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MONETARY POLICY, FIRM SIZE AND EQUITY RETURNS IN AN EMERGING MARKET: PANEL EVIDENCE OF MALAYSIA

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ABSTRACT

The present study provides new empirical evidence on the effects of monetary policy shocks (domestic and international monetary policy) on equity returns in an emerging economy (i.e., Malaysia) for 1990–2008 using firm-level data. Using an augmented Fama-French (1992, 1996) multifactor model, empirical results based on system GMM estimations and a sample of 449 firms shows that firms' stock returns responded negatively to monetary policy shocks. Moreover, the effect of domestic monetary policy shocks also have differential effects, with a statistically significant impact on small firms' equity returns but not on large firms' stock returns. The effect of international monetary policy upon equity returns is also heterogeneous by firm size; significant effects were observed for the equity returns of large firms but not for a case of small firms.

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

INTRODUCTION

Most economists agree that monetary policy plays a prominent role in stimulating real sector activity and stabilising domestic prices, at least in the short run (Bernanke & Blinder, 1992; Christiano, Eichenbaum, & Evans, 1996). However, the effects of monetary policy on macroeconomic variables are often indirect and do not manifest themselves immediately. The most direct and immediate effect of monetary policy is through financial market variables. Thus, a good understanding of the link between monetary policy and asset prices (particularly stock returns) is crucial for the monetary authorities if they are to take advantage of the stock market channel in the monetary transmission mechanism. This is because monetary policy is believed to be transmitted to economic activity through the stock market via two possible mechanisms: Tobin's *q* (for example, through changes in the cost of capital) and the wealth channel (for example, changes in the value of private portfolios). Specifically, an expansion of monetary policy leads to an increase in stock prices, which raises q and investment, thereby leading to an increase in aggregate demand and a rise in output. In contrast, according to the wealth channel, an expansion of monetary policy, which raises stock prices, raises the value of household wealth, thus increasing the lifetime resources of consumers, which subsequently causes consumption and output to rise.

The present study aims to provide the first empirical evidence on the effect of monetary policy shocks on stock returns in an emerging market economy (i.e., Malaysia). Specifically, this study investigates monetary policy's effects on stock returns in a Malaysian firm-level dataset by augmenting a standard Fama and French (1992, 1996) multifactor model of stock returns through the inclusion of identified monetary policy changes.

The significant contribution of this study differs from previous work in four ways. First, in the Malaysian context, there have been a few studies (for example, Habibullah & Baharumshah, 1996; Ibrahim, 1999; Ibrahim & Aziz, 2003) that have examined the link between a monetary policy measure and aggregate stock returns, but none of these studies used identified monetary policy changes. Therefore, this study improves upon the previous studies by measuring monetary policy shocks using an identified VAR (SVAR) approach. There are two possible reasons for using identified monetary policy changes in modelling the determinants of firm-level equity return. First, an identified VAR is the best method for solving the endogeneity problem of monetary policy. This method allows the monetary authorities to set the current interest rate level after considering the current level of business cycle conditions and other relevant economic variables. This process implied that any changes in the interest rates correspond to changes in business cycle conditions and other relevant economic variables (Ehrmann & Fratzscher, 2004). Second, the negative response of monetary policy changes on equity return can be explained by two theories: the "financial propagation" mechanism as proposed by Bernanke and Gertler (1989), and the "credit channel" mechanism as discussed by Bernanke and Gertler (1995). First, according to the "financial propagation" mechanism, an adverse monetary policy shock raises the information and agency cost associated with external finance, which in general reduces access to bank loans and external finance. Thus, this forces the firm to decrease the investment level and eventually reduces the cash flow and stock returns. Second, under the "credit channel" mechanism, the effect of monetary policy on equity return works through the "balance sheet channel" and the 'bank lending channel'. The mechanism under the 'balance sheet channel' is similar to the "financial propagation" mechanism. In contrast, under the "bank lending channel", it is expected that a contraction of monetary policy leads banks to shrink the supply of loans and charge higher interest rates for new loan contracts, subsequently causing a decline in firms' cash flow and real earnings as well as stock returns.

Second, although Allen and Cleary (1998), Clare and Priestley (1998), Lau, Lee and Mcinish (2002) and Shaharudin and Fung (2009) have examined the determinants of firm-level stock returns in Malaysia, they have ignored the role of monetary policy variables. Third, the determinants of firm-level equity return have been estimated by augmenting the Fama and French (1992, 1996) multifactor model in a dynamic panel data framework. Using the Fama and French (1992, 1996) multifactor model allows us to control for other determinants of firm-level equity returns, particularly the role of international factors (for example, international market returns and international monetary policy) and firm financial characteristics (for example, the ratio of book value to market value, firm liquidity, leverage, and sales growth). Fourth, the findings on the heterogeneity of monetary policy effects upon firm-level equity return have been limited in the previous literature. Therefore, this study provides a significant contribution by examining the heterogeneous nature of monetary policy effects according to firm size (small and large firm).

The results of the study can be summarised as follows. First, monetary policy shocks (domestic and international) are statistically and negatively significant in influencing the firm-level stock returns in an emerging market economy. In general, firm-level stock returns responded more to international monetary policy shocks than domestic monetary policy. Second, 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. Third, international monetary policy shocks are also statistically significant in influencing the stock returns of large firms, whereas small firms' stock returns are not significantly affected.

REVIEW OF THE LITERATURE

An important issue in any evaluation of monetary policy effects is the appropriate identification of monetary policy. Previous studies have documented four approaches to the measurement of 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 to measure 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 & Fratzscher, 2004). 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 orthogonalised innovations from a structural VAR approach.

Another approach to the identification of monetary policy shocks is through event study methodology, which allows an analysis of higher-frequency data compared to the SVAR literature and is based on quarterly or monthly data. Examples of research using event study are Kuttner (2001), Ehrmann and Fratzscher (2004), Bernanke and Kuttner (2005), Basistha and Kurov (2008) in the US economy, Bredin, Hyde, Nitzsche and O'reilly (2007) in the UK economy, and Bredin, Hyde, Nitzsche and O'reilly (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, Cipollini and Demetriades (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 Federal Open Market Committee (FOMC) meetings and of the Chairman's biannual monetary policy testimony to Congress (Rigobon & Sack, 2004).

This study uses the structural VAR (SVAR) approach in measuring monetary policy shocks for three reasons. First, the SVAR approach allows us to solve the endogeneity of monetary policy, which allows the monetary authority to set the interest rates after observing other macroeconomic variables and business cycle conditions. In fact, as mentioned previously, most recent empirical studies on monetary policy and real economic activity have adopted the SVAR approach in measuring the monetary policy shocks. Second, it is not possible to use event study methodology in Malaysia because data are not available at higher-frequency levels. In fact, the Bank Negara Malaysia (BNM) does not have a properly minuted meeting about the changes in monetary policy framework compared to advanced countries such as the UK and US. Third, because this study uses panel data evidence at the firm level, the methodology proposed by Rigobon and Sack (2004) is inappropriate because it also needs a high-frequency data set of financial market variables.

It is generally believed that individual stock returns react differently to monetary policy according to their size (small and large 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, Stein and Wilcox (1993) argued that a contraction of monetary policy predominantly affects firms that are heavily dependent on bank loans, because banks respond to a monetary contraction by shrinking their overall supply of credit. 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 on the supply of their goods.

A recent study by Chortareas and Noikokyris (2014) using a standard event study methodology revealed that there is no significant relationship between market based policy surprises and equity return in UK. Moreover, the impact of monetary policy decision on equities depends on the Monetary Policy Committee (MPC) members' voting record publication. In Japan, Masahiko and Minoru (2014) have concluded that there is a little evidence that the demand side of the interest rates and balance sheet channel explain the heterogeneous effects of monetary policy on equity return. However, there is evidence that the supply sides of the interest rates and balance sheet channel, when measured by capital intensity, financial leverage and interest rates burden, can explain the heterogeneity effects of monetary policy on equity return. In the US, a recent study by Bouakez, Essid and Normandin (2013) using SVAR methods revealed that the interaction between monetary policy and stock returns is much weaker than suggested by earlier empirical studies. In contrast, Maio (2014) using VAR methodology found that there is a negative effect of Fed fund rate shocks in US on stock return that comes from a corresponding negative effect on future expected cash flows (cash-flow news), which is stronger than the effect on future equity risk premiums (discount rate news).

MONETARY POLICY AND STOCK MARKET: THEORETICAL ASPECT

The effect of monetary policy on stock prices (*SP*) can be explained by the present value or discounted cash flow model. Following Ioannidis and Kontonikas (2008), the model can be expressed as follows:

$$SP_t = E_t\left[\sum_{j=1}^{k}\left(\frac{1}{1+R}\right)^j D_{t+j}\right] + E_t\left[\left(\frac{1}{1+R}\right)^k SP_{t+k}\right] \quad (1)$$

where E_t is the conditional expectations operator based on information available to the market participant at time t, D_{t+j} is the present value of expected future dividends, R is the rate of return used by the market participants to discount future dividends and K is the investor's time horizon (stock-holding period). The standard transversality condition implies that, as the horizon K increases, the second term in the right-hand side vanishes to zero (by assuming no rational stock price bubbles) or can be written as

$$\lim_{K\to\infty} E_t\left[\left(\frac{1}{1+R}\right)^K SP_{t+K}\right] = 0 \quad (2)$$

Therefore, the familiar version of the discounted cash flow model is

$$SP_t = E_t\left[\sum_{j=1}^{\infty}\left(\frac{1}{1+R}\right)^j D_{t+j}\right] \quad (3)$$

In Equation (3), the changes in monetary policy variable affect stock returns in two ways. First, stock returns can be directly affected by altering the discount rate used by market participants. For example, monetary tightening leads to an increase in the interest rates at which firms' future cash flows are capitalised, causing stock prices to decrease. This is valid under two assumptions: the discount factors used by the market participants are linked to the market interest rates and the monetary authority is capable of controlling market interest rates. Second, monetary policy changes have an indirect effect on the firm's stock value by influencing market participants' expectations of future economic activity and altering expected future cash flows. For instance, an easing of monetary policy has been expected to raise the overall level of economic activity, and the stock price responds positively because of the expectation of higher cash flow in the future. This is because higher cash flow will be associated with higher dividends in the future and, consequently, increased stock prices and returns.

ESTIMATION PROCEDURES

In this paper, the standard Fama and French (1992, 1996) multifactor model is augmented to enable an examination of the determinants of firm-level stock returns. This section briefly explains the multifactor modelling, dynamic panel data model and data specification.

Augmented Fama and French Multifactor Model

The three-factor model as proposed by Fama and French (1992, 1996) can be represented as follows:

$$R_{it} - RF_t = \alpha_i + \beta_i [RM_t - RF_t] + s_i (SMB_t) + h_i (HML_t) + \varepsilon_{it} \tag{4}$$

where R_{it} is the return on asset i in period t, RF_t is the risk-free rate, β_i is the coefficient loading for the excess return of the market portfolio, s_i is the coefficient loading for the excess average return of the portfolio with a small equity class over portfolios of big equity class, h_i 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 ε_{it} is the error term for asset i at time t.

In Equation (4) the sensitivity of the excess return of asset i at time t $(R_{it} - RF_t)$ is determined by three factors:

1. The excess return on a broad market portfolio $(RM_t - RF_t)$
2. The difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, small minus big)
3. 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 (HML, high minus low)

According to Fama and French (1992, 1996), the two additional variables, SMB and HML, can explain the usefulness of a firm's 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.

The innovation of this paper is to augment the Fama and French (1992, 1996) three-factor model by considering the role of monetary policy shocks (domestic and international monetary policy). 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. This section briefly discusses the definitions and justifications of the dependent and independent variables in the augmented Fama and French (1992, 1996) multifactor model (please refer to Table 1 for the summary and the description of the variables used in this study).

Dependent variable

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

$$r_{it} = R_{it} - RF_t \tag{5}$$

where $R_{it} = \left[\frac{SP_{it} - SP_{i,t-1}}{SP_{i,t-1}} + DY_{it} \right]$, 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 12-month Treasury bill rate.

Independent variables

The independent variables are market return, firm-specific financial variables, and monetary policy shocks.

Market return 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:

$$rm_t = RM_t - RF_t \tag{6}$$

where $RM_t = \left(\frac{KLCI_t - KLCI_{t-1}}{KLCI_{t-1}} \right)$.

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. The selection of this variable is reasonable given that the Malaysian stock market is an emerging and relatively small market that is exposed to international financial conditions, in particular to the stock market development from large countries such as the US. There are two possible reasons why the US stock market is an appropriate proxy for international market returns. First, the US is the largest of Malaysia's trading partners. For example, on average, from 1997 to 2008, exports to the US have constituted 20% of total Malaysian exports. Second, the US is also the major investor in the Malaysian equity market. For example, from 2000 to 2008, on average, the equity investment from the US was approximately 20% of the total equity investment by country. Therefore, the international market return in terms of excess return can be expressed as follows:

$$ir_t = IR_t - USTB_t \qquad (7)$$

where $IR_t = \left(\frac{SP500_t - SP500_{t-1}}{SP500_{t-1}} \right)$, and *USTB* is the 12 months US Treasury Bill rate, 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 (BVMV), leverage (debt-equity ratio), liquidity ratio, and real sales growth. 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 (*RSALESG*) have been transformed into logarithms.

BVMV is the ratio between the book value of common equity and the market equity at the fiscal year-end in the previous period. Market equity is computed by multiplying shares outstanding by the price per share. High BVMV tend to exhibit higher average returns, whereas stocks with low BVMV ratios tend to exhibit lower returns. This is because a financially strong and established company will have a relatively high book value (strong balance sheet position), which results in a high BVMV as well. In addition, the BVMV is also a good indicator of market efficiency. Therefore, we predict a significant positive sign for the BVMV on firm equity returns.

Firm financial leverage also plays an important role as a risk factor in explaining the equity returns. For example, firms with a higher leverage (higher debt-equity ratio) are likely to experience a greater price decline because of worries about the firms' possible inability to make interest and loan payments, which may lead to bankruptcy (Wang, Meric, Liu, & Meric, 2009). Therefore, the relationship between financial leverage and returns should be negative.

Liquidity ratio is measured as liquid assets (LIQ) divided by total assets. Liquid assets comprise total cash plus marketable securities. Liquidity has been found to be an important factor in explaining the stock returns. As argued by Wang et al. (2009), investors favour the stocks of firms with larger cash holdings over cash-constrained firms because a high liquidity level indicates that the firm is better able to meet its maturing obligations. In fact, firms with higher liquid assets are less prone to bankruptcy because higher cash holdings reduce the probability that a cash shortage will force the firm into default. Therefore, we predict a positive sign for the liquidity ratio upon firm equity returns.

The important role of sales growth in explaining the stock return has been discussed by Lakonishok, Shleifer and Vishny (1993), Davis (1994), and Lau et al. (2002). All of these studies found that stock returns are negatively related to the past sales growth. Lakonishok et al. (1993) argued that stocks with high past sales growth are typically glamour stocks, and stocks with low past sales growth are out-of-favour or value stocks. They found that the stocks with low growth in sales (value stocks) earn an abnormal return of 2.2%, whereas the stocks with high growth in sales (glamour stocks) earn an abnormal return of -2.4%. This finding indicates that the value stocks outperformed the glamour stocks.

To control for inflation, firm sales are expressed in real terms (*rsales*) 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 (*RSALESG*) is calculated as follows:

$$RSALESG_{it} = \left[\frac{rsales_{i,t} - rsales_{i,t-1}}{rsales_{i,t-1}} \right] \tag{8}$$

Monetary policy shocks

As mentioned before, the main objective of this study is to examine the effect of monetary policy shocks on firm-level equity returns. Therefore, two monetary policy shocks variables, domestic monetary policy shocks (*DMPS*) and international monetary policy shocks (*IMPS*), have been considered. 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 general convention in the empirical literature on monetary policy study is to specify the VAR model in levels rather than in the first differences, or to use the vector error correction model (VECM). Thus, in this study, the model is specified in levels of the variables even though several variables, namely, world oil prices and foreign and domestic output, may appear to contain a random walk component and are non-stationary. There are three reasons why using the VAR in levels is a more appropriate specification. First, this study takes into account a suggestion made by Ramaswamy and Sloek (1997), who discuss the trade-off between the loss of efficiency (when the VAR is estimated in levels while not imposing any cointegrating relationships) and the loss of information (when the VAR is estimated in first-differences). Essentially, they suggest that it is reasonable not to impose cointegration restrictions on the VAR model in cases where there is no prior economic theory that can propose either the number of long-run relationships or how they should be interpreted. Second, asymptotically, the responses from the VAR in levels will be equivalent to the responses from the VEC model.

However, estimation of the VAR in levels instead of the VEC only involves a loss of efficiency. Third, if the evidence for cointegrating relationships is particularly not strong in the data, imposing such relationships on the levels VAR to form the VEC may lead to misspecification error (see, Ramaswamy & Sloek, 1997). In summary, this study takes the stand that the relationships specified in the SVAR model are plausible on economic grounds, and thus, testing stationarity of the variables is not really necessary. Other studies that do not test the stationarity of the variables in SVAR analysis include Cushman and Zha (1997), Kim and Roubini (2000), Dungey and Pagan (2000) and Dungey and Fry (2003), to name a few.

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:

$$A_0 Y_t = \Gamma_0 D_0 + A(L) Y_t + \varepsilon_t \quad (9)$$

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 (6 × 1) matrix $[LOIL \quad LYUS \quad FFR \quad LYM \quad INF \quad IBOR]'$, a vector of system variables, where *LOIL* is the log of world oil price (world average crude price of petroleum in US$ per barrel), *LYUS* is the log of US income proxy by the Industrial Production Index, *FFR* is the US Federal Fund Rate as a proxy for an international monetary policy stance, *LYM* is the log of a Malaysian income proxy by the 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. INF is entered into the model instead of CPI, which is in levels, because INF is the variable of interest in the analysis of the effect of a monetary policy shock. Other studies that have used inflation in VAR include Dungey and Pagan (2000), Dungey and Fry (2003) and Berkelmans (2005) for the Australian case and Garrat, Pesaran and Shin (2003) for the UK. Tang (2006) and Zaidi and Fisher (2010) also use inflation in their models for Malaysia.

D_0 is a vector of deterministic variables (which may include constant, trend and dummy variables), $A(L)$ is a *k*th order matrix polynomial in the lag operator *L*, and $\varepsilon_t = \left[\varepsilon_{loil} \quad \varepsilon_{lyus} \quad \varepsilon_{ffr} \quad \varepsilon_{lym} \quad \varepsilon_{\inf} \quad \varepsilon_{ibor}\right]$ is the vector of structural shocks that satisfies the conditions that $E(\varepsilon_t) = 0$, $E(\varepsilon_t \varepsilon_s^{'}) = \Omega_\varepsilon = I$ (identity matrix) for all $t = s$. However, Equation (9) cannot be directly observed or directly estimated to derive the true value of A_0, $A(L)$ and ε_t. Hence, Equation [9] has been estimated by transforming it to the reduced form representation as follows:

$$Y_t = A_0^{-1} \Gamma_0 D_0 + A_0^{-1} A(L) Y_t + A_0^{-1} \varepsilon_t \quad (10)$$

or

$$Y_t = \Pi_0 D_0 + \Pi_1 (L) Y_t + e_t \quad (11)$$

Where $\Pi_0 = A_0^{-1} \Gamma_0$, $\Pi_1 = A_0^{-1} A(L)$, $e_t = A_0^{-1} \varepsilon_t$ and $E(e_t e_t') = A_0^{-1} \Omega A_0^{-1'} = \Sigma$

The solution to the SVAR system can be generated by recovering the relationship between the reduced-form disturbances (e_t) and the underlying structural shocks (ε_t). This relationship can be estimated through Equation (11), which is $e_t = A_0^{-1}\varepsilon_t$ or $A_0 e_t = \varepsilon_t$, using the maximum likelihood estimates. In matrix form, this relationship can be represented as follows:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} e_t^{LOIL} \\ e_t^{LYUS} \\ e_t^{FFR} \\ e_t^{LYM} \\ e_t^{INF} \\ e_t^{IBOR} \end{bmatrix} = \begin{bmatrix} \varepsilon_t^{LOIL} \\ \varepsilon_t^{LYUS} \\ \varepsilon_t^{FFR} \\ \varepsilon_t^{LYM} \\ \varepsilon_t^{INF} \\ \varepsilon_t^{IBOR} \end{bmatrix} \quad (12)$$

The matrix in Equation (12) shows that international monetary policy, that is, US monetary policy (FFR), has been assumed to respond contemporaneously to world oil prices and US income. In contrast, domestic monetary policy variables, 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, ε_t with contemporaneous matrix A_0. Monthly structural shocks are then cumulated within a year 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. In addition, as mentioned before, the effect of monetary policy shocks is expected to be heterogeneous according to the firm sizes (small and large).

Therefore, the baseline augmented Fama and French (1992, 1996) multifactor model in terms of excess return can be represented as follows:

$$r_{it} = \alpha_0 + \beta_1 rm_t + \beta_2 (SMB_t) + \beta_3 (HML_t) + \beta_4 ir_t + \beta_5 DMPS_t + \beta_6 \, IMPS_t + \beta_7 \, RSALEG_{i,t-1} + \beta_8 \, ln\left(\frac{BV_{i,t-1}}{MV_{i,t-1}}\right) + \beta_9 \, ln\left(\frac{LIQ_{i,t-1}}{TA_{i,t-1}}\right) + \beta_{10} \, ln\left(\frac{DEBT_{i,t-1}}{EQUITY_{i,t-1}}\right) + \varepsilon_{it} \tag{13}$$

Table 1
The definitions/description of the variables

Variables	Definitions/descriptions
Firm stock prices	The year end of firm-level stock prices. The firms are listed in the main board of Bursa Malaysia. The firm level stock price has been expressed in terms of excess return series.
KLCI	The year end of Kuala Lumpur Composite Index. The KLCI is also expressed in terms of excess return series as a proxy for domestic market return.
S&P 500	The year end of Standard & Poor 500 Index. This index has been expressed in terms of excess return series as a proxy for international market return.
BVMV	The ratio of book value to market value.
Debt-equity ratio	The ratio of total debt-equity.
LIQ/TA	The liquidity ratio, which is the ratio of liquid asset as a percentage of total asset.
RSALEG	The growth of firm sales in real terms.
HML	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 (HML, high minus low).
SMB	The difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, small minus big).
Monetary policy shocks	Identified by using recursive structural VAR identification scheme. Domestic monetary policy variables, that is inter-bank overnight rate (IBOR), are assumed to respond contemporaneously to all variables in the VAR model, whereas international monetary policy, that is US Federal Fund Rate (FFR), has been assumed to respond contemporaneously to world oil prices and US income. A monthly structural shock is cumulated within a year in order to compute the annual monetary policy shock.

Dynamic Panel Data

The firm-level equity return in the current year can also be explained by its past returns. 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 (13) can be rewritten as follows:

$$r_{it} = \alpha_{ij} r_{i,t-1} + \beta_1' X_t + \beta_2' X_{it} + \delta_1' W_t + \eta_i + \nu_{it}$$

$$\text{for } i = 1,....,N \text{ and } t = 1,....,T \tag{14}$$

where r_{it} is the firm stock returns (excess return) as a dependent variable, $r_{i,t-1}$ is the lagged dependent variable, whereas, X_t, X_{it} and W_t are vectors of variables. Specifically, X_t is the domestic market return (rm_t), small minus big (SMB_t) and high minus low (HML_t). X_{it} is firm financial characteristics such as book-value-market-value $(BVMV)$, real sales growth $(RSALESG)$, 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 $(\varepsilon_{it} = \eta_i + \nu_{it})$ follows the one-way error component model, where η_i is an unobserved firm-specific time-invariant effect that allows for heterogeneity in the means of the r_{it} series across individuals, where $\eta_i \sim IID(0, \sigma_\eta^2)$ and v_{it} is the remainder stochastic disturbance term, which is assumed to be independent across individuals and $v_{it} \sim IID(0, \sigma_v^2)$.

In Equation (14), the lagged values of firm excess return, $r_{i,t-1}$, are correlated with the firm-specific effect (η_i). This is because, since $r_{i,t}$ is a function of (η_i), it immediately follows that $r_{i,t-1}$ is also a function of (η_i). Arellano and Bover (1995) proposed a forward orthogonal deviation transformation or forward Helmert procedure to eliminate the firm-specific effect. This transformation method essentially subtracts the mean of future observations available in the sample from the first $T - 1$ observations, and its main advantage is that it preserves sample size in panels with gaps. According to Roodman (2009), the first-difference transformation has some weakness; i.e., if some explanatory variable (x_{it}) 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. Hayakawa (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 for the panel data with gaps.

This procedure can be expressed as follows:

$$x_{it}^{*} = c_{it}\left[x_{i,t-1} - \frac{1}{T_{it} - t + 1}\left(x_{it} + x_{i,t-1} + ... + x_{i,t-1}\right)\right] \tag{15}$$

where T_{it} is the number of time-series observations on firm i and c_{it} is the scale factor that is $\sqrt{\frac{T_{it} - t + 1}{T_{it} - t + 2}}$. However, transforming Equation (14) 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 variable. 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 current, past or future error.

In this study, the lagged dependent variable $\left(r_{i,t-1}\right)$, X_t variables [domestic market return $\left(rm_t\right)$, small minus big (SMB_t) and high minus low (HML_t)] and X_{it} variables [all of a firm's financial characteristics, such as book value market value (*BVMV*), real sales growth (*RSALESG*), debt-equity ratio and liquidity ratio] are assumed to be endogenous variables. Monetary policy shocks (domestic and international) are assumed to be strictly exogenous variables. In addition, because the Malaysian stock market is an emerging and relatively small market that is highly vulnerable to the international stock market, the international stock return (ir_t) is also considered strictly exogenous. The endogenous variables and strictly exogenous variables in the transformed equation will be instrumented with the lagged level of the regressors. The GMM estimator based on these moment conditions is known as the difference GMM.

However, Alonso-Borrego and Arellano (1999) and Blundell and Bond (1998) showed that, in the case of lagged dependence, the explanatory variables are persistent over time or are 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 (α) approaches unity or as the variance of the individual effects (η_i) increases relative to the variance of the idiosyncratic error (v_{it}).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. Thus, based on this argument, the present study uses a system GMM procedure in estimating the dynamic model of firm equity return.

This study uses a one-step system GMM in estimating the baseline multifactor model. However, for robustness checking, a two-step system GMM estimation has also been considered. The one-step estimator is the estimation method by transforming a one-step residual in computing the robust standard error, whereas the two-step estimator is used in correcting the standard error. Bond (2002) argued that a one-step result is preferred over two-step results because his simulation studies have shown that the two-step estimator is less efficient when the asymptotic standard error tends to be too small or the asymptotic t-ratio tends to be too large. However, Windmeijer (2005) argued that the two-step GMM performs somewhat better than the one-step GMM in estimating the coefficients, with lower bias and standard errors. In fact, the reported two-step standard errors with the correction work well; therefore, the two-step estimation with corrected standard errors seems modestly superior to cluster robust one-step estimation.

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). First, Sargan or Hansen tests of over-identifying restrictions test the overall validity of the instruments by analysing 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 been correctly specified. Second, the serial correlation tests confirm that there is no serial correlation among the transformed error terms. Finally, to test the validity of the 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 the Bloomberg database, whereas 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 Bursa Malaysia. 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 sectors. However, not all firms have been considered in this study. The firm-level data have 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.

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) firms. Therefore, the sample has been split into large and small firms in the following way. First, the share of market capitalisation for each firm was computed by expressing the market capitalisation for each firm as a percentage of total market capitalisation in a particular year. Second, the average (mean) value of market capitalisation 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 224 firms in the large category and 225 firms in the small category. Examples of previous studies that used this procedure are Laeven (2002), Rungsomboon (2005), Kaplan and Zingales (1997), Lamont, Polk and Saa-Requejo (2001) and Ehrman and Fratzscher (2004).

EMPIRICAL RESULTS

This section reports the estimation results of the dynamic augmented Fama and French (1992, 1996) multifactor model using the one-step system GMM estimation for the full-sample and subsample analyses (large and small firms). For the robustness test, alternative estimation techniques, namely, the two-step system GMM and difference GMM estimation (one- and two-step estimation), were also considered. 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 shown in Table 2, for the whole-sample estimation, firm-level stock returns are statistically significantly influenced by the lagged dependent variable, small minus big (SMB), high minus low (HML), international market returns, monetary policy shocks (domestic and international), and firm financial characteristic variable, namely, the ratio of book value to market value (BVMV). The contemporaneous effect of domestic monetary policy shocks is negatively and statistically significant, at least at the 5% 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 4.9% 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 in that a 100 basis point increase in FFR (US monetary policy) leads to a 6.8% decrease in contemporaneous firm stock returns. The larger role of foreign monetary policy in transmitting to domestic stock returns 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, US monetary policy 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 shown in Table 2 (column 1), the *p*-values for the AR (2) and Hansen tests are higher and statistically insignificant, at least at the 10% significance level. This result implies that the empirical model has been correctly specified due to the absence of serial correlation (autocorrelation) in the residuals; also, the instruments used in the models are valid. In addition, the differences in the Hansen tests are also statistically insignificant in all models, which indicates the validity of additional moment conditions. The difference in Hansen test has not been reported in the Table 2 to save space. However, the results are available upon request.

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 shown in Table 2, column 2 and column 3, 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

9% 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 5.3%. 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 markets. The investors, particularly the fund manager, will liquidate domestic assets (for example, by selling their shares) and invest them 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 domestic country. This action will reduce domestic stock returns because of the portfolio adjustment by the investors.

Table 2

Augmented Fama-French Multifactor Model: System GMM Estimation (one-step estimation)

Explanatory variable	Whole sample			Large firm			Small firm		
	coef.	Robust std. error	*p*-value	coef.	Robust std. error	*p*-value	coef.	Robust std. error	*p*-value
Lagged Dependent Variable									
$r_{i,t-1}$	0.026	0.011	0.021^{**}	0.021	0.012	0.072^{*}	0.049	0.024	0.036^{**}
$r_{i,t-2}$	0.008	0.013	0.527	0.003	0.014	0.803	0.060	0.020	0.003^{***}
Domestic Market Return	0.380	0.125	0.764	0.050	0.161	0.755	0.301	0.176	0.087^{*}
Small Minus Big (SMB)	1.259	0.176	0.000^{***}	1.064	0.183	0.000^{***}	1.459	0.344	0.000^{***}
High Minus Low (HML)	0.915	0.103	0.000^{***}	0.910	0.128	0.000^{***}	0.845	0.155	0.000^{***}
International Market Return	0.157	0.060	0.016^{**}	0.155	0.070	0.028^{**}	0.221	0.121	0.069^{*}
Book-Value-Market Value	0.090	0.026	0.001^{***}	0.130	0.031	0.000^{***}	0.099	0.043	0.021^{**}
Lagged of real sales growth	0.002	0.009	0.453	0.024	0.005	0.003^{***}	0.002	0.012	0.849
Financial leverage	0.004	0.009	0.634	0.017	0.012	0.162	0.002	0.013	0.866
Liquidity	0.006	0.021	0.779	0.050	0.025	0.048^{**}	–0.019	0.029	0.506
Domestic Monetary Policy Shocks	*–0.049*	*0.020*	0.016^{**}	*–0.031*	*0.025*	*0.216*	*–0.090*	*0.038*	0.019^{**}
International Monetary Policy Shocks	*–0.068*	*0.034*	0.034^{**}	*–0.053*	*0.012*	0.014^{**}	*–0.002*	*0.021*	*0.915*
Number of observations		3803			2409			1394	
Observations per group		8.82			11.05			6.54	
Number of firms		431			218			213	
Number of instrument		28			107			102	
AR(1) – *p*-value		0.000			0.000			0.000	
AR(2) – *p*-value		0.134			0.376			0.936	
Hansen test – *p*-value		0.154			0.147			0.206	

Note: *** significant at 1%; ** significant at 5%; * significant at 10%. 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% 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, Chong and Loayza (2002) and Roodman (2009) except for the whole sample.

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% significance level. Therefore, the estimated models for the small and large firms have been correctly specified.

Robustness Checking

To check robustness, the baseline model was re-estimated using various strategies such as the two-step system GMM estimation, difference GMM (one-step and two-step estimation), various instrumental strategies (for example, using different assumptions about endogenous and predetermined variables) and the combination of instrument with level and difference equations. In general, the main results are robust, i.e., monetary policy shocks (domestic and international monetary policy) are statistically and negatively significant in influencing the firm stock return. In fact, there is a heterogeneous effect of monetary policy shocks according to firm size (large and small firm equity).

SUMMARY AND CONCLUSIONS

This paper provides new empirical evidence about the effect of monetary policy shocks (domestic and international monetary policy) on firm-level stock returns in an emerging market, with reference to the Malaysian stock market, using a dynamic panel data framework. 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). 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 summarised 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 significantly affected by monetary policy shocks, whereas this is not the case for large firms. Second, in general, firm-level stock returns 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, Jensen and Johnson (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.

This study has four important suggestions for policy implications. First, the negative trade-off between firm-level equity return and monetary policy may have a direct effect on the level of economic activity. For example, monetary policy tightening (an increase in interest rates policy) leads to a reduction of firm-level equity return and subsequently will transmit to economic activity (economic growth, and inflation) via three channels: the wealth effect on consumption, Tobin's Q effect on firm investment, and the financial accelerator effect on investment. Second, 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 spill-over 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. Third, the domestic monetary authorities should also observe the fluctuations and developments in the domestic stock market to take advantage of the stock market channel to the whole economy. Fourth, the different effects of domestic and international monetary policy on equity return according to firm size suggest relevant policy implications for the monetary authority, market participants, and firms. First, the monetary authority must make an accurate assessment about the overall effect of monetary policy on economic activity. Second, from the perspective of practitioners or market participants, particularly investors, they should observe all relevant information in the market (internal or external information), particularly monetary policy changes, to formulate an effective investment strategy and minimise their business risk. Third, from the firms' point of view, they should maintain sound financial performance and observe the international and domestic environments to stabilise their share prices.

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