Does Firm-Level Equity Return Respond to Domestic and International Monetary Policy Shocks? A Panel Data Study of Malaysia

(Adakah Kadar Pulangan Ekuiti Firma Bertindakbalas kepada Kejutan Dasar Kewangan Domestik dan Antarabangsa)

Zulkefly Abdul Karim
Mohd. Azlan Shah Zaidi
Universiti Kebangsaan Malaysia

Bakri Abdul Karim
Universiti Malaysia Sarawak

ABSTRACT

This paper examines the effect of domestic and international monetary policy shocks upon Malaysian firm-level equity returns in a dynamic panel data framework. The determinant of firm-level equity return has been estimated using augmented Fama and French (1992, 1996) multifactor model. The results of the study revealed that firms’ stock returns have responded negatively to domestic and international monetary policy shocks. Interestingly, the effect of domestic monetary policy shocks also have differential effects, having a statistically significant impact on small firms’ equity returns, but not on large firms’ stock returns. The effect of domestic monetary policy shocks also varies according to the subsector of the economy in which firms are operating. The effect of international monetary policy upon equity returns is also heterogeneous by firm size and subsector of economic activity.

Keywords: augmented Fama-French multifactor model; dynamic panel data; firm’s stock return; monetary policy shocks

INTRODUCTION

This paper aims to provide empirical evidence on the effect of monetary policy shocks upon stock returns in an emerging market economy. Specifically, this study investigates the effect of domestic and international monetary policy shocks upon firm-level equity returns in Malaysia by augmenting a standard Fama and French (1992, 1996) multifactor model of stock returns through the inclusion of identified monetary policy changes.

There are three reasons why this study is very interesting. First, most economists agree that the effects of monetary policy upon macroeconomic variables are often indirect, and do not manifest immediately. The most direct, and immediate effect of monetary policy is through financial market variables. Thus, understanding the link between monetary policy and asset prices (in particular stock returns) is crucial for the monetary authorities if they are to take advantage of the stock market channel in the monetary transmission mechanism. Second, monetary policy is believed to be transmitted to economic activity through the stock market via two possible mechanisms; Tobin-q (for example, through changes in the cost of capital). Apart from that, the transmission mechanism can be described as following: $M \uparrow \Rightarrow P \uparrow \Rightarrow q \uparrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$, which $M \uparrow$ indicates expansionary monetary policy, leading to an increase in stock prices ($P \uparrow$), which raises $q$ and investment ($I \uparrow$) and subsequently increases output.
which include the augmented Fama and French (1992, 1996) multifactor model, dynamic panel data framework, and data specification. Section 4 presents the main empirical results, and finally, section 5 summarizes and concludes.

**REVIEW OF THE LITERATURE**

An important issue in any evaluation of monetary policy's effects is the appropriate identification of monetary policy. Previous studies have documented four approaches to measuring monetary policy changes. First, some studies, for example Jensen and Johnson (1995), Thorbecke (1997), Perez-Quiros and Timmermann (2000), and Jensen and Mercer (2002) have used changes in market interest rates or official rates for measuring monetary policy changes. However, the problem with this measure is that it makes strong assumptions that monetary policy is completely exogenous, that is, unconnected with other economic variables. In fact, in reality monetary policy may be endogenous when the monetary authorities set the interest rate after considering the business cycle conditions and other relevant economic variables. This means that any changes in the interest rates correspond to changes in business cycle conditions and other relevant economic variables (Ehrmann and Fratzscher, 2004). In order to solve the endogeneity problem of monetary policy, a number of empirical studies have used alternative approaches such as structural VAR (identified VAR) in measuring monetary policy shocks. For example, Christiano et al. (1996), Thorbecke (1997), Patelis (1997), Lastrapes (1998), Rapach (2001), and Bjørnland and Leitemo (2009) have extracted monetary policy shocks through orthogonalized innovations from a structural VAR approach.

Another approach to identifying monetary policy shocks is through event study methodology that allows an analysis of higher-frequency data compared to the SVAR literature, which is based on quarterly or monthly data. Examples of research using event study are Kuttner (2001), Ehrmann and Fratzscher (2004), Bernanke and Kuttner (2005), and Basistha and Kurov (2008) in the US economy, Bredin et al. (2007) in the UK economy, and Bredin et al. (2009) in the European economy. For example, Bernanke and Kuttner (2005) introduce the surprise component of monetary policy actions in an event study framework and they found that the stock market has a negatively strong response to the contraction of monetary policy.

In contrast, Rigobon (2003), Rigobon and Sack (2004) and Caporale et al. (2005) have identified monetary policy through heteroskedasticity present in the financial market based on a high-frequency data set. In fact, this identification is closely related to the event study methodology. According to this identification strategy, the response of asset prices to changes in monetary policy can be identified based on an increase in the variance of policy shocks that occurs on the days of FOMC meetings.
and of the Chairman’s biannual monetary policy testimony to Congress (Rigobon & Sack 2004).

It is generally believed that individual stock returns react differently to monetary policy according to their size (small and large firms), subsector economic activity, and financially constrained and less-constrained firms. Therefore, understanding why individual stock returns react so differently to monetary policy is an interesting issue to investigate. For example, Bernanke and Blinder (1992) and Kashyap et al. (1993) argued that a contraction of monetary policy predominantly affects firms that are heavily dependent on bank loans, as banks respond to a monetary contraction by shrinking their overall supply of credit. Agency costs are usually assumed to be smaller for large firms because of the economies of scale in collecting and processing information about their situation. As a result, large firms can more easily finance directly from financial markets and are less dependent on bank loans. Therefore, under imperfect capital markets with information asymmetries, the stock prices of firms quoted on stock markets respond to monetary policy in different ways (Ehrmann & Fratzscher 2004). Specifically, small firms that have less information are affected more than large firms in response to a monetary policy contraction. This is because banks tend to reduce their credit lines and small firms have difficulty in finding alternative sources of financing, which should lead to a constraint of the supply of their goods.

On the other hand, the response to monetary policy shocks also differs across firms according to the subsector of economic activity. Peersman and Smets (2005) and Dedola and Lippi (2005) have provided three possible reasons for the differential response of monetary policy across economic subsectors. Ganley and Salmon (1997) and Hayo and Uhlenbrock (2000) have also found the cross-industry heterogeneity of the impact of monetary policy shocks in UK and Germany, respectively. First, the interest-sensitivity of the demand for products differs across firms. For example, firms that produce goods for which demand is highly cyclical or interest-sensitive should see their expected future earnings affected relatively more following a monetary policy change. Second, changes in the cost of capital induced by monetary policy are more important for capital-intensive industries. Third, if monetary policy affects exchange rate, tradable goods industries are likely to be affected more strongly. All these factors imply that expected future earnings are affected in a heterogeneous way across industries in response to monetary policy changes, which should be reflected in the responsiveness of stock returns. Therefore, we can expect equity returns of firms in cyclical industries, capital-intensive industries, and industries that are relatively open to trade to be affected more strongly by monetary policy shock (Ehrmann & Fratzscher 2004).

Ehrmann and Fratzscher (2004), using a multifactor model in panel-corrected standard error approach, found that the firms’ stock return reacts differently to the US monetary policy shocks. Changes in monetary policy are measured by the unexpected component of the FOMC announcements on the days of policy decisions. Specifically, the industrial sectors that are cyclical and capital-intensive (for example, technology, communications, and cyclical consumer goods) often react two to three times more strongly to the US monetary policy shocks than non-cyclical industries. The effect of monetary policy shocks also differs by firm size: small firms, based on either the number of employees or the market value of the firm, have a stronger reaction to monetary policy shocks than medium-sized and large firms. In addition, by using various measures of financial constraints, they also found that firms that are financially constrained with low cash flow, poor credit ratings, low debt-to-capital ratio, high price-earning ratio, and high Tobin’s q have responded significantly more to monetary policy than less-constrained firms. Ehrmann and Fratzscher (2004) used more direct measures of financial constraints, namely the cash flow-to-income ratio, the ratio of debt to total capital, and Moody’s investment and bank loan rating. In theory, firms with large cash flow should be immune to changes in interest rates as they can rely more on internal financing of investment. Firms with a lower ratio debt to capital are affected more by monetary policy because they are more bank-dependent.

RESEARCH METHODOLOGY

AUGMENTED FAMA AND FRENCH MULTIFACTOR MODEL

In investigating the role of monetary policy upon firm-level equity return, this study has added two monetary policy variables namely domestic and international monetary policy to the Fama and French (1992, 1996) three factor model. The three factor model as proposed by Fama and French (1992, 1996) can be represented as follows:

\[ R_{it} - RF_t = \alpha_i + \beta_i (R_M - RF_t) + \beta_s (SMB_t) + \beta_h (HML_t) + \varepsilon_{it} \]

where, \( R_{it} \) is the return on asset \( i \) in period \( t \), \( RF_t \) is the risk-free rate, \( \beta_i \) is the coefficient loading for the excess return of the market portfolio, \( \beta_s \) is the coefficient loading for the excess average return of portfolio with small equity class over portfolios of big equity class, \( \beta_h \) is the coefficient loading for the excess average returns of portfolio with high book-to-market equity class over those with low book-to-market equity class, and \( \varepsilon_{it} \) is the error term for asset \( i \) at time \( t \). In addition to the monetary policy variables, other variables namely, international market returns and four firm specific financial variables have been considered in the model. Therefore, the
baseline augmented Fama and French (1992, 1996) multifactor model can be represented as follows:

\[
R_{it} = RF_t + \alpha_t + \beta_1[R_{Mt} - RF_t] + \beta_2(SMB_t) + \beta_3(HML_t) + \beta_4[DMPs_t] + \beta_5[IMPS_t] + \beta_6[RSALEG_{i,t-1}] + \epsilon_{it}
\]

In Equation [1], there are two types of risk-free interest rates, namely the Malaysian twelve months Treasury Bill rate (RF), and the US twelve months Treasury Bill rate (USTB). Therefore, Equation [1] can be re-expressed in term of excess return. In the capital market theory, excess return or risk premium measured the difference between the expected market rate of return and the risk-free rate of return as following:

\[
r_{it} = \alpha_t + \beta_1m_{it} + \beta_2(SMB_t) + \beta_3(HML_t) + \beta_4[DMPs_t] + \beta_5[IMPS_t] + \beta_6[RSALEG_{i,t-1}]
\]

where \(m_{it}\) is the risk-free asset proxy, namely the US twelve month Treasury Bill rate.

\[
R_{it} = \ln(\frac{SP_{it}}{SP_{i,t-1}}) + \ln(\frac{DEBT_{i,t-1}}{EQUITY_{i,t-1}}) + \ln(\frac{BV_{i,t-1}}{MV_{i,t-1}}) - RF_t
\]

In Equation [2], there are two types of risk-free interest rates, namely the Malaysian twelve months Treasury Bill rate (RF), and the US twelve months Treasury Bill rate (USTB). Therefore, Equation [1] can be re-expressed in term of excess return. In the capital market theory, excess return or risk premium measured the difference between the expected market rate of return and the risk-free rate of return as following:

\[
r_{it} = \alpha_t + \beta_1m_{it} + \beta_2(SMB_t) + \beta_3(HML_t) + \beta_4[DMPs_t] + \beta_5[IMPS_t] + \beta_6[RSALEG_{i,t-1}]
\]

where \(m_{it}\) is the risk-free asset proxy, namely the US twelve month Treasury Bill rate.

DEPENDENT VARIABLE

The dependent variable in this study is the firm-level stock return. The firm stock return has been expressed in terms of excess returns (\(r_{it}\)) as follows:

\[
r_{it} = \left[\frac{SP_{it}}{SP_{i,t-1}} - \frac{DY_{it}}{SP_{i,t-1}}\right] - RF_t
\]

where \(SP_{it}\) is a closing stock price at year-end for firm \(i\) at time \(t\), \(DY_{it}\) is the dividend yield for firm \(i\) at year-end at time \(t\), and \(RF_t\) is a risk-free asset proxy, namely the Malaysian twelve-month Treasury bill rate.

INDEPENDENT VARIABLES

SMB (SMALL MINUS BIG) AND HML (HIGH MINUS LOW)

SMB, small minus big is the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks, and HML, high minus low is the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks. According to Fama and French (1992, 1996), the two additional variables that are SMB and HML are provided the possible usefulness of a firm characteristics in explaining the returns. This means that the SMB (as a proxy for size variable), and the HML (as a proxy for the ratio of book value to market equity) are related to the risk factors in explaining the returns.

MARKET RETURNS VARIABLES

There are two market return variables, namely domestic (RM) and international market (IR) returns. The domestic market returns' (RM) proxies are the returns from the Kuala Lumpur Composite Index (KLCI). The domestic market return is also expressed in terms of excess returns as follows;

\[
r_{RM,t} = \frac{KLCI_{t} - KLCI_{t-1}}{KLCI_{t-1}} - RF_t
\]

As international financial market integration increases, international market returns (IR) become more important in influencing domestic firms' stock returns. Therefore, the returns from the Standard & Poor 500 Index (SP500) are used as a measurement of an international market return.

\[
ir_{t} = \frac{SP500_{t} - SP500_{t-1}}{SP500_{t-1}} - USTB_t
\]

where \(USTB\) in the 12 months US Treasury Bill rate is a proxy for a risk-free asset.

Firms’ Financial Characteristics

There are four firm-specific financial variables that have been considered in the augmented Fama and French (1992, 1996) multifactor model. The variables include the ratio of book value to market value (BV/MV), leverage (debt-equity ratio), real sales growth, and liquidity ratio. These variables can capture the role of company-specific idiosyncratic risk factors in explaining the returns. All firm-specific variables are expressed with a lagged effect because the market participants observe the firm’s previous financial performance when deciding whether to participate in the market (for example, the decision to buy or sell the stock). Therefore, the lagged value of firm-specific financial variables is expected to influence the current stock prices and return. In fact, if a market is efficient, the price of a stock is expected to reflect all the information relevant to investors for the purpose of security analysis and trade. All variables except real sales growth (RSALEG) have been transformed into logarithms.

In order to control for inflation, firm sales are expressed in real terms (\(r\)sales) by dividing the year-end nominal sales in period \(t\) by the consumer price index (\(CPI\)) in period \(t\). Therefore, the firm real sales growth (\(RSALEG\)) is calculated as follows:

\[
RSALEG_{it} = \left[\frac{r\text{sales}_{i,t} - r\text{sales}_{i,t-1}}{r\text{sales}_{i,t-1}}\right]
\]
Monetary Policy Shocks

Monetary policy is measured through a recursively identified structural VAR (SVAR). Therefore, the SVAR model has been estimated with six variables in level form. The data are at a monthly frequency, spanning the period from January 1990 until December 2008, and are collected from the International Monetary Fund (IMF) database. According to the Akaike information criteria (AIC), the optimal lag length is six months. The SVAR-A model proposed by Amisano and Giannini (1996) can be expressed as follows:

$$A_0y_t = A(L)y_t + e_t$$

where $A_0$ is an invertible square matrix of coefficients relating to the structural contemporaneous interaction between the variables in the system, $Y_t$ is a (6x1) matrix or [LOIL LYUS FFR LYM INF IBOR], that is, the vector of system variables, where LOIL is log of world oil price (world average crude price of petroleum in US $ per barrel), LYM is log of US income proxy by Industrial Production Index, FFR is the US Federal Fund Rate as a proxy for an international monetary policy stance, LYM is log of Malaysian income proxy by Industrial Production Index, INF is the inflation rate which is computed from the Consumer Price Index (CPI), and IBOR is the inter-bank overnight rate as a proxy for domestic monetary policy. $D_0$ is a vector of deterministic variables (which may include constant, trend and dummy variables), $A(L)$ is a $k^\text{th}$ order matrix polynomial in the lag operator $L$, and $e_t = [e_{loil} e_{lyus} e_{ffr} e_{lym} e_{inf} e_{ibor}]$ is the vector of structural shocks which satisfies the conditions that $E(e_t) = 0, E(e_t e_s') = \Omega_e = I$ (identity matrix) for all $t = s$.

International monetary policy, that is US monetary policy (FFR), has been assumed to respond contemporaneously to world oil prices and US income. In contrast, a domestic monetary policy variable, that is inter-bank overnight rate (IBOR), is ordered last in the VAR system, by assuming that the Malaysian monetary policy responds contemporaneously to all variables in the VAR.

Specifically, monthly monetary policy shocks are computed by mapping the residual from the reduced form VAR, $e_t$, with contemporaneous matrix $A_0$. Then, monthly structural shocks are cumulated within a year in order to compute the annual monetary policy shock. The expected sign of monetary policy shocks on equity returns is negative, which indicates that firm-level equity returns will decrease in response to a 100 basis point increase in policy rates.

**DYNAMIC PANEL DATA**

The firm-level equity return in the current year can also be explained by its past returns. According to the weak form efficient market hypothesis (EMH), all past prices of a stock are reflected in today’s stock price. Therefore, the past return of the stock is also connected to the current stock return. Some studies, for example, Jegadeesh (1990), Jegadeesh and Titman (1993), Grinblatt and Moskowitz (2004), and Wang et al. (2009) have discovered that past returns contain information about the current expected return. Therefore, the dynamic version of the augmented Fama and French (1992, 1996) multifactor model in equation [2] can be rewritten as follows:

$$r_{it} = a_i + \beta_1 r_{i,t-1} + \beta_2 X_i + \beta_3 X_{i,t-1} + \delta_i W_t + \eta_i + \nu_{it}$$

for $i = 1, ..., N$ and $t = 1, ..., T$ [8]

Where, $r_{it}$ is the firm stock return (excess return) as a dependent variable, $r_{i,t-1}$ is the lagged dependent variable, $X_i$ is domestic market return ($r_m$), small minus big ($SMB_i$) and high minus low (HML_i), $X_{it}$ is firm financial characteristics such as book-value-market-value ($BVMV_i$), real sales growth ($RESG$), debt-equity ratio and liquidity ratio, and $W_t$ is monetary policy shocks (domestic and international monetary policy) and international market return. In addition, it is assumed that the error term ($\nu_t = \eta_t + \nu_{it}$) follows the one-way error component model, where $\eta_t$ is an unobserved firm-specific time-invariant effect which allows for heterogeneity in the means of the $r_{it}$ series across individuals where $\eta_t ~ \text{IID}(0, \sigma^2_\eta)$ and $\nu_{it}$ is the remainder stochastic disturbance term which is assumed to be independent across individuals, where $\nu_{it} ~ \text{IID}(0, \sigma^2_\nu)$.

In equation [8], the lagged values of firm excess return, $r_{i,t-1}$ are correlated with the firm-specific effect ($\eta_t$). This is because, since $r_{i,t}$ is a function of ($\eta_t$), it immediately follows that $r_{i,t-1}$ is also a function of ($\eta_t$). Arellano and Bover (1995) proposed a forward orthogonal deviation transformation or forward Helmert’s procedure to eliminate the firm-specific effect. This transformation method essentially subtracts the mean of future observations available in the sample from the first observations, and its main advantage is that it preserves sample size in panels with gaps. According to Roodman (2009), first-difference transformation has some weakness; i.e., if some explanatory variable ($x_{i,t}$) is missing, then both $\Delta x_{i,t}$ and $\Delta x_{i,t+1}$ are missing in the transformed data. However, under orthogonal deviations, the transformed $x_{i,t+1}$ need not go missing. Hayakaya (2009) argued that, by using a Monte Carlo simulation study, the GMM estimator of the model transformed by the forward orthogonal deviation tends to work better than when transformed by the first difference. However, transforming equation [8] using forward orthogonal deviation introduces a new bias which is the correlation between the transformed error terms with the transformed lagged dependent variable. Similarly, the transformation of explanatory variables also becomes potentially endogenous because they are related to the transformed error term. Therefore, three assumptions can be made regarding the explanatory variables. For instance,
the explanatory variable can be a predetermined variable that is correlated with the past error, and endogenous variables are potentially correlated with the past and present error. In contrast, a strictly exogenous variable is uncorrelated with either current, past or future error.

However, Alonso-Borrego and Arellano (1999) and Blundell and Bond (1998) showed that, in the case of lagged dependent, the explanatory variables are persistent over time or nearly a random walk; therefore, lagged levels of these variables are weak instruments for the regression equation in differences. This happens either as the autoregressive parameter (\( \alpha \)) approaches unity, or as the variance of the individual effects (\( \eta_i \)) increases relative to the variance of the idiosyncratic error (\( \epsilon_i \)). Hence, to decrease the potential bias and imprecision associated with the difference estimator, Blundell and Bond (1998) have proposed a system GMM approach by combining both regression in differences and regression in level. In addition to the regression in difference, the instruments for the regression in level are the lagged differences (transformed) of the corresponding instruments.

The success of the GMM estimator in producing unbiased, consistent and efficient results is highly dependent on the appropriate adoption of the instruments. Therefore, there are three specification tests as suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). Firstly, Sargan or Hansen tests of over-identifying restrictions test the overall validity of the instruments by analyzing the sample analogue of the moment conditions used in the estimation process. If the moment condition holds, then the instrument is valid and the model has correctly specified. Secondly, the serial correlation tests confirm that there is no serial correlation among the transformed error term. Finally, to test the validity of extra moment’s conditions on the system GMM, the difference in Hansen test is used. This test measures the difference between the Hansen statistic generated from the system GMM and the difference GMM. Therefore, failure to reject the three null hypotheses gives support to the estimated model.

**DATA SPECIFICATION**

The data set is of yearly frequency collected from various sources. The year-end firm stock prices, KLCI and sp500 Index are collected from Bloomberg database; meanwhile the year-end firm financial characteristics such as book-value-market-value, sales, liquidity and financial leverage are collected from Thompson Financial DataStream; all data sets span the period from 1990 to 2008.

This study has focused on the main board publicly listed companies in the Malaysian Bourse. Recently, there have been 650 companies listed in the main board covering various subsector economic activities such as plantations (agriculture), property, consumer products, industrial products, services, technology and financial. However, not all firms have been considered in this study. The firm-level data has been refined by deleting certain firms such as the financial firms and firms whose data set covers a period of less than five years. After refining the data, we have 449 firms.

**DETECTING OUTLIERS**

In order to deal with the influential data points, two statistics are used, namely DFITS and DFBETA statistics as proposed by Belsley et al. (1980) and a later extended version by Belsley (1991). The DFITS measure is a scaled difference between the in-sample and out-of-sample predicted value for the \( j_{th} \) observations (Baum, 2006). It also evaluates the result of fitting the regression model including and excluding that observation. The DFITS statistics are computed as follows; 

\[
DFITS_j = r_j \sqrt{\frac{k}{n}} \sqrt{\frac{k}{n} - h_j},
\]

where \( r_j \) is a studentized (standardized) residual, which is 

\[
r_j = \frac{e_j}{s_{(j)} \sqrt{1 - h_j}},
\]

with \( s_{(j)} \) referring to the root mean squared error of the regression equation with the \( j_{th} \) observation removed, \( e_j \) is the residual, and \( h_j \) is the value of leverage. The value of leverage (\( h_j \)) is computed from the diagonal elements of the ‘hat matrix’ as follows: 

\[
h_j = x_j(X'X)^{-1}x_j,
\]

where \( x_j \) is the jth row of the regressor matrix. Belsley et al. (1980) suggest that a cut-off value of \( |DFITS_j| > 2 \sqrt{\frac{k}{n}} \) indicates highly influential observations; therefore, these firms have to be removed from the regression model. By using DFITS statistics, 88 firms out of 449 firms or 19 per cent of the firm observations are removed from the sample. Finally, we have 361 firms in this study (see Table 1 for the detailed firm by subsector categories).

In addition to DFITS statistics, we can also detect the outliers on one regressor by using DFBETA statistics. The DFBETA for regressor measures the distance that this regression coefficient would shift when the observation is included or excluded from the regression, scaled by the estimated standard error of the coefficient.

**TABLE 1. Number of Firms by Categorisation**

<table>
<thead>
<tr>
<th>By sector</th>
<th>After Detecting Outliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>24</td>
</tr>
<tr>
<td>Consumer Products</td>
<td>57</td>
</tr>
<tr>
<td>Hotel</td>
<td>03</td>
</tr>
<tr>
<td>Industrial Products</td>
<td>88</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>06</td>
</tr>
<tr>
<td>Mining</td>
<td>01</td>
</tr>
<tr>
<td>Plantation</td>
<td>22</td>
</tr>
<tr>
<td>Property</td>
<td>61</td>
</tr>
<tr>
<td>REITS</td>
<td>01</td>
</tr>
<tr>
<td>Services</td>
<td>88</td>
</tr>
<tr>
<td>Technology</td>
<td>10</td>
</tr>
<tr>
<td>Total Firms</td>
<td>361</td>
</tr>
</tbody>
</table>
(Baum, 2006). The DFBETA statistics are computed as follows: $\hat{\beta}_j = \sum_{i=1}^n \frac{\hat{e}_i}{s_i} x_{ij}$, where $\hat{e}_i$ are the residuals obtained from the partial regression of $x_j$ on the remaining columns of $X$, and $s_i^2$ is their sum of squares. Belsley et al. (1980) suggest a cut-off value of $|\text{DFBETA}_j| > 2\sqrt{\frac{N}{T}}$ for the highly influential observations.

### SPLITTING THE SAMPLE SIZE

As argued earlier, there may be significant differences in the way that the monetary policy shocks affect equity returns of different-sized (large and small) and firms operating in different subsectors of the economy.

The sample has been split into large and small firms in the following way. First, the share of market capitalization for each firm was computed by expressing the market capitalization for each firm as a percentage of total market capitalization in a particular year. Second, the average (mean) value of market capitalization share is computed for each firm over all years. Third, the median value of these averages is then computed to generate the threshold. The firm is considered large if the mean value of market capitalization share is greater than the median value, and small otherwise. According to this criterion, there are 180 firms in the large category, and 181 firms in the small category.

In addition, this study also examines the effect of monetary policy shocks on different-sized (large and small) and firms operating in different subsectors of economic activity. However, not all of the subsectors in the economy can be considered in estimating the dynamic multifactor model due to there being insufficient observations. The standard rule of thumb to estimate dynamic panel data is large cross-section (N) observation, which is at least 50, and short time series observation. Therefore, this study only examines four subsectors of economic activity, namely industrial products, consumer products, property and the services sector.

### EMPIRICAL RESULTS

This section reports the estimation results of the dynamic augmented Fama and French (1992, 1996) multifactor model by using the one-step system GMM estimation for the full-sample and subsample analyses (large and small firms and subsectors of economy activity). Particular focus is placed on the effects of monetary policy shocks (domestic and international monetary policy) on firm-level stock returns by examining the whole-sample and subsample analyses.

#### WHOLE SAMPLE

As can be seen in Table 2, for the whole-sample estimation, firm-level stock returns are statistically and significantly influenced by the lagged dependent variable, domestic market returns, small minus big, international market returns, monetary policy shocks (domestic and international), and several firm financial characteristics variables, namely the ratio of book value to market value (BVMV) and liquidity. The contemporaneous influence of domestic monetary policy shocks is negatively and statistically significant, at least at the 10 per cent significance level, in influencing the firm-level stock returns. A 100 basis point (one percentage point) increase in the domestic inter-bank overnight rate (IBOR) leads to a 4.5 per cent decrease in firms’ stock returns. The negative reaction of firms’ stock returns to monetary policy tightening is also consistent with the standard economic theory prediction.

The effect of foreign monetary policy shocks on domestic firms’ stock returns is significantly larger than domestic monetary policy shocks that a 100 basis point increase in FFR (US monetary policy) leads to an 8 per cent decrease in contemporaneous firm stock returns. The larger role of foreign monetary policy in transmitting to domestic stock return is reasonable given that the Malaysian stock market is an emerging market and relatively smaller than other markets, and is therefore more vulnerable to an exogenous shock from a large country. The significant influence of US monetary policy supports the view that US monetary policy is a risk factor in global financial markets; therefore it can directly and immediately influence the domestic economy through financial markets.

As stated before, the validity of the system GMM depends on the three specification tests, namely the AR(2) test for serial correlation, the Hansen test for testing the validity of instrument adopted, and the difference in Hansen tests. As can be seen from Table 2 (column 1), the p-values for the AR(2) and Hansen tests are higher and statistically insignificant, at least at the ten per cent significance level. This result implies that the empirical model has been correctly specified due to there being no serial correlation (autocorrelation) in the residuals; also, the instruments used in the models are valid. In addition, the difference in the Hansen tests are also statistically insignificant in all models, which indicates that the validity of additional moment conditions. The difference in Hansen test has not been reported in the Table 2 and Table 3 in order to save space. However, the results are available upon request.

#### HETERGENEITY OF MONETARY POLICY EFFECTS: SUBSAMPLE RESULTS

##### Large and Small Firms

The results of subsample analysis are reported in Table 2 in column 2 (large firms) and column 3 (small firms). According to the credit channel theory, the presence of the asymmetric information problem in the credit market causes firm-level equity returns to behave differently in response to monetary policy shocks. As can be seen in
Table 2, column 2 (large firms) and column 3 (small firms), large firms’ stock returns are not significantly affected by domestic monetary policy shocks whereas small firms’ stock returns are significantly affected. The small firms’ stock returns decrease by 8.7 per cent in response to a 100 basis point increase in domestic monetary policy. As noted by credit channel theory, the large firms are less dependent on bank loans; therefore, during monetary contraction they will not contract their business activities (for example, investment). This is because they are able to raise alternative funds through international money markets, and by issuing private bonds. In contrast, small firms are more reliant on domestic bank credit; hence, contraction of monetary policy will reduce the demand for credit, and subsequently lead to a decline in the cash flow, sales and stock returns.

By comparison, international monetary policy shocks significantly influence the large firms’ equity returns, although this is not the case for small firms’ equity returns. A 100 basis point increase in US monetary policy is associated with a decline in the large firms’ stock returns of 6.2 per cent. Ehrmann and Fratzscher (2006) provide three plausible causes of microeconomic effects on individual firms’ equity return in response to US monetary policy shocks. First, firms’ stock prices are affected through the financing costs from international financing. For instance, large firms are more reliant on obtaining some of their funds from foreign markets (for example from the US money market) and are exposed to two sources of risks, namely foreign interest rate and exchange rate risk. Therefore, an increase in US interest rates due to a tightening of monetary policy would increase the financing cost and diminish the cash flow, which would subsequently decrease the investment level, firm sales and stock returns. Second, the stock price evaluation of firms with business links with the US is affected indirectly through the impact of US monetary policy on real economic activity in the US. Finally, for financial investors, a change in US interest rates is likely to trigger a portfolio rebalancing by investors (local, global investors or US). For example, an increase in US interest rates due to monetary tightening will stimulate capital outflows from domestic to foreign market. The investors, in particular the fund manager, will liquidate domestic assets (for example, by selling their shares) and invest it in foreign-denominated assets such as bonds, money market instruments and bank deposits, because an investment in the foreign country is more profitable than in the

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Whole sample</th>
<th></th>
<th>Large firm</th>
<th></th>
<th>Small firm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Robust</td>
<td>Standard error</td>
<td>p-value</td>
<td>Robust</td>
<td>Standard error</td>
</tr>
<tr>
<td>Lagged Dependent Variable</td>
<td></td>
<td>coef.</td>
<td>error</td>
<td>p-value</td>
<td>coef.</td>
<td>error</td>
</tr>
<tr>
<td>$r_{i,t-1}$</td>
<td></td>
<td>0.032</td>
<td>0.042</td>
<td>0.445</td>
<td>0.076</td>
<td>0.036</td>
</tr>
<tr>
<td>$r_{i,t-2}$</td>
<td></td>
<td>0.043</td>
<td>0.018</td>
<td>0.015***</td>
<td>0.065</td>
<td>0.031</td>
</tr>
<tr>
<td>Domestic Market Return</td>
<td></td>
<td>1.099</td>
<td>0.049</td>
<td>0.000***</td>
<td>1.201</td>
<td>0.1556</td>
</tr>
<tr>
<td>Small Minus Big (SMB)</td>
<td></td>
<td>0.963</td>
<td>0.077</td>
<td>0.000***</td>
<td>0.603</td>
<td>0.204</td>
</tr>
<tr>
<td>High Minus Low (HML)</td>
<td></td>
<td>0.064</td>
<td>0.108</td>
<td>0.556</td>
<td>-0.027</td>
<td>0.299</td>
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<tr>
<td>International Market Return</td>
<td></td>
<td>0.297</td>
<td>0.044</td>
<td>0.000***</td>
<td>0.143</td>
<td>0.060</td>
</tr>
<tr>
<td>Domestic Monetary Policy Shocks</td>
<td></td>
<td>-0.045</td>
<td>0.026</td>
<td>0.090**</td>
<td>-0.004</td>
<td>0.011</td>
</tr>
<tr>
<td>International Monetary Policy Shocks</td>
<td></td>
<td>-0.080</td>
<td>0.131</td>
<td>0.000***</td>
<td>-0.062</td>
<td>0.025</td>
</tr>
<tr>
<td>Book-Value-Market Value</td>
<td></td>
<td>0.137</td>
<td>0.0226</td>
<td>0.000***</td>
<td>-0.003</td>
<td>0.031</td>
</tr>
<tr>
<td>Lagged of real sales growth</td>
<td></td>
<td>0.007</td>
<td>0.009</td>
<td>0.453</td>
<td>0.033</td>
<td>0.011</td>
</tr>
<tr>
<td>Financial leverage</td>
<td></td>
<td>0.011</td>
<td>0.009</td>
<td>0.191</td>
<td>0.018</td>
<td>0.030</td>
</tr>
<tr>
<td>Liquidity</td>
<td></td>
<td>0.035</td>
<td>0.015</td>
<td>0.026**</td>
<td>0.031</td>
<td>0.042</td>
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<tr>
<td>Number of observations</td>
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<td>1297</td>
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<td>7.67</td>
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<tr>
<td>Observations per group</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of firms</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of instrument</td>
<td></td>
<td>274</td>
<td></td>
<td>105</td>
<td></td>
<td></td>
</tr>
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<td>AR(1) – p-value</td>
<td></td>
<td>0.000</td>
<td></td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR(2) – p-value</td>
<td></td>
<td>0.441</td>
<td></td>
<td>0.686</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hansen test-p-value</td>
<td></td>
<td>0.203</td>
<td></td>
<td>0.153</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *** significant at 1 per cent; ** significant at 5 per cent; * significant at 10 per cent. Constants are not included in order to save space.

All p-values of the difference in Hansen tests of exogeneity of instruments subsets are also rejected at least at 10 per cent significance level, but are not reported here. The full results are available upon request.

Instrument for orthogonal deviation equation:
Lags 2 to 4 for all endogenous variables and all lags for strictly exogenous variables (whole sample). Lags 2 to all available lags for all endogenous variables and all lags for strictly exogenous variables (large firm and small firm).

The estimation also collapses the instruments matrix as proposed by Calderon et al. (2002) and Roodman (2009) except for the whole sample.
domestic country. This action will reduce domestic stock returns because of the portfolio adjustment by the investors.

All specification tests such as serial correlation and over-identifying restriction are valid for the small and large samples. The AR(2) and Hansen test are insignificant, at least at the 10 per cent significance level. Therefore, the estimated models for the small and large firms have been correctly specified.

Subsectors of Economic Activity

Table 3 reports the effects of monetary policy shocks upon stock returns in subsectors of the economy. Four subsectors have been considered, namely consumer products, industrial products, property and services. As can be seen in Table 3, the effect of monetary policy upon equity returns varies across industries, as some industries are significantly affected by monetary policy shocks while others are not. Domestic and international monetary policies are statistically insignificant in influencing the stock returns of firms in the consumer products and services sectors. In contrast, stock returns of firms in the industrial products sector are significantly affected by monetary policy shocks (domestic and international monetary policy). A one percentage point increase in domestic monetary policy leads to a decrease in industrial firms’ stock returns by 3.2 per cent. However, the effect of international monetary policy shocks on industrial firms’ stock returns is larger than that of domestic monetary policy, as the stock returns decline by 9.1 per cent in response to the shock. This suggests that the stock returns of firms in the industrial products sector are more sensitive to international monetary policy shocks than to domestic monetary policy.

All specification tests in terms of AR(2) for serial correlation and the Hansen test are also statistically insignificant, at least at the 10 per cent significance level, but not been reported here. The full results are available upon request.

Instrument for orthogonal deviation equation:
Lags 2 to 3 for all endogenous variables and all lags for strictly exogenous variable (for consumer product and property), lags 2 to 5 for all endogenous variables and all lags for strictly exogenous variable (for industrial product) and lags 2 to 4 for all endogenous variables and all lags for strictly exogenous variable (for services).

The estimation also collapses the instruments matrix as proposed by Calderon et al. (2002) and Roodman (2009) for all subsectors of economic activity.

### Table 3. Augmented Fama-French Multifactor Model by Subsector of Economy: System GMM Estimation (one-step estimation)

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Consumer product</th>
<th>Industrial product</th>
<th>Property</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coeff</td>
<td>std. error</td>
<td>p-value</td>
<td>coeff</td>
</tr>
<tr>
<td>Lagged Dependent Variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r_{i,t}$</td>
<td>0.088</td>
<td>0.063</td>
<td>0.160</td>
<td>0.086</td>
</tr>
<tr>
<td>$r_{i,t-1}$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Domestic Market Return</td>
<td>1.021</td>
<td>0.176</td>
<td>0.000***</td>
<td>1.318</td>
</tr>
<tr>
<td>Small Minus Big (SMB)</td>
<td>0.057</td>
<td>0.288</td>
<td>0.001***</td>
<td>0.630</td>
</tr>
<tr>
<td>High Minus Low (HML)</td>
<td>0.331</td>
<td>0.333</td>
<td>0.321</td>
<td>-1.163</td>
</tr>
<tr>
<td>International Market Return</td>
<td>0.027</td>
<td>0.103</td>
<td>0.794</td>
<td>0.143</td>
</tr>
<tr>
<td>Domestic Monetary Policy Shocks</td>
<td>-0.061</td>
<td>0.065</td>
<td>0.314</td>
<td>-0.032</td>
</tr>
</tbody>
</table>

Note: *** significant at 1 per cent; ** significant at 5 per cent; * significant at 10 per cent. Constants are not included in order to save space.

All p-values of the difference in Hansen tests of exogeneity of instruments subsets are also rejected at least at 10 per cent significance level, but not been reported here. The full results are available upon request.
which indicates that there is no serial correlation and that the instruments adopted in the model are valid.

SUMMARY AND CONCLUSIONS

This paper extends the existing literature by providing new empirical evidence about the effect of domestic and international monetary policy shocks on firm-level stock returns in an emerging market, with reference to the Malaysian stock market, using a dynamic panel data framework. Monetary policy shocks are identified using recursive VAR identification scheme. An augmented Fama and French (1992, 1996) multifactor model has been used to estimate the determinants of firm-level stock returns by focusing on the heterogeneous effects of monetary policy shocks on firm size (large and small firm equity returns) and subsectors of the economy. In addition, the role of international market returns and several firm financial characteristics variables have also been considered in estimating the determinants of firm-level stock returns.

The main findings can be summarized as follows. First, monetary policy shocks (domestic and international monetary policy) are statistically and negatively significant in influencing firm-level stock returns. In fact, the effect of domestic monetary policy shock varies in firms of different sizes. The equity returns of small firms are statistically and significantly affected by monetary policy shocks, whereas this is not the case for large firms. Second, in general, firm-level stock returns have responded more to international monetary policy shocks than to domestic monetary policy. The higher response of domestic stock returns in response to a US monetary policy shock is also consistent with previous studies, for example that of Conover et al. (1999) in 16 industrialised countries. International monetary policy shocks are also statistically significant in influencing large firms’ stock returns, whereas small firms’ stock returns are not significantly affected. Third, the effect of monetary policy shocks is also heterogeneous according to the nature of the business (subsector). For example, domestic monetary policy shocks are only statistically significant in influencing the stock returns of firms in the industrial products subsector, whereas international monetary policy shocks are only statistically significant in influencing the stock returns of firms in the industrial products and property sectors. The other sectors are not significantly affected by monetary policy shocks.

This study has three important suggestions for policy. First, the domestic monetary authorities should monitor the external environment, such as international stock markets and international monetary policy, in formulating their monetary policy. This is because the effect of international spillover to firm-level equity returns is also important, which suggests that foreign variables are a risk factor in domestic stock markets and can also influence the domestic economy through financial market variables. In the meantime, the domestic monetary authorities should also observe the fluctuations and developments in the domestic stock market in order to take advantage of the stock market channel to the whole economy. From the perspective of practitioners or market participants, in particular investors, they should observe all relevant information in the market (internal or external information), in particular monetary policy changes, in formulating an effective investment strategy and minimizing the risk. From the firms’ point of view, they should maintain sound financial performance and observe the international and domestic environment in order to stabilize their share prices.

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Zulkefli Abdul Karim
Mohd Azlan Shah Zaidi
School of Economics
Universiti Kebangsaan Malaysia
43600, UKM, Bangi, Selangor,
zai@ukm.my
azlan@ukm.my

Bakri Abdul Karim
Faculty of Business and Economics
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak