlights the economic significance of the Kuala Lumpur stock exchange. From 1993 to 1996, listed firms raised more than US$5,941.01 million in gross proceeds, representing an average of more than US$26 million of capital raised per IPO. This average amount increased to US$40 million after the Asian financial crisis. The increase in the number of listed companies also increased the ratios of stock market capitalisation to GDP and total value traded to GDP. These statistics suggest that the Malaysian stock market has become one of the fastest growing markets in East Asia.[1]

A number of studies related to IPO anomalies in Asia have been conducted, including research on Australia (Bayley, Lee, & Walter, 2006), Hong Kong (Jaggi, 1997), Japan (Isobe, Ito, & Kairys, 1998; Cai & Wei, 1997), Singapore (Firth & Liau-Tan, 1997), Taiwan (Chen, Chiou, & Wu, 2004) and Thailand (Kim, Kitsabunarat, & Nofsinger, 2004). However, previous studies on Malaysian IPOs have investigated the issuance environment[2] (Ahmad-Zaluki, Campbell, & Goodacre, 2011; Chowdhry & Sherman, 1996; Paudyal et al., 1998; How, Jelic, Saadouni, & Verhoeven, 2007), underwriters' reputation (Jelic, Saadouni, & Briston, 2001) and the impact of macroeconomic factors on the primary bond and equity markets (Ameer, 2007). This paper has two primary objectives: (1) to gauge the influence of interest rate, stock market returns, foreign private equity flows, and industrial production on the number of IPOs and (2) to determine what causes "hot" and "cold" IPO regimes. While many macroeconomic variables could be examined,[3] this paper focuses on only five variables: nominal interest rate, foreign portfolio equity investment, industrial production, bank credit and stock market returns. These macroeconomic variables have sufficient support in the finance literature (see Fama & French, 1989; Jensen, Mercer, & Johnson, 1996; Avramov & Chordia, 2006).

This paper makes a twofold contribution to the literature. First, it extends research on macroeconomic variables to primary equity market activities in an emerging market context. The time period and the number of IPOs covered in this paper are greater than those considered in previous Malaysian IPO studies (e.g., Jelic et al., 2001; Paudyal et al., 1998; Wu, 1993). Second, this paper uses a switching regression technique to demonstrate that the impact of macroeconomic factors on Malaysian IPOs[4] is not time-invariant. The Markov switching technique allows us to document the *existence* of the unknown IPO market condition, i.e., the occurrence of hot or cold regimes in the IPO market. A hot IPO regime (market) is associated with periods of upward increase in the number of IPOs, and a cold IPO regime is associated with a downward trend in the number of IPOs.

The empirical results show a significant relationship between local macroeconomic variables and the number of IPOs. Interest rate and industrial production have significant positive influences on the number of IPOs. Using the Markov regime switching regression model, we show that there is a 10% probability of swing from a "hot" to "cold" IPO market regime (and vice versa) due to variations in the interest rate. On average, a hot IPO market lasted for only 10 months, and a cold IPO market lasted for only 9 months. These findings indicate that if there is an increase of one standard deviation in the interest rate, there is a 10% chance that IPOs will slow down in Malaysia and that this downward trend will persist for approximately 9 months. These results show that IPOs are, to a large extent, driven by monetary policy in Malaysia.

LITERATURE REVIEW AND HYPOTHESES

Rock (1986) suggests that new firms set the offering price of new shares at a discount, expecting that uninformed investors will purchase these shares. Allen and Faulhaber (1989) and Welch (1989) make the following hypotheses: new firms offer shares at a discount to signal their "good" quality to attract future investors; IPOs' initial performance may be due to deviations in stock prices from their fundamental value due to over-optimism on the part of investors; and the greater the initial return on the IPO date, the greater will be the degree of subsequent correction of underpricing (Shiller, 1990). Loughran, Ritter and Rydqvist (1994) and Ritter (1998) provide a review of IPO studies and believe that IPO underpricing is an international phenomenon.

According to the literature on information spillover, IPO clustering is a result of firms' free-riding on the information production of earlier IPOs, which then creates IPO waves (Hoffmann-Burchardi, 2001). Yung, Colak and Wang (2008) argue that adverse selection theory is also key to understanding IPO clustering (see, e.g., Rock, 1986). The authors argue that when the economic outlook is good, more firms go public to capitalise on new investment opportunities. Among these good quality firms are some marginal quality firms that do not have the capacity or management skills to take advantage of new investment opportunities. These firms benefit due to information about the good quality of other IPOs prior to their IPO and because the market does not have complete information on each firm. The IPOs of marginal quality firms are also ranked higher among other IPOs. This notion of adverse selection has found relevance and resonance in the IPO literature as one of the causes of IPO clustering (Lowry & Schwert, 2002; Leite, 2007).

There are relatively few empirical papers that have investigated IPOs from a macroeconomic perspective (Loughran et al., 1994; Rydqvist & Hőgholm, 1995). La Porta, Lopez-De-Silanes, Shleifer and Vishny (1997) find a strong positive influence of macro-economic variables, such as GDP growth rates, on the number of IPOs in emerging markets. Besides GDP growth rates, some researchers report that interest rates also influence the number of IPOs and the total amount raised through equity issues (see: Chang, 2009; Ameer, 2007; Neumeyer & Perri, 2005; Uribe & Yue, 2006; Jovanovic & Rousseau, 2004; Brau, Francis, & Kohers, 2003). In *neoclassical economic theory*, there is a dynamic interaction between interest rate, financing and investment; interest rate generates a "credit multiplier" effect and a monetary policy transmission shock. Brau et al. (2003) argue that interest rate affects the choice of IPO for takeover for new companies because when the interest rate is lower, acquiring companies can use more debt to finance the acquisition of the target, thus reducing IPOs and increasing takeover activity. Jovanovic and Rousseau (2004) find that the relation between an IPO's volume and interest rate is non-monotonic. For very high levels of interest rate, IPOs are discouraged because future income is discounted more heavily, whereas for very low interest rates, there are gains to waiting until interest rates rise to favourable levels. Chang (2009) argues that interest rate is a tool to execute tight or loose monetary policy, which affects the stock market[5] through credit channels (see, e.g., Bernanke & Gertler, 2001). Thus, we hypothesise as follows:

> H1: There is a negative relationship between interest rate and the number of IPOs.

With the opening of local stock markets to foreign investors, IPOs provide foreign investors access to local stock markets to achieve portfolio diversification.[6] Kaminsky, Lyons and Schmukler (2001) report that mutual fund investments in the form of net private equity flows to East Asian emerging markets has been a major source of development for capital markets. U.S. mutual funds constituted the largest source of foreign capital for the emerging market firms (Aggarwal, Klapper, & Wysocki, 2005). According to the *capital demands hypothesis* (Lowry, 2003), when companies have higher demands for external capital, managers think of lower costs for raising capital by sharing the risks with foreign investors. Because foreign investors are attracted to emerging market firms due to higher returns, local firms benefit from risk sharing and lower cost of equity. Though we do not have any reliable information on the percentage of shares that were sold to foreigners in Malaysian IPOs, it is plausible that these foreign investors might have access to new shares through foreign funds and local funds. In light of the above arguments, we hypothesise as follows:

> H2: There is a positive relationship between foreign net private equity flows and the number of IPOs.

Current national stock levels, measured by GDP or industrial production, are positively related to future levels of real activity (Bilson, Bailsford, & Hooper, 2001). According to *neoclassical economics theory*, industrial production is also a leading indicator of business cycle and a proxy for income (Neumeyer & Perri, 2005). The growth rate in industrial production signals entrepreneurs to access capital markets for new financing. The increase in output leads to expansionary demand shocks in the economy (Flannery & Protopapadakis, 2002). Korajczyk and Levy (2003) argue that aggregate equity issues vary pro-cyclically and aggregate debt issues vary counter-cyclically for firms that access public financial markets. In an open economy like that of Malaysia, these expansionary shocks would signal to entrepreneurs an increase in the demand for their output and vice versa; thus, we hypothesise as follows:

> H3: There is a positive relationship between industrial production and the number of IPOs.

According to the *theories of credit provision* (see Petersen & Rajan, 1997), trade credit exists as a substitute for bank financing. In an economy with a developed banking system, the acquisition of information on borrowers, debt contract negotiation and corrective actions are better handled. Though suppliers have a cost advantage over banks in acquiring information about the financial health of buyers, suppliers are not sophisticated enough to screen complex projects. Fama (1985) argues that banks have access to inside information, while outside (public) debt holders rely on publicly available information. According to the *bank lending channel theory*, central banks can slow real activity by raising banks' cost of funds, thereby reducing the supply of credit.[7] In such circumstances, banks refrain from lending to borrowers because of the high costs of funds. In such situations, firms would seek stock market financing (Williamson, 1988) instead of bank debt for growth. Thus, we hypothesise as follows:

> H4: There is a negative relationship between bank credit and the number of IPOs.

According to *investor sentiment theory* and the *market timing hypothesis*, a stock index reflects investor sentiments, which affects the costs of issuing equity, causing IPO volume to fluctuate over time. Firms issue equity as stock prices increase. During these periods, the costs of going public are especially low. Consequently, a large number of firms find it optimal to go public. In contrast, during periods of low investor sentiment, investors may undervalue firms, reducing the number of IPOs. Previous studies (see, e.g., Loughran et al., 1994; Rees, 1997; Pagano, Panette, & Zingales, 1998) have found a significant positive influence of stock index on IPO volume (Rydqvist & Hogholm, 1995); thus, in light of these studies, we hypothesise as follows:

H5: There is a positive relationship between stock market index and the number of IPOs.

DATA

The data consists of all Malaysian IPOs during the period January 1990 to December 2008. The IPO data were obtained from Bursa Malaysia. Macroeconomic data such as interest rate (*INTR*) and industrial production (*Ind*-Pr) were obtained from Bank Negara Malaysia. The data on foreign net private equity flows (*FN_Equity*) and total outstanding bank credit to the private sector (*CREDIT*) were obtained from IMF International Financial Statistics.

The main time series indicators of IPOs include the following: the number of IPOs per month, denoted by *N_IPO*; the total number of IPOs per year, denoted by *T_IPO*; and the duration of an IPO, denoted by *D_IPO*, which is defined as the total number of days between the date of an IPO's prospectus and its listing date and provides useful information about the quality of IPO application. According to Guo et al. (2010), the duration time indicates an IPO's hazard of listing. IPO performance indicators are average initial-day returns of all IPOs (denoted by *IPO_Return*) and excess initial-day returns (denoted by *Abn_IPO Return*), which are calculated as the difference between *IPO-Return* and the return on the KLCI Composite index (denoted by *R_KLCI*).

Preliminary Findings

Table 1 shows the descriptive statistics of IPOs' time series and performance indicators. We find that the mean (median) *N_IPO* was 3.80 (3.00) and that *T_IPO* was 45.68 (39). *T_IPO* was lowest in 2008 and highest in 1996. The mean (median) *D_IPO* was 35 days (40 days), which implies that an applicant issuer had to wait more than one month from issuing an IPO prospectus before listing on the Kuala Lumpur Stock Exchange. Mean (median) *IPO_ Returns* were 64.6% (38.9%), and *Abn_IPO Returns* were 63.33% (37.53%). The average interest rate was 7% and reached its peak level of 12% during 1998–1999. The high standard deviation of *CREDIT* was due to the fact that there was a gradual increase of

2–4% in *CREDIT* annually until 2004; however, after 2004, *CREDIT* increased almost threefold from its lowest level in mid-1998. The median *FN_Equity* was negative. The Malaysian government imposed capital controls in 1998; consequently, foreign portfolio investment significantly decelerated. The data show a reversal in the *FN_Equity* downward trend from 2004 onwards.

The annual time series of *N_IPO*, *T_IPO*, *D_IPO*, and *IPO_ Returns* are summarised in Panel B. The mean *IPO_Returns* were at their highest levels from 1993 to 1996. A total of 221 IPOs were listed during this time period. After the Asian financial crisis in 1997, there was a remarkable slowdown in the performance of IPOs. *IPO_Returns* decreased more than the mean (median) returns for the entire period. Even though *N_IPO* increased from 20 in 2001 to 78 in 2005, *IPO_Returns* dropped to their lowest levels. Prior to the Asian financial crisis, no IPO had experienced negative returns. We find that some IPOs had negative initial day returns during the Asian financial crisis, and these IPOs were clustered in 1997–1998, 2001–2002, 2004–2005 and the middle half of 2008. This finding may also be related to market sentiments, as the KLCI Index and trading volumes fell sharply during 1997–1998 and 2001–2002. It is plausible that investors were less exuberant about the prospect of investing in new technology firms[8] after the technology bubble burst in the developed markets.

Figure 1 depicts the trend and movement of *N_IPO* and the nominal interest rate (a), *N_IPO* and lagged *IPO_Returns* (b), and *D_IPO* and *IPO_Returns* (c). There are two striking features of this graph (see a): the trends in *N_IPO* and the interest rate are cyclical, and their movements seem to display a non-monotonic relationship. The interest rate shows a downward trend from January 2000 onwards; it remained between 6% and 7%, but there was no sharp increase in *N_IPO* (except during 2004–2006). The trend and movement of *N_IPO* and *IPO_Returns* show a direct relationship between the two (see b). The rise in the average level of underpricing from mid-1993 until mid-1997 increased *N_IPOs.* We observed two distinct patterns of relationship between *D_IPO* and *IPO_Return* (see c). In the first phase, the research finds that when IPOs had to wait more than one month to be listed during 1991–1996 (mean *D_IPO* was 40 days), *IPO_Return* (underpricing) was higher until mid-1997. In the aftermath of the Asian financial crisis (February-July 1998), when *D_IPO* exceeded more than 60 days, *IPO_Return* (underpricing) is decreased substantially. In the second phase (2003–2008), when the average *D_IPO* decreased to approximately one month (mean *D_IPO* was 25 days), *IPO_Return* (underpricing) also decreased substantially. These patterns illustrate that when investors have less information about the quality of the issuer and have to wait longer for an IPO listing, greater information asymmetry and adverse selection drives *IPO_Return* (underpricing) high and vice versa.

Table 1
Descriptive statistics

Panel A

	Mean	Median	Std	Min	Max
IPO Activity indicators:					
N_IPO (per month)	3.80	3.00	2.94	0.00	13.00
T_IPO (per year)	45.68	39.00	21.33	19	84
D_IPO (days)	35.62	39.93	15.06	0.00	73.66
IPO performance indicators:					
IPO _Return (%)	64.60	38.87	78.82	–290.40	385.00
Abn _ IPO Return (%)	63.33	37.53	82.49	–282.09	399.10
Market performance indicators:					
R_KLCI (%)	0.46	0.50	7.80	–24.67	34.23
Macroeconomic indicators:					
INTR (%)	7.36	6.75	1.2819	6.00	12.10
CREDIT (RM Bill)	300.64	287.73	177.888	68.60	718.70
*Ind*_Pr	116.67	110.55	26.5373	70.47	167.80
FN–Equity (RM Bill)	1.5392	–0.8479	21.7082	–70.2752	32.965

Panel B

IPO Years	*T_IPO* (per year)	*D_IPO* (days)	*IPO _Return* (%)	*N_IPO* Negative Returns (%)
1990	30	43	54.41	0
1991	37	41	38.44	1
1992	46	46	44.20	2
1993	34	46	105.13	0
1994	59	39	116.32	0
1995	44	41	86.36	0
1996	83	41	182.26	0
1997	84	42	99.27	15
1998	28	42	4.11	8
1999	20	26	31.08	1
2000	38	35	60.77	2
2001	20	38	18.48	10
2002	51	39	18.40	12
2003	58	33	43.35	6
2004	72	24	41.12	12
2005	78	25	21.36	20
2006	39	26	25.17	7
2007	28	21	33.40	3
2008	19	20	-4.19	12

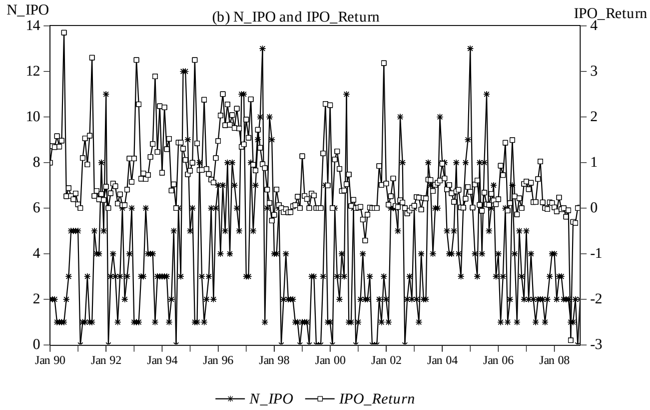


Figure 1: *(Continued)*

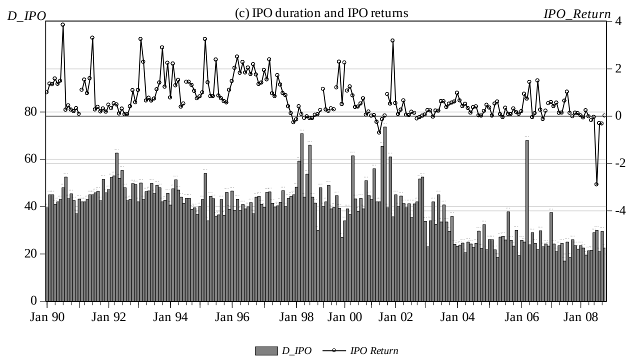


Figure 1. Number of IPO, interest rate, IPO returns and duration 1990M01 to 2008M12.

RESULTS

Linear Regression Results

Before estimating regression, the presence of unit roots in the IPOs' time series and performance indicators using the Augmented Dickey-Fuller (ADF) test (with trend and intercept) are verified. Under this test, the null hypothesis is that a time series variable has a unit root or is not stationary. Natural logarithm transformation has been used and tested for the presence of unit roots in the time series levels and their first differences. The results show that the null hypothesis of unit roots in the log difference time series is rejected for all variables. Thus, these variables are integrated of order 1.

Table 2
Augmented Dickey Fuller tests

This table report the results of Augmented Dickey Fuller test in the log levels and the log differences of the time series variables: *N-IPO*, number of IPOs per month; *R_KLCI*, return on KLCI index; *CREDIT*, outstanding bank credit to private sector; *Ind*-Pr, industrial production index, and *INTR* base lending interest rate.

Variables	Log levels	Log difference
N_IPO	–3.0923	-7.1410^{***}
R_KLCI	–2.2025	-4.3212^{***}
CREDIT	–1.8219	-5.1758^{***}
Ind_Pr	–1.8660	-6.8443^{***}
INTR	–2.4384	-7.7122^{***}

***, **, * denotes significance level at 1%, 5% and 10%

The Tobit model is used to investigate the relationship between macroeconomics and the number of IPOs. Because there were 16 months without any IPOs, our sample becomes a censored sample, and the Tobit model (also known as the censored regression model) is appropriate in such circumstances. This research used the maximum likelihood method to estimate the parameters of the linear regression model:

$$\begin{aligned} N\_IPO_t = {} & \alpha_0 + \alpha_1 INT_t + \alpha_2 FN\_Equity_t + \alpha_3 KLCI_t + \alpha_4 R\_KLCI_t + \alpha_5 Ind\_\mathrm{Pr}_t + \\ & \alpha_6 CREDIT_t + \alpha_7 INT\_C_t + \alpha_8 EXG\_C_t + e_t \end{aligned} \tag{1}$$

For month *t*, *N_IPO* is the number of IPOs. *INT* is the nominal interest rate (base lending rate); *FN_Equity* is the total net private foreign equity investment; *KLCI* denotes the KLCI 100 Composite Index; and R_KLCI_t is the return on the KLCI Composite Index. *Ind*_Pr is the monthly industrial product index. $CREDIT_t$ is the total bank credit to the private sector. The following three dummy variables are also been used. *INT-C* is equal to 1 for the period 1998–2008, and otherwise 0; it indicates changes in Bank Negara Malaysia policy to adjust base lending rates to its overnight intervention rate instead of a 3-month inter-bank rate. *EXG-C* is equal to 1 for the period 1998–2001 and otherwise 0, denoting the imposition of capital controls from September 1998 to May 2001. *AFC* is equal to 1 for the period July 1997 to September 1998, and otherwise 0, denoting the Asian financial crisis period. The residual error term, e_t, is N (0, σ^2) distributed.

This table reports the Tobit regression results using Equation (1):

$$N\_IPO_t = \alpha_0 + \alpha_1 INT_t + \alpha_2 FN\_Equity_t + \alpha_3 KLCI_t + \alpha_4 R\_KLCI_t + \alpha_5 Ind\_\mathrm{Pr}_t + \alpha_6 CREDIT_t + \alpha_7 INT\_C_t + \alpha_8 EXG\_C_t + e_t \quad (1)$$

The dependent variable N_IPO_t is total number of IPOs per month in a year. INT_t is interest rate; FN_Equity_t is total net private foreign equity investment; $KLCI_t$ denotes KLCI 100 Composite index. *R_KLCI*, return on KLCI index; *Ind*_Pr is the monthly industrial product index; $CREDIT_t$ is the total bank credit to private sector. *INT_C* is equal to 1 for the period 1998–2008, and otherwise 0, denoting change in Bank Negara Policy to adjust base lending rate to its overnight intervention rate instead of the 3-month inter-bank rate; *EXG_C* is equal to 1 for the period 1998–2001 and otherwise 0, denoting the imposition of capital controls from September 1998 to May 2001, and *AFC* is equal to 1 for the period July 1997 to September 1998, and otherwise 0, denoting the Asian financial crisis period. e_t is residual error term is N (0, σ^2) distributed. The total number of IPOs is 870 from January 1990 to December 2008, and when the numbers of IPOs in each month are summed it results in 228 monthly observations used in estimation. The maximum likelihood estimates are obtained using the Newton Raphson method. The standard errors are Huber/White reported in the parentheses.

Table 3
Tobit regression results

Variables	Expected sign	Estimates	Impact of one std. dev. change (%)
Constant		6.5498*** (2.2229)	–
INTR	(–)	–0.6927*** (0.2402)	6.7
FN_Equity	(+)	0.0022 (0.0232)	0.01
KLCI	(+)	0.0003 (0.0011)	39.02
Ind_Pr	(+)	0.0298*** (0.0090)	39.84
CREDIT	(–)	0.0321 (0.0122)	3.45
INT_C	(–)	–1.3506*** (0.5285)	
EXC_G	(–)	–2.2677*** (0.6037)	
AFC	(–)	–0.7922 (0.4851)	
Log likelihood		–533.7727	
Left censored obs.		17	
Uncensored obs.		211	

***, **, * denotes significance level at 1%, 5% and 10%.

The Tobit regression results show a significant negative relationship between the interest rate and *N_IPO* at a 5% level of significance. H_1 is supported. The impact of one standard deviation change in the interest rate produces a 7% change in the number of IPOs per month. No significant relationship between FN_Equity_t and *N_IPO* was found; thus, H_2 is not supported. There is a significant positive relationship between *KLCI* and *N_IPO*; thus, H_3 is supported. The impact of a one-standard-deviation change in KLCI produces a 39% increase in the number of IPOs per month. The results are similar to those of previous studies (see, e.g., Loughran et al., 1994; Rees, 1997), which have found a significantly positive influence of stock index on IPO volume in developed countries. There is a significant positive relationship between *Ind*-Pr and *N_IPO*; hence, H_5 is also supported. The impact of a one-standard-deviation change in industrial output produces a 39% increase in the number of IPOs per month.

The results also show that the imposition of capital controls from September 1998 to May 2001 and changes in the central bank policy for setting lending rates during 1998–2001 had a significant negative impact on the number of IPOs. These findings are supported by earlier empirical literature that has found a significant negative impact of capital controls on the Malaysian economy (see, e.g., Cook & Devereux, 2002).

Long-run Equilibrium Relationship between IPOs and Macroeconomic Variables

This research used Johansen's (1991) multivariate cointegration technique to establish a long-run equilibrium relationship between interest rate, industrial production, private credit and number of IPOs.[9] The trace test statistic of the null hypothesis that there are at most *r* cointegrating vectors and *n*-*r* common stochastic trends is calculated using

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n}\ln(1-\lambda_i)$$

A maximum eigenvalue test for the null hypothesis of *r* cointegrating vectors is as follows:

$$\lambda_{\max}(r, r+1) = -T\ln(1-\lambda_{r+1})$$

where λ are the *n*-*r* least-squared canonical correlations and *T* is the sample size. The results from trace tests show that there is one cointegration equation in the system, and maximum eigenvalue tests also report one cointegration equation (see Table 4). This finding implies that there exists a long-run equilibrium relationship between *INTR*, *Ind*-Pr, *CREDIT* and *N_IPO* in Malaysia.

The table reports the results of Johansen conintegration test. The unrestricted cointegration rank tests assume a linear deterministic trend (constant but no trend in conintegration equations). The number of lags (in first differences) are 1 to 2.

Table 4
Multivariate cointegration tests

Panel A: Trace test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	*P-value***
None *	0.1716	56.2473	47.8561	0.0060
At most 1	0.1016	25.6151	29.7970	0.1406
At most 2	0.0264	5.9809	15.4947	0.6066
At most 3	0.0092	1.5357	3.8414	0.8651

Trace test indicates 1 cointegrating equations at the 5 % level

Panel B: Maximum eigenvalue test

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	*P-value***
None *	0.1617	31.0532	27.5834	0.0172
At most 1	0.1016	18.5684	21.1316	0.1009
At most 2	0.0489	6.7236	14.2646	0.5223
At most 3	0.0041	0.0288	3.8414	0.8651

Max-eigenvalue test indicates 1 cointegrating equation at the 5% level
* denotes rejection of the hypothesis at the 5% level
**MacKinnon-Haug-Michelis (1999) *p*-values

The dynamic relationship between the macroeconomic variables and IPOs using Vector Error Correction (VEC) methodology were also been examined to infer fluctuation and adjustments in the number of IPOs in response to changes in the macroeconomic variables. VEC allows us to determine how much time the IPO market takes to adjust to its long-run equilibrium.[10] This research adopts the VEC approach in a similar way to Tran and Jeon (2011), but the choice of macroeconomic variables to apply VEC is altered. Let $Y_{t,\ i} \equiv (X_i, Mj)$, where X_i *is N_IPO* and M_j is the vector of the macroeconomic variables (*j=INTR*, *Ind*-Pr, *CREDIT*, *IPO_Returns*). If $Y_{t,\ i}$ is cointegrated, a VEC model is specified as follows:

$$\Delta Y_{t,i} = \alpha_i + \gamma_i \beta_i Y_{t-1,i} + \sum_{j=1}^{k} \Gamma_{j,i} \Delta Y_{t-j,i} + \varepsilon_{t,i} \tag{2}$$

where α is a constant vector representing a linear trend, and the matrix Γ reflects the short-run aspects of the relationship among the elements of $Y_{i,t}$. β represents the cointegrating vector, and γ is the error correction coefficient, which provides information on the speed of adjustment to the long-run equilibrium path, as in Tran and Jeon (2011). The coefficient of the error correction term is expected to have a negative sign in a range of $-1 < \gamma < 0$. Table 5 reports the estimated error correction coefficients (under various assumptions about the trend).

Table 5
VEC model estimation- error correction terms
This table reports the results from the VEC model estimation. The constant and error correction terms with associated *t*-statistics [in the square brackets] are reported. *P*-values of heteroskedasticity (Het.) test in the VEC residuals; LM test for serial correlation in the VEC residuals (up to lag 4) and Doornik-Hansen (DH) test of VEC model residuals are multivariate normal reported under Het.test, LM.test and DH.test respectively. ***, **, * denotes significance level at 1%, 5% and 10%.

	1	2
α	–0.0718	1.5326
	[–0.8955]	[0.3708]
γ	-0.1744^{***}	-0.1691^{***}
	[–2.5959]	[–2.3008]
Het. test	0.7183	0.7064
LM(1).test	0.6933	0.4648
LM(4).test	0.2945	0.2492
DH.test	0.0009^{***}	0.0354^{**}
Adj.R^2	0.3358	0.3373

Note: 1 shows that the VEC model has intercept but no trend in data (using 1-3 lags); 2 shows that VEC model has intercept and no trend in data (using 1-3 lags) and uses exogenous variables of *INTC, EXGC* and *AFC* in VEC specification.

The VEC results show that the interest rate and industrial production explain well over 30% of the variations in *N_IPO*. Furthermore, the estimation results show that the error coefficient term has an expected significant negative sign, i.e., –0.34 (1–3 lag specification) and -0.46 (1–4 lag specification). Various diagnostic tests on the residuals of the VEC model were applied to detect any significant homoskedasticity, autocorrelation and normality in the residuals. These tests include the Lagrange multiplier test (LM test) for autocorrelation in the residuals up to lag 4, the White heteroskedasticity test (Het. test) for testing deviation from homoskedasticity, and the Doornik-Hansen test (DH test) for testing multivariate normality of the residuals. The results of the diagnostic tests (*p-values*) show no autocorrelation (up to lag 4) or heteroskedasticity in the residuals. The error correction terms (see columns 1 and 2) imply that only approximately 16%–17% of disequilibrium in the number of IPOs in the time period $t - 1$ is completed in year t, which implies a very low adjustment. Using the estimated value α of the VEC model, it takes approximately 13 months to complete a halfway adjustment towards the long-run equilibrium number of IPOs.

MARKOV REGIME SWITCHING REGRESSION MODEL

The Markov regime switching regression model is defined in Equation (3).

$$N\_IPO_t = \alpha_t + \beta_{1,S_t} x_{1,t} + \beta_{2,S_t} x_{2,t} + \beta_3 x_{3t} + \varepsilon_t \tag{3}$$
$$\varepsilon_t : N(0, \sigma^2_{S_t})$$

where *N_IPO* denotes the total number of IPOs per month, and x_1 denotes *INTR*, x_2, *IPO_Return* and x_3, *Ind*_Pr. $\beta_{1,s}$ and $\beta_{2,s}$ are the switching parameters. The variable x_3 does not change state; therefore, β_3 is a non-switching parameter. S_t, denotes the state at time t, $S_t = 1....K$ (we use $s = 2$). $\sigma^2_{S_t}$ is the error variance of the regime switching variable in state S_t., In Equation (3), the interest rate and *IPO_Return* cause the number of IPOs to change from state s_1 to state s_2, $\sigma^2_{S1_t}$ tracks the variance of *INTR* from one state to another and $\sigma^2_{S2_t}$ tracks the variance of *IPO_Return* from one state to another. ε_t is the residual vector that follows a normal distribution.

$p = \begin{bmatrix} p_{11} & p_{21} \\ p_{21} & p_{22} \end{bmatrix}$ is a transition matrix that controls the probability of a switch from state j (column j) to state i (column i). The sum of each column in p is equal to one, as they represent full probabilities of the process of each state. The logic of Equation (3) is as follows: the number of IPOs per month shifts between two regimes, i.e., a cold regime ($s = 1$) and a hot regime ($s = 2$). The regime is unobserved. The transition from one state to another is governed by a first order Markov process. The model in Equation (3) also estimates two probabilities: (1) the probability of remaining in a "cold" regime when the IPO market is currently in a cold regime p_{11} and (2) the probability of remaining in a "hot" regime when the IPO market is currently in a hot regime p_{22}. The model also provides 'regime switching' probabilities, which are of interest to this paper, such as the probability of moving from a "cold" IPO regime to a "hot" IPO regime, denoted by p_{12}, and from a "hot" IPO regime to a "cold" IPO regime, denoted by p_{21}.

The usefulness of the nominal interest rate and *IPO_Return* in explaining the regime switching behaviour of *N_IPO* are tested. Thus, in the base case of Equation (3.1), regime switching depends only on the *nominal interest rate*, and the coefficient $\beta_{1,1}$ denotes the coefficient of interest rate in regime *s* = 1 and $\beta_{1,2}$ for regime *s* = 2, such that

For $s_{t=1}$, $N\_IPO_t = \beta_{1,1} INTR_t + \beta_2 IPO\_\mathrm{Re}turns_t + \beta_3 Ind\_\mathrm{Pr}_t + \varepsilon_t$ (3.1)

$\varepsilon_t : N(0,\sigma_1^2)$

For $s_{t=2}$, $N\_IPO_t = \beta_{1,2} INTR_{,t} + \beta_2 IPO\_\mathrm{Re}turns_t + \beta_3 Ind\_\mathrm{Pr}_t + \varepsilon_t$

$\varepsilon_t : N(0,\sigma_2^2)$

$(\beta_{1,1};\sigma_1^2 \neq \beta_{1,2};\sigma_2^2)$

In the second experiment (Equation (3.2)), regime switching to depend only on *IPO-Returns* is allowed.

For $s_{t=1}$, $N\_IPO_t = \beta_{1,1} IPO\_\mathrm{Re}turn_t + \beta_2 INTR_t + \beta_3 Ind\_\mathrm{Pr}_t + \upsilon_t$ (3.2)

$\upsilon_t : N(0,\sigma_1^2)$

For $s_{t=2}$, $N\_IPO_t = \beta_{1,2} IPO\_\mathrm{Re}turn_{,t} + \beta_2 INTR_t + \beta_3 Ind\_\mathrm{Pr}_t + \upsilon_t$

$\upsilon_t : N(0,\sigma_2^2)$

$(\beta_{1,1};\sigma_1^2 \neq \beta_{1,2};\sigma_2^2)$

In the third case, both the *nominal interest rate* and *IPO-Returns* variables to shift regimes are allowed, as shown by the coefficients $\beta_{1,1}, \beta_{1,2}, \beta_{1,2}, \beta_{22}$. This specification is allowed to examine the impact of *interest rate* and *IPO-Returns* on the number of IPOs.

For $s_{t=1}$, $N\_IPO_t = \beta_{1,1} INTR_t + \beta_{2,1} IPO\_\mathrm{Re}turns_t + \beta_3 Ind\_\mathrm{Pr}_t + \varepsilon_t$ (3.3)

$$\varepsilon_t : N(0, \sigma_1^2)$$

For $s_{t=2,}$ $N\_IPO_t = \beta_{1,2} INTR_{,t} + \beta_{2,2} IPO\_\mathrm{Re}turns_t + \beta_3 Ind\_\mathrm{Pr}_t + \varepsilon_t$

$$\varepsilon_t : N(0, \sigma_2^2)$$

$$(\beta_{1,1}, \beta_{1,2}; \sigma_1^2 \neq \beta_{1,2}, \beta_{22}; \sigma_2^2)$$

From Equation (3.3), cold and hot IPO regimes can be detected as a consequence of the changes in both variables (instead of one variable as in Equation (3.2)).

Markov Regime Switching Regression Estimation Results

Table 6 shows the Markov regime switching regression results. The estimated parameter $\beta_{1,1}$ from Equation (3.1) implies that *N_IPO* decreased significantly due to higher *INTR*. The duration of the regime was 9 months, while $\beta_{1,2}$ implies a significant increase in the number of IPOs. This regime lasted 8.9 months. These results indicate that the time durations of hot and cold IPO regimes are nearly similar, and hot IPO regimes are less volatile than cold IPO regimes in Malaysia. The probability of switching from a cold regime to a hot regime is 11%, and the probability of switching from a hot regime to a cold regime is 10%. The standard deviation of the model shows that both regimes have higher volatilities, but the first regime is more volatile than the second regime.

In Equation (3.2), we used initial IPO returns (underpricing) as a switching variable; the estimated parameter $\beta_{1,1}$ shows that *IPO-Returns* (initial IPO undervaluation) have a negative effect on *N_IPO*; however, subsequent *IPO-Returns* have a positive impact on subsequent *N_IPO*, as indicated by the positive sign of $\beta_{1,2}$.

This result seems to suggest that the impact of the initial IPO returns on *N_IPO* in cold and hot markets also exists for emerging markets such as Malaysia, which is similar to the results for developed countries reported elsewhere. Interestingly, the duration of hot IPO regimes extends longer than the duration previously estimated in Equation (3.1), and there is a reduction in cold IPO regimes to only 3.96 months. It can be argued that, as hot IPO regimes evolve, issuers learn of investors' herding instincts and try to induce investors by offering shares at lower prices. In emerging markets, attracting foreign investors through IPOs has helped these countries to stimulate and develop their infrastructure for secondary markets; thus, it can be argued that price discovery from the secondary market invigorated the primary market.

Table 6

Markov regime switching regression results

For $s_{t=1}$, $N\_IPO_t = \beta_{1,1}INTR_t + \beta_2 IPO\_Returns_t + \beta_3 Ind\_Pr_t + \varepsilon_t$ $\varepsilon_t : N(0, \sigma_1^2)$

For $s_{t=2}$, $N\_IPO_t = \beta_{1,2}INTR_{,t} + \beta_2 IPO\_Returns_t + \beta_3 Ind\_Pr_t + \varepsilon_t$ $\varepsilon_t : N(0, \sigma_2^2)$ (3.1)

For $s_{t=1}$, $N\_IPO_t = \beta_{1,1}IPO\_Returns_t + \beta_2 INTR_t + \beta_3 Ind\_Pr_t + \varepsilon_t$ $\upsilon_t : N(0, \sigma_1^2)$

For $s_{t=2}$, $N\_IPO_t = \beta_{1,2}IPO\_Returns_{,t} + \beta_2 INTR_t + \beta_3 Ind\_Pr_t + \varepsilon_t$ $\upsilon_t : N(0, \sigma_2^2)$ (3.2)

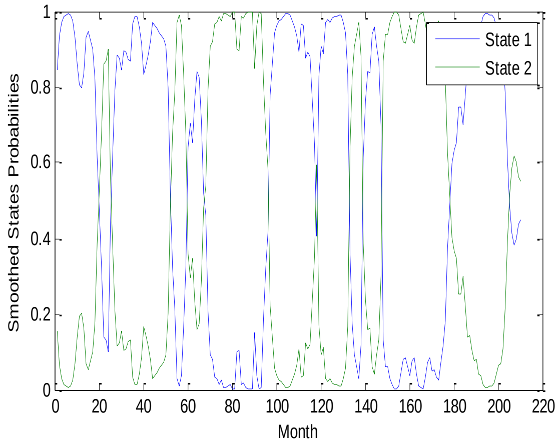
For $s_{t=1}$, $N\_IPO_t = \beta_{1,1}INTR_t + \beta_{2,1}IPO\_Returns_t + \beta_3 Ind\_Pr_t + \varepsilon_t$ $\varepsilon_t : N(0, \sigma_1^2)$

For $s_{t=2}$, $N\_IPO_t = \beta_{1,2}INTR_{,t} + \beta_{2,2}IPO\_Returns_t + \beta_3 Ind\_Pr_t + \varepsilon_t$ $\varepsilon_t : N(0, \sigma_2^2)$ (3.3)

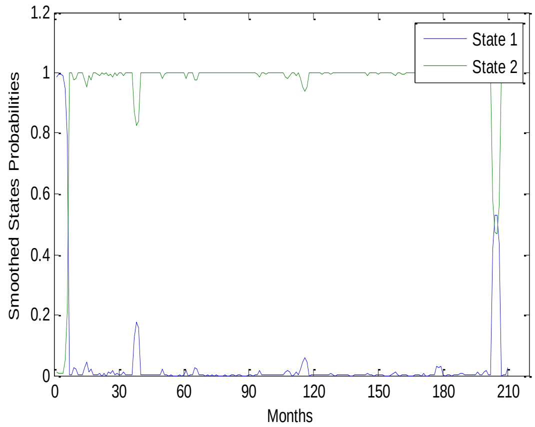
	Switching parameter				*Non–switching parameter*		Probabilities				Standard deviation of model		Log likelihood
	$\beta_{1,1}$	$\beta_{1,2}$	$\beta_{2,1}$	$\beta_{2,2}$	β_2	β_3	P_{11}	P_{12}	P_{21}	P_{22}	σ_1	σ_2	
Eq (3.1)	–0.4047*	0.4670*	–	–	4.0575*	0.0583	0.89*	0.11**	0.10**	0.90***	2.9087***	2.8976***	–504.8879
	(0.2140)	(0.1942)			(0.0720)	(0.2452)	(0.13)	(0.05)	(0.04)	(0.08)	(1.0546)	(0.2163)	
Duration	Cold	9.38											
months	Hot	9.73											
Eq (3.2)	–1.6798***	0.0779	–	–	2.3832***	0.3550***	0.75***	0.25	0.01	0.99**	0.4110***	2.5023***	–522.9227
	(0.2761)	(0.0624)			(0.1128)	(0.0559)	(0.25)	(0.28)	(0.01)	(0.07)	0.1075)	(0.2504)	
Duration	Cold	3.96											
months	Hot	157.67											
Eq (3.3)	0.2488***	0.6532***	0.0250	1.4081	–	4.2526*	0.94*	0.06	0.16	0.84	2.9195***	2.8822***	–488.7236
	(0.0862)	(0.1979)	(0.5288)	(1.7267)		(0.7204)	(0.13)	(0.06)	(0.16)	(0.22)	(0.4847)	(0.3874)	
Duration	Cold	15.82											
months	Hot	6.40											

The dependent variable is *N_IPO* the number of IPOs per month. *INTR* is interest rate, *IPO_Returns* is the IPO return; *Ind_Pr* is monthly production index. The covariance matrix is robust to Heteroskedasticity of unknown form. The standard errors are reported in the parentheses. The duration of a regime *S* is calculated using $(1/1-P_{jj})$ where j=1, 2

Finally, the joint influence of the nominal interest rate and initial IPO returns on *N_IPO* in Equation (3.3) are estimated. The impact of *INTR* is higher than the impact of *IPO_Returns* on *N_IPO*. The estimation results show that *IPO_Returns* do not have a significant impact on *N_IPO* in either of the two regimes. These findings distinguish the parallel effects of local macroeconomic variables on *N_IPO*, which has not yet been empirically tested in the IPO literature. *Ind_*Pr has a significant impact on *N_IPO*. The durations of hot IPO regimes extend longer than previously estimated in Equation (3.1), and there is a reduction in cold IPO regimes.

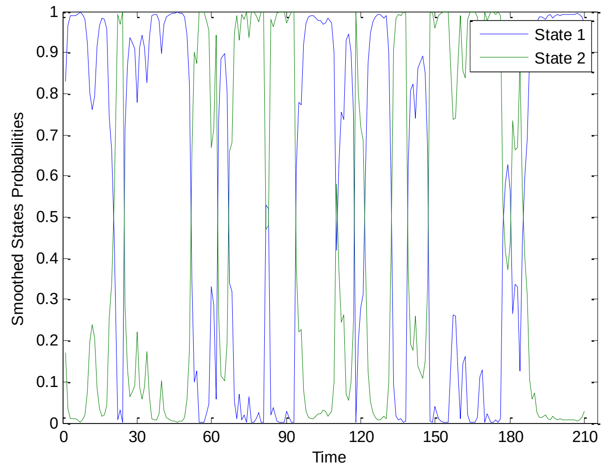


(a) Equation 3.1



(b) Equation 3.2

Figure 2. (continued)



(c) Equation 3.3

Figure 2. Smooth states probabilities estimates for *N_IPO*

Figure 2 shows the smooth filtered probabilities of Markovian states obtained from estimations of Equations (3.1), (3.2) and (3.3). The filter provides inferences about the probabilities of the IPO market in either cold or hot regimes. These probabilities show dynamic links between local macroeconomic variables, such as *INTR* and *IPO_Returns*, and fluctuations in *N_IPO*. In general, it is apparent that interest rate changes produced wider swings in the probabilities of IPO market regime shifts than in initial underpricing.

The probability curves obtained from Equation (3.1) (see a) show that the number of IPOs was higher in the earlier 1990s, a period associated with a hot regime, and then decreased after the Asian financial crisis. The probability curves obtained from Equation. (3.2) (see b) show that only at the beginning of the sample period is there evidence to suggest that changes in *IPO_Returns* resulted in sudden hikes in *N_IPO*; however, the curve then remains flatter for most of the time period before showing another hike at the end of the sample period. Thus, it is evident that *INTR* is more helpful in determining the timings of regime shifts, highlighting the importance of this variable. There are two turning points each for hot and cold IPO regimes. From 1993 to 1996, the nominal interest rate was in the range of 8–9%, compared to its lowest level of 6% in the early 1990s; consequently, the number of IPOs per month increased, as shown by our estimated hot period that lasted from

May 1992 to June 1994. Finally, State 1 and State 2's smoothed probability curves obtained from Equation (3.3) reveal that when the two variables, interest rates and initial returns, are jointly tested for influence on IPO regime shifts, both variables exert far more influence on *N_IPO* than they do individually in cold regimes compared to hot regimes (see c).

From an empirical perspective, these findings are of interest to managers, investors, regulators and policymakers in emerging markets. Knowledge about IPO market regimes (hot and cold) is useful for managers. From the new and seasoned equity offerings perspective, when managers are able to gauge IPO market conditions in terms of demand for new securities, they may issue new equity securities. For investors, IPO market conditions may guide them in trade-offs and outcomes expected from their strategic investment allocations in the IPO market.

CONCLUSIONS

This paper examines the impact of local macroeconomic variables on IPOs in Malaysia. The results show that the nominal interest rate, industrial production and initial IPO returns have significant impacts on the number of IPOs. Furthermore, results from trace tests and maximum eigenvalue tests confirm that there exists a long-run equilibrium relationship between the interest rate, industrial production, private bank credit and the number of IPOs. Though the results show that interest rates have a stronger relationship than other variables in a linear regression model, using the Markov regime switching regression approach, we are able to detect that they have a significant influence on the number of IPOs, particularly during hot IPO market regimes. The results also confirm that "hot" and "cold" regimes exist in Malaysia and are affected by changes in the interest rate. There is a 5% probability of switching out of a cold IPO regime to a hot IPO regime due to changes in the interest rate. The results imply that monetary policy has a direct impact on capital markets and that central bank intervention propagates IPO cycles in Malaysia. This study has data limitations. The impact of GDP, private consumption, and employment on IPOs could not been tested. Thus, the empirical findings may not provide a complete picture of macroeconomic influences on the IPO market. It is plausible that monetary policy affects IPOs through another channel, i.e., consumer loans to finance the purchase of new shares in IPOs, which could be explored in future research.

NOTES

1. From 1999 to 2005, the ratio of total stock market capitalisation to GDP increased from 50% to 131%, and the ratio of total value traded to GDP increased from 18% to 67% (Source: World Federation of Exchanges, 2010). The number of new listings increased from 271 in 1991 to 978 in 2008.
2. Paudyal et al. (1998) report that underwriters' reputation, over-subscription, market volatility and proportion of shares sold are important factors in determining IPOs' long-term performance. Ameer (2007) also reports the impact of interest rate, market returns and inflation rates on aggregate equity and bond issuance in Malaysia.
3. They include balance of trade, consumer credit, Consumer Price Index (CPI), employment, home sales, money supply, real GNP per capita, and private consumption. Monthly data are not available for these variables.
4. Guo et al. (2010) used the Markov regime switching technique for IPOs in Hong Kong. Markov models are ideal for capturing differences between population distributions and sample realisations because the estimation method permits the implied probabilities of drawing regimes to be inferred endogenously.
5. Some empirical studies have established that the effect of interest rates on conditional returns is larger in a volatile regime than in a stable regime (see Chen, 2007).
6. Until the imposition of capital controls in September 1998, Malaysia's capital account had been mostly liberalised. Ghazali et al. (2007) report a significant relationship between financial openness and stock market development in Malaysia.
7. Base lending rate was introduced in 1995, at which time it was linked to the weighted average of the 3-month interbank rate. In 1998, the base lending rate was linked to the 3-month Bank Negara intervention rate instead of the 3-month interbank rate (Bank Negara Malaysia, 1999).
8. During 2004–2008, most IPOs came from the MESDAQ market, which hosted new technology companies.
9. The choice of lag length in the cointegration analysis was decided using Akaike Information Criterion (AIC) and Schwartz Information Criterion.
10. The time required for a halfway adjustment is obtained using $\ln(1 - 0.5)/\ln(1 - \alpha)$, where α is the error correction coefficient in the VEC model.

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