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Monetary Policy, Financial Constraints and Equity Return: Panel Evidence

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ABSTRACT

This paper examines the effects of monetary policy shocks upon the equity returns of financially constrained and less-constrained firms by augmenting the Fama and French (1992, 1996) multifactor model and using a dynamic panel data approach. Monetary policy shocks are generated via a recursive structural VAR (SVAR) identification scheme which allows the monetary authority to set the overnight interbank rate after observing the current value of world oil price, foreign income, foreign monetary policy, domestic output and inflation. The firms are split into two categories namely, financially constrained and financially less-constrained using the cash-flow to income ratio. The results reveal that the equity returns of financially constrained firms are more affected by domestic monetary policy shocks than the returns of less constrained firms. However, international monetary policy shocks significantly influence the equity returns of financially less-constrained firms, but not the financially constrained firms.

Keywords: Monetary policy; financial constraints; Augmented Fama and French; dynamic panel data

INTRODUCTION

This paper examines monetary policy shocks (domestic and international monetary policy) effects upon the equity returns of financially constrained and less-constrained firms in an emerging market economy (i.e. Malaysia). For this purpose, the following research design is employed. First, an identified monetary policy change series is generated via an open economy recursive structural VAR (SVAR) identification scheme. Second, firm stock returns are assumed to follow an augmented Fama and French (1992, 1996) multifactor model, which is then estimated using a dynamic panel technique in generalized method of moment or GMM framework. Third, the firm-level data set is divided into two categories that are financially constrained and less constrained firms using the methodology proposed by Kaplan and Zingales (1997).

Theoretically, the negative response of stock market returns to monetary policy changes can be explained by two theories, namely, 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.

There are two reasons that motivate this study. First, a good understanding of why an individual stock return reacts so differently to monetary policy is crucial for the monetary authority and financial market participants. For example, the monetary authority needs to know which categories of firm are more severely affected during monetary policy tightening. Thus, the most affected firm/sector may require financial assistance during a period of tight monetary policy. In contrast, for financial market participants, the heterogeneous effects of monetary policy on equity return is crucial for their business plan, in particular for formulating an effective investment, and risk management decisions. Second, the effects of monetary policy on financial constraint is also relating to the credit channel theory. Thus, the effect of monetary policy on firms (for example, equity return) tends to be asymmetric. In particular, firms that are financially constrained are likely to be affected more strongly by changes in interest rates than firms that are less constrained. For example, Lamont et al. (2001) found that financially constrained firms react more strongly to changes in monetary policy or to business cycle conditions than less constrained firms.

The contributions of this study differ from previous work in three ways. First, this paper is the first attempt (as far as can be established) to estimate how Malaysian monetary policy shocks affect the firm-level stock returns according to financial constraints and less-constraints criteria. Second, this study identifies monetary policy changes using a recursive structural VAR (SVAR) identification scheme. There have been a few studies [for example, Habibullah and Baharumshah (1996); Ibrahim (1999) and Ibrahim and 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. Third, there have also been several studies that have examined the determinants of firm-level stock returns in Malaysia, but they have ignored the effects of domestic and international monetary policy shocks in modelling the firm-level equity return [for example, see Allen and Cleary (1998); Clare and Priestley (1998); Lau et al. (2002) and Shaharudin and Fung (2009)].

The results of the study indicate that there exits differential effects of monetary policy shocks (domestic and international) upon firm-level equity return in Malaysia. The equity returns of financially constrained firms are significantly more affected by domestic monetary policy shocks than those of less constrained firm. In addition, the equity return of financially constraints firms are significantly affected by international monetary policy shocks.

The remainder of the paper is organized as follows. Section 2 briefly reviews the previous literature, and Section 3 discusses the research methodology. Section 4 presents the main empirical results and a variety of robustness tests. Finally, section 5 summarizes and concludes.

REVIEW OF LITERATURE

It is generally believed that individual stock returns react differently to monetary policy according to their size (small and large firm), sub-sector 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[1]. Therefore, under imperfect capital markets with information asymmetries, for firms that are quoted on stock markets, their stock prices respond to monetary policy in different ways (Ehrmann and 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.

The literature on the credit channel states that the effect of monetary policy upon firm-equity returns has also differed by financially constrained and less-constrained firm. In particular, firms that are financially constrained are likely to be affected more strongly by changes in interest rates than firms that are less constrained. The equity returns of financially constrained firm are responded more to monetary policy tightening because inability to fund investment due to credit constraints or inability to borrow, inability to issue equity, and dependence on bank loans or illiquidity of asset. In contrast, the equity return of unconstrained firm are less responded to monetary policy shock because they are enable to access external financing due to the good credit condition. For example, study by Perez-Quiros and Timmermann (2000) by using the size of firms as a proxy for the degree of credit constraints have found that smaller firms' returns are more affected by monetary policy tightening than large firms.

[1] 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 less dependent on banks loans.

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, and 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. 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-dependant. This findings have been supported by Basistha and Kurov (2008) in a US study which shows that the size of the response of stock returns to monetary policy shocks is more than twice during recession and tight credit conditions as in good economic times. In fact, the response of firm stock returns to monetary news depends on the individual credit characteristics of firms. For example, the equity return of the companies that are likely to be credit constrained react more strongly to monetary news in recessions and in tight credit market conditions as compared to the company that is relatively unconstrained.

Most of the literature on the stock market channel has focused on the effect of domestic monetary policy. There has been little interest in investigating the effect of international monetary policy shocks on domestic market stock returns. For example, Conover et al. (1999), found that the equity markets in several countries have reacted more to the US monetary policy than to local monetary policy. In fact, the response of stock markets is generally higher in expansive than in restrictive US monetary policy periods. Ehrmann et al. (2005) estimate the effect of US monetary policy on stock markets for the Euro area and found that a 100 basis point increase in US monetary policy dropped Euro area stock markets by nearly 2 percent. In comparison, the effect of Euro monetary policy on the US stock market is relatively smaller, that is 0.5 percent. Recently, Ehrmann and Fratzsche (2006) by analyzing 50 equity markets worldwide, found that on average global equity market returns fall by 3.8 percent in response to a 100 basis point tightening of US monetary policy. Some countries, for example Indonesia, Korea and Turkey have experienced stock return declines of more than 10 percent in response to the US monetary policy shocks.

Therefore, with this background, this study makes a novel contribution to the literature by examining the effects of monetary policy shocks (domestic and international monetary policy) upon the equity return, by using a disaggregated firm-level data set in an emerging market economy (i.e. Malaysia). The focus of this study is to examine monetary policy effects upon the firm-level stock returns of financially constrained and less constrained firms.

RESEARCH METHODOLOGY

Baseline Model

In investigating the role of monetary policy on firm stock return, this study has added two monetary policy variables namely domestic and international monetary policy in the Fama and French (1992, 1996) three factor model[2]. 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:

$$\begin{aligned} R_{it} - RF_t &= \alpha_0 + \beta_1\left[(RM_t) - RF_t\right] + \beta_2(SMB_t) + \beta_3(HML_t) + \beta_4\left[(IR_t) - USTB_t\right] + \beta_5 DMPS_t \\ &+ \beta_6 IMPS_t + \beta_7 RSALEG_{i,t-1} + \beta_8 \ln\left(\frac{BV_{i,t-1}}{MV_{i,t-1}}\right) + \beta_9 \ln\left(\frac{LIQ_{i,t-1}}{TA_{i,t-1}}\right) + \beta_{10} \ln\left(\frac{DEBT_{i,t-1}}{EQUITY_{i,t-1}}\right) + \varepsilon_{it} \end{aligned} \quad (1)$$

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

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

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 portfolio with 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 (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[3] as following;

$$r_{it} = \alpha_0 + \beta_1 rm_t + \beta_2 (SMB_t) + \beta_3 (HML_t) + \beta_4 ir_t + \beta_5 DMPS_t + \beta_6 IMPS_t + \beta_7 RSALEG_{i,t-1} + \beta_8 \ln\left(\frac{BV_{i,t-1}}{MV_{i,t-1}}\right) + \beta_9 \ln\left(\frac{LIQ_{i,t-1}}{TA_{i,t-1}}\right) + \beta_{10} \ln\left(\frac{DEBT_{i,t-1}}{EQUITY_{i,t-1}}\right) + \varepsilon_{it} \quad (2)$$

DEFINITIONS AND EXPLANATIONS OF THE VARIABLES

Dependent Variable

The dependent variable is the firm-level equity returns in terms of excess returns (r_{it}). It calculated as follows;

$$r_{it} = \left[\frac{SP_{it} - SP_{i,t-1}}{SP_{i,t-1}} + DY_{it}\right] - RF_t \quad (3)$$

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 months Treasury bill rate.

INDEPENDENT VARIABLES

Market Return Variables

In equation (2), there are two market return variables namely domestic (RM) and international market (IR) returns. The domestic markets return (RM) is proxied by the return of Kuala Lumpur Composite Index (KLCI). The domestic market return is also expressed in term of excess returns as follows;

$$rm_t = \left(\frac{KLCI_t - KLCI_{t-1}}{KLCI_{t-1}}\right) - RF_t \quad (4)$$

As international financial market integration increases, international market returns (IR) become more important in influencing domestic firms' stock returns. Therefore, the return of Standard & Poor 500 Index (SP500) is 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, which is has exposed to international financial conditions, in particular to the stock market development from large country like US. Therefore, the international market return in terms of excess return can be expressed as follows;

$$ir_t = \left(\frac{SP500_t - SP500_{t-1}}{SP500_{t-1}}\right) - USTB_t \quad (5)$$

where, $USTB$ in the 12 months US Treasury Bill rate as a proxy for a risk-free asset.

Firm Financial Characteristics

In equation (2), there are four firm specific financial variables that have been considered in the multifactor model. The variables include the ratio of book value to market value (BVMV), leverage

[3] 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.

(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 in the augmented multifactor model. 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. 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.

Firm financial leverage (debt-equity ratio) is also play an important role as 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 to the firms’ possible inability to make interest and loan payments, which may lead bankruptcy (Wang et al., 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 asset comprises total cash plus marketable securities. The liquidity has been found to be an important factor in explaining the stock return. As argued by Wang et al. (2009), investors favour the stocks of firms with larger cash holdings than cash-constrained firms because a high liquidity level indicates that the firm is better to meet its maturing obligations. In fact, firms with higher liquid asset are safer against bankruptcy because higher cash holdings reduce the probabilities 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 have been discussed by Lakonishok et al. (1993), Davis (1994), and Lau et al. (2002). All 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 percent, whereas the stocks with high growth in sales (glamour stocks) earn abnormal return of -2.4 percent. This finding indicates that the value stock outperformed the glamour stock.

In order 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;

$$RSALESG_{it} = \left[\frac{rsales_{i,t} - rsales_{i,t-1}}{rsales_{i,t-1}} \right] \tag{6}$$

MONETARY POLICY SHOCKS

An important issue in any evaluation of monetary policy’s effects is the appropriate identification of monetary policy. This study uses structural VAR (SVAR) approach in measuring monetary policy shocks. Using SVAR, its permit to solve the endogeneity of monetary policy, which is allows the monetary authority to set the interest rates after observing other macroeconomics variables and business cycle conditions. In equation (2), there are two monetary policy shocks variables, which are domestic monetary policy shocks $(DMPS)$, and international monetary policy shocks $(IMPS)$. In order to deal with the endogeneity problem associated with monetary policy variables, 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 January 1990 until December 2008, and are collected from 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:

$$A_0 Y_t = \Gamma_0 D_0 + A(L) Y_t + \varepsilon_t \tag{7}$$

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 or $[LOIL \quad LYUS \quad FFR \quad LYM \quad INF \quad IBOR]'$, that is the vector of system variables, where $LOIL$ is log of world oil price (in US $ per barrel), $LYUS$ 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^{th} order matrix polynomial in the lag operator L, and $\varepsilon_t = \lfloor \varepsilon_{loil} \quad \varepsilon_{lyus} \quad \varepsilon_{ffr} \quad \varepsilon_{lym} \quad \varepsilon_{\inf} \quad \varepsilon_{ibor} \rfloor$ is the vector of structural shocks which satisfies the conditions that $E(\varepsilon_t) = 0$, $E(\varepsilon_t \varepsilon_s^{'}) = \Omega_\varepsilon = I$ (identity matrix] for all $t = s$.

International monetary policy, namely the US monetary policy (FFR) has been assumed to respond contemporaneously to world oil prices and US income. In contrast, the domestic monetary policy variable, namely the interbank overnight rate (IBOR) is ordered last in the VAR system, assuming the Malaysian monetary policy responds contemporaneously to all variables in the VAR. However, equation (7) cannot be directly observed or directly estimated to derive the true value of A_0, $A(L)$ and ε_t. Hence, equation (7) would be estimated in a reduced form representation as follows;

$$Y_t = A_0^{-1}\Gamma_0 D_0 + A_0^{-1}A(L)Y_t + A_0^{-1}\varepsilon_t \qquad (8)$$

or

$$Y_t = \Pi_0 D_0 + \Pi_1(L)Y_t + \mu_t \qquad (9)$$

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

Monetary policy structural shocks are generated from $\mu_t = A_0^{-1}\varepsilon_t$. Specifically, monthly monetary policy shocks are computed by mapping the residual from the reduce form VAR, ε_t with contemporaneous matrix A_0. Then, the monthly structural shocks are cumulated within year in order to compute the annual monetary policy shock.

DYNAMIC PANEL DATA

The firm-level equity returns in current year can also be explained by its past returns[4]. 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:

$$r_{it} = \sum_{j=1}^{p} \alpha_j r_{i,t-j} + \beta_1' X_t + \beta_2' X_{it} + \delta_1' W_t + \eta_i + \nu_{it}$$

for $i = 1,....,N$ and $t = 1,....,T$ (10)

where, r_{it} is the firm stock return (excess return) as the dependent variable, $r_{i,t-j}$ is the lagged dependent variable (past excess returns), X_t and X_{it} are weakly exogenous (endogenous) or predetermined variables, and W_t is the strictly exogenous variable. In addition, it is assumed that the error term $(\varepsilon_{it} = \eta_i + \nu_{it})$ follows a one-way error component model, where η_i is an unobserved firm-specific time-invariant effect which allows for heterogeneity in the means of the r_{it} series across

[4] According to the weak form efficient market hypothesis (EMH), all past prices of a stock are reflected in today stock price. Therefore, the past return of the stock has also connected to the current stock return.

individuals where $\eta_i \sim IID(0, \sigma_\eta^2)$, and v_{it} is the stochastic disturbance term which is assumed independent across individuals, where $v_{it} \sim IID(0, \sigma_v^2)$.

The inclusion of the lagged dependent variables in equation (10) implies that there is correlation between the regressors and the error term since the lag of firm excess returns $r_{i,t-1}$ depends on $\varepsilon_{i,t-1}$. The present of lagged dependent variables, show that OLS, fixed effects and random effects are biased and inconsistent for fixed T as N gets large. Hence, due to this correlation, the dynamic panel data estimation in equation (10) suffers from Nickell (1981) bias, which disappears only if T is large or approaches to infinity. In order to deal with the endogeneity issue, this study used the generalized method of moments (GMM) estimators which was developed by Anderson and Hsiao (1982), Arellano and Bond (1991), Arellano and Bover (1995), and recently extended by Blundell and Bond (1998). This estimator is designed for dataset with a large number of individual observations (N) over a limited number of time periods (T).

INSTRUMENT CHOICE

In this study, the lagged dependent variable $(r_{i,t-j})$, X_t variables [domestic market return (rm_t), small minus big (SMB_t) and high minus low (HML_t)], and X_{it} variables [all firm financial characteristics namely the ratio of book value to market value $(BVMV)$, real sales growth $(RSALESG)$, debt-equity ratio and liquidity ratio] are all assumed to be endogenous variables. Therefore, the set of moment conditions can be written as following:

$$E\left[r_{i,t-s}\left(\varepsilon_{it}^*\right)\right] = 0 \quad for \quad t = 3,....T; s \geq 2 \tag{11}$$

$$E\left[X_{t-s}\left(\varepsilon_{it}^*\right)\right] = 0 \quad for \quad t = 3,....T; s \geq 2 \tag{12}$$

$$E\left[X_{i,t-s}\left(\varepsilon_{it}^*\right)\right] = 0 \quad for \quad t = 3,....T; s \geq 2 \tag{13}$$

Monetary policy shocks (domestic and international) are assumed to be strictly exogenous. In addition, since the Malaysian stock market is an emerging market and a relatively small market that is vulnerable to the international stock market, the international stock return (ir_t) is also considered as a strictly exogenous variable. Therefore, the additional set of moment condition is:

$$E\left[W_{t-s}\left(\varepsilon_{it}^*\right)\right] = 0 \quad for \quad t = 1,2,3,4,...,T; s = 0 \tag{14}$$

Where, W_t is a strictly exogenous variable (monetary policy shocks and international market return). Equation (14) indicates that the complete series of $W_t' = (W_{t1}, W_{t2}, ..., W_T)$ become valid instruments in each of the transformed equations. Equation (11)-(14) shows that the endogenous variables in the transformed equation will be instrumented with the lagged level of the regressors. The GMM estimator based on moment conditions in (11)-(14) is known as the difference GMM.

However, Alonso-Borrego and Arellano (1999) and Blundell and Bond (1998) show that if the lagged dependent and the explanatory variables are persistent over time or nearly a random walk, then 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 regressions in differences and in levels. In addition to the regression in differences, the instruments for the regression in levels are the lagged differences (transformed) of the corresponding instruments. Consequently, the extra moment conditions for the second part of the system, that is the regression in levels, can be written as follows:

$$E\left[r^*_{i,t-s}\left(\eta_i + v_{i,t}\right)\right] = 0 \quad for \quad s = 1; t = 3,4,...T \tag{15}$$

$$E\left[X^{*}{}_{t-s}\left(\eta_i + v_{i,t}\right)\right] = 0 \quad for \quad s = 1; t = 3,4,...T \tag{16}$$

$$E\left[X^{*}{}_{i,t-s}\left(\eta_i + v_{i,t}\right)\right] = 0 \quad for \quad s = 1; t = 3,4,...T \tag{17}$$

$$E\left[W^{*}{}_{t-s}\left(\eta_i + v_{i,t}\right)\right] = 0 \quad for \quad s = 0; t = 2,3,4,...T \tag{18}$$

By combining the set of moment conditions in the transformed equations (11)-(14) and in the levels equations (15)-(18), the system GMM can be constructed by stacking a system of $(T-2)$ transformed equations and $(T-2)$ untransformed equations, corresponding to periods $3,....,T$ for which instruments are observed.

However, as noted by Roodman (2009), the system GMM can generate moment conditions prolifically. Too many instruments in a system GMM overfits endogenous variables even as it weakens the Hansen test of the instruments' joint validity. Therefore, this study has used two main techniques in limiting the number of instruments, namely; (i) use only certain lags instead of all available lags for instruments, and (ii) combine instruments through addition into smaller sets by collapsing the block of the instrument matrix. These two techniques have been proposed by Beck and Levine (2004), Calderon et al. (2002), Cardovic and Levine (2005) and Roodman (2009).

In addition, this study uses a one-step and two-step system GMM in the baseline multifactor model. As argued by Baltagi (2008), the parameters are asymptotically similar if the ε_{it} is $i.i.d$. However, Bond (2002) stated that a one-step result is to be preferred to two-step results. This is 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 big. Therefore, Windmeijer (2005) has provided a bias correction for the standard errors in the two-step estimators. As noted by Windmeijer (2005), 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 are 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 adoption of appropriate instruments. Therefore, there are three specifications test 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, which tests the overall validity of the instruments by analyzing the sample analogue of the moments conditions used in the estimation process. If the moment condition holds, then the instrument is valid and the model has been correctly specified. Secondly, the serial correlation tests, that is there is no serial correlation in 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. Failure to reject the three null hypotheses gives support to the estimated model.

DATA SPECIFICATION AND DETECTING OUTLIERS

The data set is observed at a yearly frequency collected from various sources. The year-end firm's stock prices, KLCI and SP500 Index are collected from the Bloomberg database; the year-end firm's financial characteristics, namely, book-value-market-value, sales, liquidity and financial leverage are collected from Thompson Financial DataStream. All data sets are spanning from 1990 to 2008.

This study has focused on the main board publicly listed companies in the Malaysian Bourse. Currently, there are 650 companies listed in the main board which cover various sub-sectors of economy activity such as plantations (agriculture), property, consumer products, industrial products, services, technology and financial services. However, not all of the firms have been considered in this study. The firm-level data has refined by deleting some firms such as the financial firms and firms that have a data set covering less than 5 years. After refining the data, there are 449 firms in the sample.

In order to deal with the influential data points, DFITS statistics has been used 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 is computed as follows; $DFITS_j = r_j \sqrt{\frac{h_j}{1-h_j}}$, 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[5]. Belsley et al. (1980) suggest that a cut-off value of $\left|DFITS_j\right| > 2\sqrt{\frac{k}{N}}$ indicates highly influential observations, therefore the firms have to be removed from the regression model. By using DFITS statistics, there are 88 firms out of 449 firms or 19 percent of the firm observations are removed from the sample. Finally, we have 361 firms in this study (see Appendix 1 for the detailed firm by sub-sector category).

SPLITTING THE SAMPLE SIZE: FINANCIAL CONSTRAINTS AND LESS-CONSTRAINTS FIRMS

As argued earlier that there may be significant differences in the way that the monetary policy shocks affects firms' equity returns of financially constrained and less-constrained firm. Kaplan and Zingales (1997) defined the term 'financial constraint' as a wedge between internal and external financing of a firm investment. Firms with stronger financial constraints are those relatively more difficult to raise funds to finance investment.

In order to split the firm according to their constraints, the methodology proposed by Kaplan and Zingales (1997), Lamont et al.(2001) and Ehrman and Fratzscher (2004) is followed, which uses a direct measure of financial constraints, that is the cash flow to income ratio. The cash flow is measured as the sum of earnings before income tax (EBIT) and depreciation. In order to segment the constrained and less constrained firms, first the average value of the cash flow to income ratio was computed for each firm over all years. Then, the median values of this ratio are computed to generate the threshold level. A firm is considered constrained if the mean value of cash flow to income ratio is less than the median value and considered less constrained otherwise. According to this criterion, there are 181 financially constrained firms and 180 financially less-constrained firms. The hypothesis to test is that firms with a lower ratio of cash flow to income are affected more by monetary policy because they are more bank-dependent and bank-dependent borrowers are hit more strongly by a change in the supply of credit. In contrast, firms with large cash flows should be more immune to changes in interest rates as they can rely more on internal financing of investment.

EMPIRICAL RESULTS

Table 1 and Table 2 reports the estimation results of the dynamic augmented Fama and French (1992, 1996) multifactor model by using one-step and two-step system GMM estimation for the sub-sample of financially constrained and less-constrained firms.

As can be seen in Table 1 (one-step estimation), the stock returns of financially constrained firms are likely to be more affected by changes in interest rates than less-constrained firms. As argued earlier, this is because financially constrained firms have limited internal funds due to the credit constrains or inability to borrow, inability to issue equity, dependence on bank loan, or illiquidity of asset. Therefore, during the monetary tightening, they have to shrink their activity (for example, investment). A decrease in investment will also reduce the firms' sales, cash flow, and equity returns. A 100 basis point increase in domestic interest rates leads to a decrease in the stock returns of financially constrained firms by 13.5 percent, whereas for less-constrained firms the stock returns decrease by 4.1 percent. Since financially constrained firms have no access to international money

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[5] 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.

markets, their equity returns are not significantly affected by international monetary policy. In contrast, for less-constrained firms, they can access the international money market, and therefore their equity return will be affected by international monetary policy. In response to a one percent increase in international monetary policy, the stock returns for less-financially constrained firm decreases by 3.2 percent.

Table 2 reports the estimation results using two-step system GMM estimation. In general, the results are consistent with the baseline results (one-step system GMM estimation). As can be seen in Table 2, financially constrained firms respond significantly to domestic monetary policy shocks, but not to international monetary policy shocks. In contrast, financially less-constrained firm respond significantly to domestic and international monetary policy shocks. However, the effect of domestic monetary policy shocks upon the equity return of less-constrained firms' is smaller than financially constrained firms.

All the specification tests AR(2) and Hansen tests in Table 1 and Table 2 are also insignificant at least at the 10 percent significance level, which implies that there is no serial correlation among the residuals and that the instruments used in the one-step and two-step system GMM estimation are valid.

Robustness Checking[6]

For robustness checking, the baseline model in equation (10) has been re-estimated with various strategies, namely by using difference GMM (one-step and two-step estimation), various instrumental strategies (for example, using different assumptions about endogenous and pre-determined variables), and the combination of instruments with levels and differences equations. In general, the main results are robust, in which the effects of monetary policy shocks also vary according to financially constrained and less-constrained firms.

SUMMARY AND CONCLUSIONS

This study provides new empirical evidence about the effects of monetary policy shocks (domestic and international monetary policy) upon firm-level equity returns in Malaysia. A dynamic model of an augmented Fama and French (1992, 1996) multifactor model has been used in estimating the determinants of firm-level stock returns by focusing on the effects of monetary policy shocks upon financially constrained and less-constrained firms.

In general, the findings of the study have supported economic theory in that firm-level equity returns have responded negatively to the monetary policy shocks (domestic and international monetary policy). This finding gives three new directions on the importance of stock market effects in monetary policy analysis. First, the negative response of firm-level equity returns indicates that the monetary authority has a greater chance to influence economic activity through the stock market effects. Second, the significant effect of international monetary policy shock on firm-level equity return indicates the relevance of international risk factors (in particular international monetary policy) in influencing the firm-level stock returns. Third, the equity return of financially constrained firms is also significantly more affected by domestic monetary policy than less-constrained firms. This finding suggests that the asymmetric response of individual firms to monetary policy shocks is influenced by the different degree of financial constraints. Therefore, financial assistance (or capital injection) from the monetary authority may be necessary for helping firms during a monetary contraction.

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[6] The full results of robustness checking are available upon request.

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APPENDIX 1

TABLE 1: Number of Firm by Categorised

By sector	Before Detecting Outliers	After Detecting Outliers
Construction	33	24
Consumer Product	66	57
Hotel	04	03
Industrial Product	114	88
Infrastructure	06	06
Mining	01	01
Plantation	30	22
Property	76	61
REITS	01	01
Services	106	88
Technology	12	10
Total Firms	**449**	**361**

TABLE 1: Augmented Fama-French Multifactor Model by Financially constraint and less-constraint: System GMM Estimation (one step estimation)

	Financial constraint firm			Financial less-constraint firm		
Explanatory variable	coeff.	Robust std. error	p-value	coeff.	Robust std. error	p-value
Lagged Dependent Variable						
$r_{i,t-1}$	0.040	0.112	0.725	0.056	0.035	0.112
$r_{i,t-2}$	0.178	0.046	0.000***	0.051	0.039	0.195
Domestic Market Return	1.730	0.266	0.000***	1.554	0.180	0.000***
Small Minus Big (SMB)	2.573	0.645	0.000***	1.669	0.280	0.000***
High Minus Low (HML)	-0.171	0.283	0.547	0.026	0.254	0.919
International Market Return	0.168	0.149	0.260	0.147	0.089	0.099*
Domestic Monetary Policy Shocks	*-0.135*	*0.062*	*0.031***	*-0.041*	*0.013*	*0.002****
International Monetary Policy Shocks	*-0.009*	*0.077*	*0.221*	*-0.032*	*0.016*	*0.051**
Book-Value-Market Value	-0.019	0.044	0.664	-0.021	0.028	0.444
Lagged of Real sales growth	0.086	0.131	0.509	-0.021	0.104	0.837
Financial leverage	0.060	0.048	0.212	0.016	0.025	0.517
Liquidity	0.125	0.096	0.195	0.092	0.043	0.032**
Number of observations		1001			1169	
Observations per group		5.82			6.96	
Number of firms		172			168	
Number of instrument		28			28	
AR(2) –p-value		0.945			0.176	
Hansen test-p-value		0.672			0.500	

Note: *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent. Constant not included in order to save space.
The dependent variable is firm-level equity return (r_{it}) in terms of excess returns.
All *p-value* of the difference in Hansen tests of exogeneity of instruments subsets are also rejected at least at 10 percent significant level, but not 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 financially constraints and less-constraint firm.
The estimation also collapses the instruments matrix as proposed by Calderon et al. (2002) and Roodman (2009).

TABLE 2: Augmented Fama-French Multifactor Model by financially constrained and less-constrained: System GMM Estimation (two step estimation)

	Financial constraint firm			Financial less-constraint firm		
Explanatory variable	coeff.	corrected std. error	p-value	coeff.	corrected std. error	p-value
Lagged Dependent Variable						
$r_{i,t-1}$	0.151	0.053	0.004***	0.043	0.037	0.248
$r_{i,t-2}$	0.211	0.044	0.000***	0.039	0.039	0.303
Domestic Market Return	1.654	0.249	0.000***	1.479	0.161	0.000***
Small Minus Big (SMB)	2.679	0.597	0.000***	1.552	0.268	0.000***
High Minus Low (HML)	-0.181	0.272	0.507	0.004	0.229	0.984
International Market Return	0.146	0.131	0.265	0.160	0.080	0.045**
Domestic Monetary Policy Shocks	*-0.118*	*0.060*	*0.049***	*-0.039*	*0.012*	*0.001****
International Monetary Policy Shocks	*-0.007*	*0.007*	*0.315*	*-0.038*	*0.015*	*0.013***
Book-Value-Market Value	-0.012	0.042	0.775	-0.014	0.028	0.620
Lagged of Real sales growth	0.084	0.124	0.498	-0.107	0.119	0.370
Financial leverage	0.008	0.024	0.746	0.013	0.018	0.484
Liquidity	0.045	0.043	0.294	0.109	0.042	0.009***
Number of observations		1001			1169	
Observations per group		5.82			6.96	
Number of firms		172			168	
Number of instrument		28			28	
AR(2) –p-value		0.786			0.280	
Hansen test-p-value		0.672			0.500	

Note: *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent. Constant not included in order to save space.
The dependent variable is firm-level equity return (r_{it}) in terms of excess returns. All *p-value* of the difference in Hansen tests of exogeneity of instruments subsets are also rejected at least at 10 percent significant level, but not 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 financially constrainted and less-constrained firm.
The estimation also collapses the instruments matrix as proposed by Calderon et al. (2002) and Roodman (2009).
The two-step estimations are based on Windmeijer (2005).