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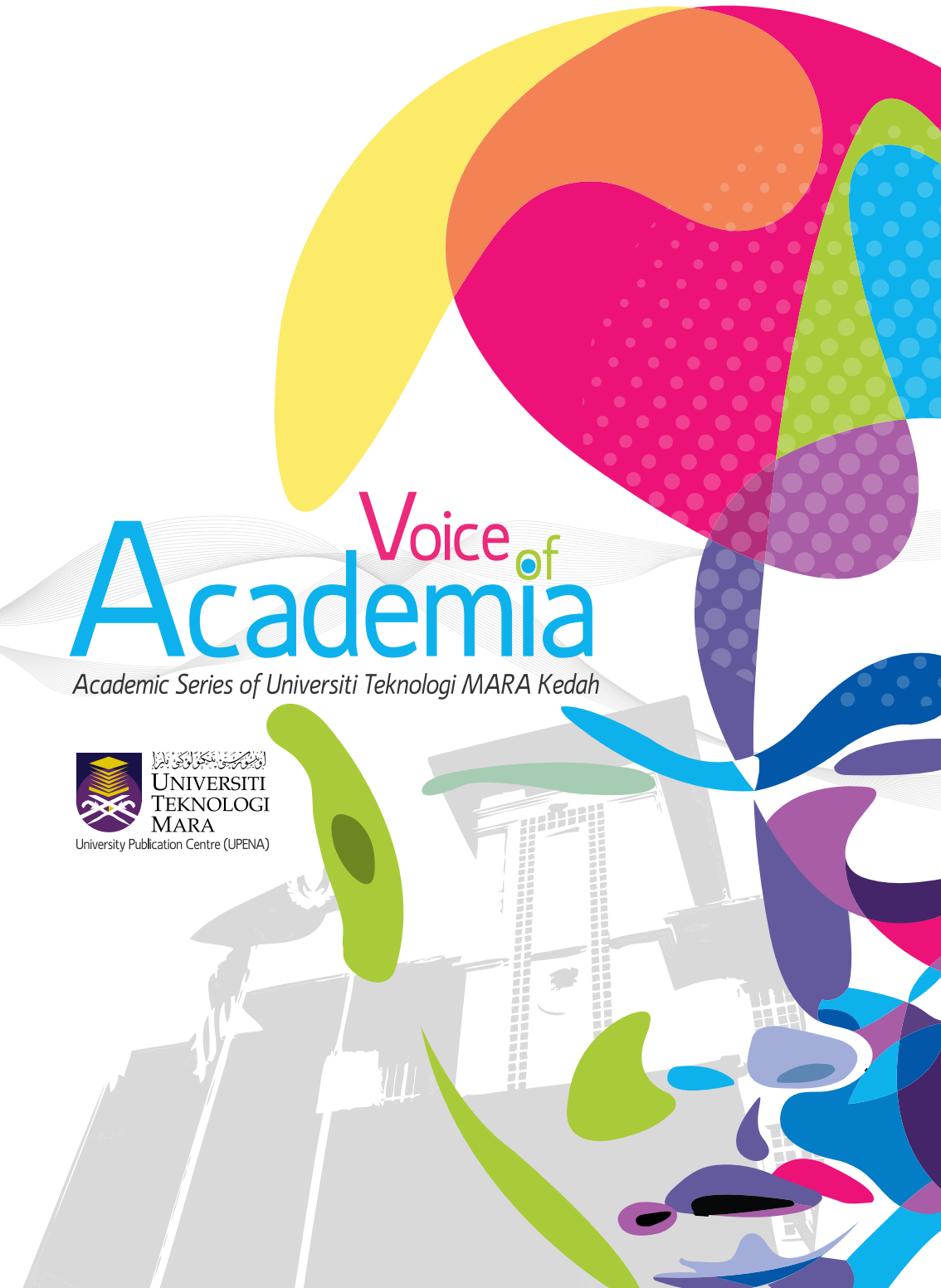

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Barisan Nasional di Ruang Maya: Isu-isu Berbangkit di Facebook Menjelang Pilihanraya Umum ke - 13	*Badrul Azmier Mohamed@ Bakar* *Azni Syafena Andin Salamat* *Mujibu Abd. Muis* *Mahazril 'Aini Yaacob* *Nur Zafifa Kamarunzaman* *Zaliha Hj. Hussin*
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Voice of Academia
Academic Series of Universiti Teknologi MARA Kedah

CONTENTS **PAGE**

Economics, Business & Finance

Warranty and its Effect towards Customer Satisfaction in Malaysia's Electronic Industry 1

Stock Market Volatility and Exchange Rate Regime in Malaysia : A Preliminary Analysis 17

Product Quality Dimension Ranking: The Preference of National Motorcycle Brand Customers 31

Exploring Young Consumers' Purchase Intention towards Foreign Brands 39

Penyesuaian Semula Repatriat untuk Kembali Bekerja di Tanah Air 57

Law

The position of a Child Offender under the Laws of Preventive Detention in Malaysia 83

Surrogate Mother Makes Money by Making Baby: Do We Need a Clear Law on this? 95

Prosedur Perbicaraan Kes Jenayah Kanak-kanak di Mahkamah Tinggi 109

Education

Combating Plagiarism in the Classroom 125

Development of New Curriculum for Bachelor's Degree in Sustainable Design 135

Revisiting Thinking Curriculum 153

Hubungan antara Tahap Komitmen Guru Terhadap Organisasi dan Gaya Kepimpinan Guru Besar 161

Others

Design Through Research: Handpicking Tools Case Study as Facilitator to Collaborative Product Development 181

Barisan Nasional di Ruang Maya: Isu-isu Berbangkit di Facebook Menjelang Pilihanraya Umum ke - 13 191

Ibn Al-Athir Al-Jazari dan Sumbangannya dalam Ilmu Gharib Al-Hadith 205

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Academic Series of Universiti Teknologi MARA Kedah

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Stock Market Volatility and Exchange Rate Regime in Malaysia: A Preliminary Analysis

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ABSTRACT

The choice of exchange rate regime and its possible impact on economic performance has recently become a new area of interest amongst both economists and policy makers. The study on the impact of exchange rate regime on financial performance, however, is relatively scarce, partly due to theoretical ambiguity and the definition of financial performance itself. Hence, this study intends to fill this gap by focusing on the stock return volatility of selected stock return indices in Malaysia over different exchange rate regimes. Specifically, the objective of this paper is to examine the impact of exchange rate regime on selected stock market return volatility. We draw on GARCH(1,1) to capture volatility clustering phenomenon. Results suggest that stock return is less volatile during managed float for Trade and Services, Construction and Finance stock return indices only. The Plantation stock return index, on the other hand, exhibits more volatility during managed float period.

Keywords: Exchange rate regime, GARCH (1,1) Stock market volatility.

1. Introduction

The stock market and exchange rate regime are arguably, two new research interests in finance and economics. Since the groundbreaking work of Mundell (1961, 1963), a vast majority of work on exchange rate regime focused on the benefits of such regimes via both theoretical structure and empirical evidence (see inter alia Eichengreen, 1994; Tornell & Velasco, 1995,2000; Rizzo, 1998; Reinhart 2000; Wickham, 2002; Lin and Lee, 2002; Reinhart & Rogoff, 2004; Berger, 2006). The major concern today in the study of the choice of exchange rate regimes is how they affect growth and inflation in the light of massive capital inflows and outflows (Wagner, 2000). The role of 'hot money' as the new form of external disturbance has sparked the interest of both academicians and policymakers. In other words, the choice of exchange rate arrangement is not neutral to the overall macroeconomic behaviour. Historically, countries with high level of inflation tend to move towards a more flexible arrangement if the domestic policies were in conflict with peg arrangement. Similarly, massive capital movements also affect financial stability but this has not been exclusively explored empirically until the late 1990s (see for example, Chang &Velasco, 1998; Eichengreen & Hausmann, 1999).This indicates that the relationship between exchange rates and financial stability has become an important subject matter especially after a crisis. Furthermore, there are no studies that integrate the stock market volatility and the choice of exchange rate regime in Malaysia. Hence, this paper offers some preliminary evidences as to how the choice of exchange rate regime can affect the stock market return volatility. Nevertheless, Frankel (1999) cautioned that no single exchange rate regime would be appropriate for all countries at any one time. That is, the choice of exchange rate regime should be dictated by the needs of the countries.

In this paper, we do not delve into the theoretical arguments of the benefits and weakness of each regime. Instead, we empirically assess the impact of exchange rate regime on stock market returns. It is expected to add to the current literature on the choice of exchange regime with special focus on stock market volatility. Since the relationship between the financial sector and the choice of exchange rate regime is relatively under explored, this study intends to shed some light in this area. The next section briefly reviews related literature followed by an explanation of the research method and data. Results are discussed in the penultimate section. The final

section concludes.

2. Review of Literature

Throughout the 20th century, the exchange rate went through a full swing, from fixed exchange rate to floating, and then back to either of the two extremes and during the crisis period in the 1990s and early 2000, a more flexible exchange rate system once again became a more popular choice. In the 1960s, economists and policy makers in the developed countries were more inclined towards floating exchange rate in response to balance of payment deficit. This was especially true for the United States. The 1980s saw a high level of accumulated inflation in countries which floated their currencies, thus bringing the debate to a set of target exchange rate to enable the central banks to exercise monetary stabilization policies. Target zone, however, was abandoned after the ERM crisis in 1992. To avoid the two extremes choices, policymakers in the 1990s opted for intermediate regimes such as the adjustable peg, dirty floating, managed float until economic and financial crisis hit Mexico (1994-1995), East Asia (1997-1998), Russia (1998), Brazil (1999), Argentina (2002). The collapse of these economies serve as a warning against peg regimes, especially in emerging markets which are subjected to volatile capital flows. Since then, countries have begun to favour more flexible exchange rate arrangements. Given all the debates through the decades, the subject matter remains the same – which exchange rate arrangement is more appropriate for a country, given its economic conditions. In the case of Malaysia, this paper covers two distinct periods of exchange rate arrangements – managed floating and currency pegging. The next subsections briefly discuss these two arrangements.

2.1 Single Currency and Basket Pegging

Pegging comes in the form of single currency pegging or basket currency pegging. Since a single currency peg to the United States dollar (USD) may expose countries to speculative attacks, a basket peg is recommended. Under normal circumstances, a basket peg consists of currencies of major trading partners or currencies in which trade is being invoiced. Although most countries in the Asian region are officially managed float or pegged to an undisclosed basket of currencies, it is a well known fact that the USD is the dominant currency or a least incur a larger weight compared to other currencies in the basket. The rationale for a basket peg is to reduce fluctua-

tions in exports (Ogawa & Ito, 2002). An important point to note is the fact that major currencies also fluctuate amongst themselves and countries which trade with these countries or use their currencies to settle trade payment would inevitably be subjected to these fluctuations. Hence there have been suggestions to stabilize fluctuations among major currencies (for example, see Bergsten & Henning, 1996; McKinnon, 1963, 2005; Williamson, 2000).

2.2 Managed float

Managed float is again, another controversial issue. In the absence of a standard definition, managed float is often viewed as an attempt to influence the exchange rates. Fisher (2001) defined managed float as an intermediate regime which differs from certain types of pegged exchange rate regimes in the sense that the desired exchange rate level is not pre-announced. Siklos (2006) in his counterfactual analysis proposed three types of managed float. Type 1 is a regime with or without explicit exchange rate target and no constraint as to how much volatility is allowed around the target. This type of regime is akin to Calvo and Reihart's (2002) fear of floating syndrome. The second type is a regime which utilizes interest rates objective to indicate suitability to enter a monetary union and finally, a regime without specific exchange rate objective but the exchange rate is managed in the manner that tends towards achieving inflation objectives. Intermediate regimes may continue to be an option since authorities may want to manipulate the level of exchange rates, the volatility of exchange rates or even control the value of the country's currency with respect to other currencies. This involves intervention in the foreign exchange market and setting a certain band within which the exchange rate is allowed to fluctuate.

The essence of managed float plus lies in its inflation targeting and measures to reduce currency mismatching in the era of high private capital mobility. Originated from Goldstein (2002), the well structured idea was formed following a series of papers by the author. As indicated by its name, this regime allows monetary authorities to 'manage' exchange rates via foreign exchange market intervention from time to time to regulate excessive short term fluctuations. In addition, the authorities can use all sorts of policies to deal with short run exchange rate movements or to manage market liquidity. The exchange rate is 'floating' in the sense that exchange

rate is fundamentally determined by market forces. Thus, managed float in Goldstein's definition is a frequently managed exchange rate with no publicly pre-announced exchange rate target. In comparison with the traditional managed float, the 'plus' in this regime has two additional reinforcing characteristics of aggressive measures to reduce currency mismatching (also known as balance sheet vulnerability or international illiquidity) and monetary policy with an inflation targeting scheme.

Countries embark on inflation targeting in the belief that lower inflation begets faster growth rates in both real and financial sectors. Empirical evidence provides support that high inflation can impede financial development (Geske & Roll, 1983). Under the inflation targeting scheme, Goldstein (2002) features four primary elements. First, the primary objective is to attain low inflation and a numerical target is given. Secondly, the numerical target would be publicly announced along with the duration to achieve the target. Third is advocating central bank independence. Finally, executing transparency and accountability in the conduct of monetary policies whereby the public would be explicitly informed of the monetary objectives. To curb currency mismatching, Goldstein (2002) proposed several measures ranging from regulating net open positions of banks, developing and deepening the financial and capital market, designing new hedging mechanisms, prohibiting government borrowing in foreign currency, to publishing data on indicators of balance sheet mismatch. In the absence of measures to avert currency mismatching, 'fear of floating' will persist in emerging economies. Based on the empirical work of Hausmann et al. (1999), Goldstein (2002) concluded that for countries to exercise monetary policy independence and low inflation target, potential balance sheet crisis linked to large currency mismatched must be resolved first.

3. Research Method and Data

3.1 Modeling the stock market volatility

This study focuses on a small area of how the exchange rate regime may affect the stock market return volatility. Engle (1982) introduced the autoregressive conditional heteroscedasticity (ARCH) process to relax the assumption of constant variance. This breakthrough has indeed been extremely useful for stock market modeling as it mitigates the problem of time varying variances and covariances. The variance of the dependent

variable is modeled as a function of lagged squared errors. In the ARCH model, we need to consider two distinct specifications which are the conditional mean and the conditional variance. Later, Bollerslev (1986) extended this model into general ARCH (GARCH) to incorporate a more flexible lag structure, leptokurtic distribution in the series and to capture volatility clustering phenomenon which become immediately apparent when stock returns are plotted through time (Bollerslev et al, 1994). In addition, GARCH allows for long term memory in the variance of the conditional returns distribution which makes it an excellent model to mimic observed statistical analysis of many time series returns on financial assets and commodity assets. Also, GARCH (1,1,) has been proven to be statistically adequate to model non-constant variances (Bollerslev et. al, 1994). Nelson (1991) introduced exponential GARCH (EGARCH) to capture asymmetry, skewness and leverage effect of the stock market return.

Daily returns of the KLCI index is calculated using the following formula:

$$r_t = ln\ (P_t / P_{t-1})\ x\ 100$$

where P_t is the index at time t and P_{t-1} is the closing price for the previous day . The returns of all series are calculated as the logarithmic difference in the daily closing price. The conditional mean equation with an autoregressive process is modeled as below:

$$r_t = a_0 + a_1 r_1 + e_t \qquad (1)$$
$$e_t / I_{t-1} \sim n(0, h_t)$$

The conditional variance which depends on one lagged squared errors and one-lagged conditional variances are as follows:

$$h_t = \mu + \alpha e^2_{t-1} + \beta h_{t-1} \qquad (2)$$
$$\alpha > 0,\ \beta > 0$$

r_t in equation (1) is the return conditional on past information, which is proxied by r_{t-1}. μ, α and β are parameters to be estimated. I_{t-1} is the information set at time $t-1$, e_t is the stochastic error conditional on I_{t-1} and is assumed to be normally distributed with zero mean and conditional/time varying variance, ht. The ARCH term ($e2_{t-1}$) is the information from the previous period measured as the lag of squared residual from the mean

equation (1). The GARCH term (h_{t-1}) is the last period's forecast variance. For the variance process to be stationary, $\alpha + \beta$ should be less than unity. If $\alpha + \beta = 1$, the model is called integrated GARCH or IGARCH and if $\alpha + \beta < 1$, this implies that the model is weakly stationary GARCH or SGARCH.

The impact of exchange rate regime can be modeled using the following approach:

$$h_t = \mu + \alpha e^2_{t-1} + \beta h_{t-1} + \varphi D1 \qquad (3)$$

This model adds the dummy variable (D1) to the conditional variance equation. *D1* dummy takes the value of 1 during the managed float area which was pre- 2 September 1998 and zero for pegged regime between 2 September 1998 to 20 July 2005. From 21 July 2005, managed float system was reinstituted hence the dummy variable takes the value of 1. The aim of this test is to examine whether managed float regime has increased or decreased volatility in stock returns by looking at the implied volatility as represented by *D1*. If $\varphi \geq 0$, it is suggestive that stock return volatility increased during managed float regime.

3.2 Data

In this preliminary study, eight (8) stock market indices are studied to provide some indication as to how the choice of exchange rate regime may affect the volatility of stock returns. The commencement date, however, differs from one regime to another since the indices were introduced at different periods of time and also due to data availability from Datastream. Detailed description of the starting and end date is provided below.

Table 1: Start and end date for stock market indices

Indices	Starting Date	End Date
Kuala Lumpur Composite Index (KLCI)	3 January 1990	11 April 2011
Kuala Lumpur Trade & Service Index (KLTAS)	25 October 1993	11 April 2011
Kuala Lumpur Construction Index (KLCON)	25 October 1993	11 April 2011
Kuala Lumpur Finance Index (KLFIN)	11 April 1991	11 April 2011
K. Lumpur Consumer Production Index (KLCSU)	25 October 1993	11 April 2011
Kuala Lumpur Plantation Index (KLPLN)	11 April 1991	11 April 2011
Kuala Lumpur Property Index (KLPRP)	11 April 1991	11 April 2011
Kuala Lumpur Industrial Index (KLIND)	11 April 1991	11 April 2011

Source: Datastream, 12 April 2011

4. Results

Tables 1 - 4 illustrate the descriptive statistics of the selected indices. The descriptive statistics are divided into four distinct groups. Table 1 reports the overall descriptive statistics. Tables 2 - 4 describe the statistics of managed float (pre- 2 September 1998 and between 21 July 2005 until 11 April 2011) and the pegged period (2 September 1998 – 20 July 2005). The pre-2 September 1998 managed float regime shows negative mean values for all indices except the Consumer Production and Plantation Indices. This may be attributable to steady and consistent demand for these two categories of products. Plantation Index constitutes mostly palm oil which is normally hedge for future transactions. The pegged period, however, seems to confer positive mean values for all stock indices in this study. This is perhaps due to the 'psychological stability' factor as a result of being in a pegged regime. The mean of the indices after the re-implementation of managed float remains positive. There are two reasons that may contribute to this condition. First, the time period is relatively short compared to the previous two. It only accounts for about 332 daily observations. Secondly, in line with the argument by Rogoff et al. (1997), this condition might be due to the delayed impact of the exchange rate regime on stock market.

The standard deviations, in all cases are less during the pegged regime when compared to the managed float regime. For Consumer, Plantation and Property Indices, the value is almost half. This trend continues after the reinstatement of the managed float regime. The minimum and maximum values do not differ much under managed float or pegged regime. The post pegged regime exhibits lower maximum and minimum values due to the short time duration accounted for in this study. The Composite, Trade and Services, and Finance Indices are all positively skewed but reveal less skewness during the pegged period. The Construction Index, on the other hand, show greater positive skewness during the pegged period. The Consumer Production, Plantation and Property Indices presents positive skewness during the managed float era but became negatively skewed during pegged regime. After managed float was restored in July 2005, all indices became negatively skewed. Kurtosis shows varied results. For the Composite, Services, Construction and Finance Indices, kurtosis is much higher during the pegged regime compared to managed float. This suggests that the stock market returns are time-varying. The reverse is true for Consumer, Plantation and Property Indices, all of which exhibit lower

kurtosis during the pegged regime.

Table 2a: Descriptive Statistics: Overall

	KLCI	**KLSER**	**KLCON**	**KLFIN**
Mean	0.0082	0.000834	-0.0008	0.0144
Standard Deviation	0.6038	1.7297933	0.8436	0.6828
Min	-10.4897	-21.09865	-9.8945	-8.9313
Max	9.0401	22.37026	10.3882	9.8270
Skewness	0.4217	0.869094	0.6200	1.0789
Kurtosis	50.9279	30.97754	29.3080	33.1857
	KLCSU	**KLPLN**	**KLPRP**	**KLIND**
Mean	0.0094	0.0159	-0.0019	0.0077
Standard Deviation	0.4994	0.6431	0.7428	0.5576
Min	-7.1560	-7.2350	-8.2157	-9.8570
Max	7.0044	6.6164	9.0777	7.4908
Skewness	0.1477	-0.2593	0.4516	-0.1507
Kurtosis	43.8228	23.0504	20.8335	47.8942

Table 2b: Descriptive Statistics : Managed Float (1990/93 – 1 September 1998)

	KLCI	**KLTAS**	**KLCON**	**KLFIN**
Mean	-0.0177	0.0011	-0.0577	-0.0095
Standard Deviation	0.7041	0.6700	1.0358	0.8060
Min	-6.1854	-9.1630	-7.5595	-4.9610
Max	9.0409	9.7153	10.0681	9.8270
Skewness	0.8610	0.7488	0.4874	1.2433
Kurtosis	27.1801	36.5178	18.7587	22.0100
	KLCSU	**KLPLN**	**KLPRP**	**KLIND**
Mean	-0.0296	-0.0025	-0.0277	-0.0161
Standard Deviation	0.6771	0.7705	0.8595	0.6379
Min	-5.9816	-7.2303	-5.2035	-6.8854
Max	7.0041	6.5055	5.6357	6.5721
Skewness	0.0725	-0.2294	0.2935	0.0260
Kurtosis	22.5235	17.8041	10.4553	22.2536

Table 2c: Descriptive Statistics: Pegged (2 September 1998- 20 May 2005)

	KLCI	**KLTAS**	**KLCON**	**KLFIN**
Mean	0.0300	0.0281	0.0252	0.0361
Standard Deviation	0.6474	0.6862	0.8692	0.7171
Min	-10.4897	-9.1630	-9.8945	-8.9313
Max	8.7986	8.1570	10.3882	9.2408
Skewness	0.06699	0.3024	1.4393	0.9959
Kurtosis	71.3970	38.4028	35.5557	41.6949
	KLCSU	**KLPLN**	**KLPRP**	**KLIND**
Mean	0.0281	0.2033	0.0097	0.0318
Standard Deviation	0.4905	0.5257	0.7832	0.6013
Min	-7.1560	-7.2350	-8.2158	-9.8569
Max	6.6254	6.6164	9.0777	7.4908
Skewness	0.6184	-0.0941	0.9738	-0.1789
Kurtosis	62.3721	43.1914	31.8185	72.0471

Table 3a: Descriptive Statistics: Managed Float (21 July 2005 – 11 April 2011)

	KLCI	KLTAS	KLCON	KLFIN
Mean	0.01580	0.0116	0.0166	0.0197
Standard Deviation	0.645116	0.3699	0.6013	0.4255
Min	-4.3336	-4.4403	-7.4525	-3.5319
Max	1.8495	1.9089	3.0910	2.2943
Skewness	-1.3740	-1.2798	-1.6760	-0.6627
Kurtosis	18.5636	19.2279	23.7243	9.9296
	KLCSU	**KLPLN**	**KLPRP**	**KLIND**
Mean	0.0203	0.0341	0.01709	0.0102
Standard Deviation	0.2931	0.5866	0.4963	0.3631
Min	-2.1918	-4.7216	-4.1992	-4.3431
Max	1.4124	5.0817	2.5773	3.0738
Skewness	-0.8402	-0.3408	-0.8638	-0.9856
Kurtosis	8.9368	14.8176	12.1511	21.2190

Table 4.1: GARCH estimation

Parameters	KLCI	KLTAS	KLCON	KLFIN
a_0	0.0199***	0.0151***	0.0163***	0.0253***
	(0.0048)	(0.0052)	(0.0079)	(0.0058)
a_1	0.1714***	0.1189***	0.1225***	0.1705***
	(0.0141)	(0.0155)	(0.0156)	(0.0141)
μ	0.0030***	0.0022***	0.0082***	0.0057***
	(0.0003)	(0.0004)	(0.0006)	(0.0006)
α	0.1074***	0.0976***	0.1040***	0.1118***
	(0.0044)	(0.0045)	(0.0046)	(0.0048)
β	0.8907***	0.9005***	0.8911***	0.8831***
	(0.0035)	(0.0036)	(0.0039)	(0.0038)
φ	-0.0011	-0.0011***	-0.0025***	-0.0022***
	(0.0004)	(0.0004)	(0.0006)	(0.0005)
Log likelihood	-2849.96	-2955.51	-4360.92	-3742.98
$\alpha + \beta$	0.9981	0.9981	0.9951	0.9949

Notes: The numbers in parentheses are the perspective standard errors. *** denote significance at 1% level.

Table 4.2: GARCH estimation

Parameters	KLCSU	KLPLN	KLPRP	KLIND
a_0	0.0167***	0.01867***	0.0026	0.0156***
	(0.0044)	(0.0058)	(0.0061)	(0.0048)
a_1	0.1098***	0.1486***	0.1647***	0.0895***
	(0.0145)	(0.0154)	(0.0139)	(0.0141)
μ	0.0012***	0.0047***	0.0050***	0.0016***
	(0.0001)	(0.0004)	(0.0005)	(0.0003)
α	0.0799***	0.1414***	0.1418***	0.0906***
	(0.0038)	(0.0056)	(0.0056)	(0.0042)
β	0.9183***	0.8480***	0.8212***	0.9008***
	(0.0029)	(0.0046)	(0.0044)	(0.0033)
φ	-.00014	0.0033***	0.0003	0.0000
	(0.0002)	(0.0004)	(0.0005)	(0.00026)
Log likelihood	-1782.85	-3612.70	-4346.77	-2773.38
$\alpha + \beta$	0.9981	0.9894	0.9630	0.9914

Notes: The numbers in parentheses are the perspective standard errors. *** denote significance at 1% level.

Table 4 presents the results from the extended GARCH model which incorporates a dummy variable to represent the regime choice. All ARCH and GARCH estimates are statistically significant at ten per cent level or better. The values of α and β estimates are less than one or unity which disqualifies the probability of having to use integrated GARCH or exponential GARCH. The sum of α and β range between 0.9630 and 0.9981. Hence, in general, these results would be adequate to indicate the stability of the variance process of the returns of the indices. Since the sum of α and β are close to one in all cases, this would suggest that the shock to volatility tend to persist over a longer period of time.

The coefficients of managed float dummy variables are negative for Trade and Services, Construction and Finance Indices at one percent significant level. This provides some pilot indication that stock volatility is less volatile during the managed float regime for these indices. Likewise, the managed float dummy for Plantation Index is positive, hence, implying more volatility during managed float.

In conclusion, it should be noted that this is a preliminary study on how stock market returns behave under different regimes. There are, of course, a host of other possible variables and economic conditions that may affect the volatility of stock returns. Nevertheless, this study can be treated as a preliminary work towards establishing some facts regarding stock market volatility and choice of exchange rate regime.

5. Conclusion

The choice of exchange rate regime would continue to be an everlasting debate as the variables studied continue to expand. Rather than concentrating on macroeconomic variables, this study attempts to explore some financial variables by empirically looking at how the stock market volatility could be affected under different exchange rate regimes. The result however, remains empirical and is subjected to a number of other contributing factors such as which market is being studied, what methods are being used, what are the underlying economic conditions and many more.

In this paper, we seek to provide some preliminary indication that the choice of exchange rate regime does affect the stock market return volatility behaviour. Three indices namely Trade and Services, Finance and

Construction exhibit lower volatility under managed float regimes. Further study should be conducted using more advanced techniques to determine the possible effect of choice of exchange rate regime on the stock market. In the stock market, the impact of being under different regimes should also be examined in terms of stock market deepening, liquidity, capitalization and the formation of more financial products.

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