

## Monetary Policy Shocks and Firm-Level Equity Returns: A Panel Data Study of Malaysia

Zulkefly Abdul Karim  
Mohd. Azlan Shah Zaidi  
School of Economics  
Faculty of Economics and Management  
University Kebangsaan Malaysia  
43600 Bangi, Selangor,  
Malaysia

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

### ABSTRACT

This paper investigates the effect of monetary policy shocks (domestic and international monetary policy) on Malaysian firm-level equity returns in a dynamic panel data framework. The results of the study revealed that firms' stock returns have responded negatively to monetary policy shocks. Interestingly, the effect of domestic monetary policy shocks also have differential effects, having a statistically significant impact on small firms' equity returns, but not on large firms' stock returns. The effect of monetary policy shocks also varies according to the subsector of the economy in which firms are operating. The effect of international monetary policy upon equity returns is also heterogeneous by firm size and subsector of economic activity.

Keywords: Monetary policy shocks; firm's stock return; dynamic panel data; augmented Fama-French multifactor model  
JEL: E52, G12, CO1

### INTRODUCTION

This paper aims to provide empirical evidence on the effect of monetary policy shocks upon stock returns in an emerging market economy. Specifically, this study investigates 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 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. Therefore, this study improves upon the previous studies by measuring monetary policy shocks using an identified VAR (SVAR) approach. Second, although Allen and Cleary (1998), Clare and Priestley (1998), Lau et al. (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 the 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, in particular 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 and subsectors of economic activity.

The results of the study indicate that 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 have responded more to international monetary policy shocks than domestic monetary policy. Domestic monetary policy shocks also have differential effects, having a statistically significant impact on small firms' equity returns, but not on large firms' stock returns. The effect of monetary policy shocks also varies by subsector of the economy in which firms are operating.

The remainder of the paper is organized as follows. Section 2 briefly reviews the previous literature that considers the identification of monetary policy, and the heterogeneity of monetary policy effects upon firm-level equity return. Section 3 explains the estimation procedures, which include the augmented Fama and French (1992, 1996) multifactor model, dynamic panel data framework, and data specification. Section 4 presents the main empirical results, and finally, section 5 summarizes and concludes.

## REVIEW OF THE LITERATURE

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

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

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

It is generally believed that individual stock returns react differently to monetary policy according to their size (small and large firms), subsector economic activity, and financially constrained and less-constrained firms. Therefore, understanding why individual stock returns react so differently to monetary policy is an interesting issue to investigate. For example, Bernanke and Blinder (1992) and Kashyap et al. (1993) argued that a contraction of monetary policy predominantly affects firms that are heavily dependent on bank loans, as banks respond to a monetary contraction by shrinking their overall supply of credit<sup>1</sup>. 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 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

---

<sup>1</sup> Agency costs are usually assumed to be smaller for large firms because of the economies of scale in collecting and processing information about their situation. As a result, large firms can more easily finance directly from financial markets and are less dependent on bank loans.

reduce their credit lines and small firms have difficulty in finding alternative sources of financing, which should lead to a constraint of the supply of their goods.

On the other hand, the response to monetary policy shocks also differs across firms according to the subsector of economic activity. Peersman and Smets (2005) and Dedola and Lippi (2005) have provided three possible reasons for the differential response of monetary policy across economic subsectors<sup>2</sup>. First, the interest-sensitivity of the demand for products differs across firms. For example, firms that produce goods for which demand is highly cyclical or interest-sensitive should see their expected future earnings affected relatively more following a monetary policy change. Second, changes in the cost of capital induced by monetary policy are more important for capital-intensive industries. Third, if monetary policy affects exchange rate, tradable goods industries are likely to be affected more strongly. All these factors imply that expected future earnings are affected in a heterogeneous way across industries in response to monetary policy changes, which should be reflected in the responsiveness of stock returns. Therefore, we can expect equity returns of firms in cyclical industries, capital-intensive industries, and industries that are relatively open to trade to be affected more strongly by monetary policy shock (Ehrmann and Fratzscher, 2004).

Ehrmann and Fratzscher (2004), using a multifactor model in panel-corrected standard error approach, found that the firms' stock return reacts differently to the US monetary policy shocks. Changes in monetary policy are measured by the unexpected component of the FOMC announcements on the days of policy decisions. Specifically, the industrial sectors that are cyclical and capital-intensive (for example, technology, communications, and cyclical consumer goods) often react two to three times more strongly to the US monetary policy shocks than non-cyclical industries. The effect of monetary policy shocks also differs by firm size: small firms, based on either the number of employees or the market value of the firm, have a stronger reaction to monetary policy shocks than medium-sized and large firms. In addition, by using various measures of financial constraints<sup>3</sup>, they also found that firms that are financially constrained with low cash flow, poor credit ratings, low debt-to-capital ratio, high price-earning ratio, and high Tobin's q have responded significantly more to monetary policy than less-constrained firms.

## ESTIMATION PROCEDURES

### Augmented Fama and French Multifactor Model

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 has been expressed in terms of excess returns ( $r_{it}$ ) as follows:

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

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

<sup>2</sup> Ganley and Salmon (1997) and Hayo and Uhlenbrock (2000) have also found the cross-industry heterogeneity of the impact of monetary policy shocks in UK and Germany, respectively.

<sup>3</sup> Ehrmann and Fratzscher (2004) used more direct measures of financial constraints, namely the cash flow-to-income ratio, the ratio of debt to total capital, and Moody's investment and bank loan rating. In theory, firms with large cash flow should be immune to changes in interest rates as they can rely more on internal financing of investment. Firms with a lower ratio debt to capital are affected more by monetary policy because they are more bank-dependent.

## 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;

$$rm_t = \left( \frac{KLCI_t - KLCI_{t-1}}{KLCI_{t-1}} \right) - RF_t \quad [2]$$

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

$$ir_t = \left( \frac{SP500_t - SP500_{t-1}}{SP500_{t-1}} \right) - USTB_t \quad [3]$$

Where, *USTB* in the 12 months US Treasury Bill rate is a proxy for a risk-free asset.

### Firms' financial characteristics

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

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:

$$RSALESG_{it} = \left[ \frac{rsales_{i,t} - rsales_{i,t-1}}{rsales_{i,t-1}} \right] \quad [4]$$

### Monetary Policy Shocks

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

$$A_0 Y_t = \Gamma_0 D_0 + A(L) Y_t + \varepsilon_t \quad [5]$$

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  $[LOIL \ LYUS \ FFR \ LYM \ INF \ IBOR]^T$ , that is the vector of system variables, where *LOIL* is

log of world oil price (world average crude price of petroleum in US \$ per barrel),  $LYUS$  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  $\varepsilon_t = [\varepsilon_{loil} \ \varepsilon_{lyus} \ \varepsilon_{ffr} \ \varepsilon_{lym} \ \varepsilon_{inf} \ \varepsilon_{ibor}]$  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, 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,  $\varepsilon_t$  with contemporaneous matrix  $A_0$ . Then, monthly structural shocks are cumulated within a year in order to compute the annual monetary policy shock. The expected sign of monetary policy shocks on equity returns is negative, which indicates that firm-level equity returns will decrease in response to a 100 basis point increase in policy rates.

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

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

[6]

In Equation [6], there are two types of risk-free interest rates, namely the Malaysian twelve-month Treasury Bill rate ( $RF$ ), and the US twelve-month Treasury Bill rate ( $USTB$ ). Therefore, Equation [6] can be re-expressed in terms of excess return<sup>4</sup> as follows:

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

[7]

## DYNAMIC PANEL DATA

The firm-level equity return in the current year can also be explained by its past returns<sup>5</sup>. 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 [7] can be rewritten as follows:

$$r_{it} = \alpha_{ij} r_{i,t-1} + \beta'_1 X_t + \beta'_2 X_{it} + \delta'_1 W_t + \eta_i + v_{it}$$

<sup>4</sup> 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.

<sup>5</sup> According to the weak form efficient market hypothesis (EMH), all past prices of a stock are reflected in today's stock price. Therefore, the past return of the stock is also connected to the current stock return.

$$\text{for } i = 1, \dots, N \text{ and } t = 1, \dots, T \quad [8]$$

Where,  $r_{it}$  is the firm stock return (excess return) as a dependent variable,  $r_{i,t-1}$  is the lagged dependent variable,  $X_t$  is 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 ( $\varepsilon_{it} = \eta_i + v_{it}$ ) follows the one-way error component model, where  $\eta_i$  is an unobserved firm-specific time-invariant effect which 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, where  $v_{it} \sim IID(0, \sigma_v^2)$ .

In equation [8], the lagged values of firm excess return,  $r_{i,t-1}$  are correlated with the firm-specific effect ( $\eta_i$ ). This is because, since  $r_{i,t}$  is a function of ( $\eta_i$ ), it immediately follows that  $r_{i,t-1}$  is also a function of ( $\eta_i$ ). Arellano and Bover (1995) proposed a forward orthogonal deviation transformation or forward Helmert's procedure to eliminate the firm-specific effect. This transformation method essentially subtracts the mean of future observations available in the sample from the first  $T - 1$  observations, and its main advantage is that it preserves sample size in panels with gaps<sup>6</sup>.

However, transforming equation [8] using forward orthogonal deviation introduces a new bias which is the correlation between the transformed error terms with the transformed lagged dependent variable. Similarly, the transformation of explanatory variables also becomes potentially endogenous because they are related to the transformed error term. Therefore, three assumptions can be made regarding the explanatory 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 either current, past or future error.

However, Alonso-Borrego and Arellano (1999) and Blundell and Bond (1998) showed that, in the case of lagged dependent, the explanatory variables are persistent over time or nearly a random walk; therefore, lagged levels of these variables are weak instruments for the regression equation in differences. This happens either as the autoregressive parameter ( $\alpha$ ) approaches unity, or as the variance of the individual effects ( $\eta_i$ ) increases relative to the variance of the idiosyncratic error ( $v_{it}$ ). 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.

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

---

<sup>6</sup> According to Roodman (2009), 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. Hayakaya (2009) argued that, by using a Monte Carlo simulation study, the GMM estimator of the model transformed by the forward orthogonal deviation tends to work better than when transformed by the first difference.

Hansen statistic generated from the system GMM and the difference GMM. Therefore, failure to reject the three null hypotheses gives support to the estimated model.

## DATA SPECIFICATION

The data set is of yearly frequency collected from various sources. The year-end firm stock prices, KLCI and SP500 Index are collected from Bloomberg database; meanwhile the year-end firm financial characteristics such as book-value-market-value, sales, liquidity and financial leverage are collected from Thompson Financial DataStream; all data sets span the period from 1990 to 2008.

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

## DETECTING OUTLIERS

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

and excluding that observation. The DFITS statistics are computed as follows;  $DFITS_j = r_j \sqrt{\frac{h_j}{1-h_j}}$ ,

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<sup>7</sup>. Belsley et al. (1980) suggest that a cut-off value of

$|DFITS_j| > 2\sqrt{\frac{k}{N}}$  indicates highly influential observations; therefore, these firms have to be

removed from the regression model. By using DFITS statistics, 88 firms out of 449 firms or 19 per cent of the firm observations are removed from the sample. Finally, we have 361 firms in this study (see Table 2 for the detailed firm by subsector categories).

In addition to DFITS statistics, we can also detect the outliers on one regressor by using DFBETA statistics. The DFBETA for regressor  $\ell$  measures the distance that this regression coefficient would shift when the  $j_{th}$  observation is included or excluded from the regression, scaled by the estimated standard error of the coefficient (Baum, 2006). The DFBETA statistics are computed

as follows:  $DFBETA_j = \frac{r_j v_j}{\sqrt{v^2(1-h_j)}}$ , where the  $v_j$  are the residuals obtained from the partial

regression of  $x_\ell$  on the remaining columns of  $X$ , and  $v^2$  is their sum of squares. Belsley et al. (1980) suggest a cut-off value of  $|DFBETA_j| > 2\sqrt{N}$  for the highly influential observations.

<sup>7</sup> The value of leverage ( $h_j$ ) is computed from the diagonal elements of the 'hat matrix' as follows:

$$(h_j) = x_j (X'X)^{-1} x_j', \text{ where } x_j \text{ is the } j\text{th row of the regressor matrix.}$$

## SPLITTING THE SAMPLE SIZE

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

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

In addition, this study also examines the effect of monetary policy shocks on different subsectors of economic activity. However, not all of the subsectors in the economy can be considered in estimating the dynamic multifactor model due to there being insufficient observations<sup>8</sup>. Therefore, this study only examines four subsectors of economic activity, namely industrial products, consumer products, property and the services sector.

## EMPIRICAL RESULTS

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

### Whole sample

As can be seen in Table 3, for the whole-sample estimation, firm-level stock returns are statistically and significantly influenced by the lagged dependent variable, domestic market returns, small minus big, international market returns, monetary policy shocks (domestic and international), and several firm financial characteristics variables, namely the ratio of book value to market value (BVMV) and liquidity. The contemporaneous effect of domestic monetary policy shocks is negatively and statistically significant, at least at the 10 per cent significance level, in influencing the firm-level stock returns. A 100 basis point (one percentage point) increase in the domestic inter-bank overnight rate (IBOR) leads to a 4.5 per cent decrease in firms' stock returns. The negative reaction of firms' stock returns to monetary policy tightening is also consistent with the standard economic theory prediction.

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

As stated before, the validity of the system GMM depends on the three specification tests, namely the AR(2) test for serial correlation, the Hansen test for testing the validity of instrument adopted, and the difference in Hansen tests. As can be seen from Table 3 (column 1), the p-values for the AR (2) and Hansen tests are higher and statistically insignificant, at least at the ten per cent significance level. This result implies that the empirical model has been correctly specified due to there being no serial correlation (autocorrelation) in the residuals; also, the instruments used in the models are valid. In addition, the difference in the Hansen tests are also statistically insignificant in all models, which indicates that the validity of additional moment conditions.<sup>9</sup>

<sup>8</sup> The standard rule of thumb to estimate dynamic panel data is large cross-section (N) observation, which is at least 50, and short time series observation.

<sup>9</sup> The difference in Hansen test has not been reported in the Table 1 in order to save space. However, the results are available upon request.



## **HETEROGENEITY OF MONETARY POLICY EFFECTS: SUBSAMPLE RESULTS**

### **Large and small firms**

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

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

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

### **SUBSECTORS OF ECONOMIC ACTIVITY**

Table 4 reports the effects of monetary policy shocks upon stock returns in subsectors of the economy. Four subsectors have been considered, namely consumer products, industrial products, property and services. As can be seen in Table 4, the effect of monetary policy upon equity returns varies across industries, as some industries are significantly affected by monetary policy shocks while others are not. Domestic and international monetary policies are statistically insignificant in influencing the stock returns of firms in the consumer products and services sectors. In contrast, stock returns of firms in the industrial products sector are significantly affected by monetary policy shocks (domestic and international monetary policy). A one percentage point increase in domestic monetary policy leads to a decrease in industrial firms' stock returns by 3.2 per cent. However, the effect of international monetary policy shocks on industrial firms' stock returns is larger than that of domestic monetary policy, as the stock returns decline by 9.1 per cent in response to the shock. This suggests that the stock returns of firms in the industrial products sector are more sensitive to international monetary policy shocks than to domestic monetary policy. Ehrmann and Fratzscher (2004) have suggested that this is because the industrial products are a tradable goods industry (open to trade or export-oriented industry) and a capital-intensive industry, and are therefore very sensitive to the interest rates changes. International monetary policy shock is also statistically significant in influencing stock returns of firms in the property sector, whereas domestic monetary policy is not significant.

All specification tests in terms of AR(2) for serial correlation and the Hansen test are also statistically insignificant, at least at the 10 per cent significance level, which indicates that there is no serial correlation and that the instruments adopted in the model are valid.

## SUMMARY AND CONCLUSIONS

Although the effect of monetary policy shocks on stock market returns has been heavily studied at the macro level, less attention has so far been given to examining the impact of monetary policy shocks on firm-level stock returns, particularly in an emerging market economy. Therefore, this paper extends the existing literature by providing 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) and subsectors of the economy. In addition, the role of international market returns and several firm financial characteristics variables have also been considered in estimating the determinants of firm-level stock returns.

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

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

## REFERENCES

- Allen, D. E. & Cleary, F. (1998). Determinants of cross-section of stock returns in the Malaysian stock market. *International Review of Financial Analysis*, 7, 253-275.
- Alonso-Borrego, C. & Arellano, M. (1999). Symmetrically normalized instrumental variable estimation using panel data. *Journal of Business & Economic Statistics*, 17, 36-49.
- Amisano, G. & Giannini, C. (1996). *Topics in structural VAR econometrics*, Berlin, Springer.
- Arellano, M. & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58, 277-297.
- Arellano, M. & Bover, O. (1995). Another look at the instrumental-variable estimation of error-components models. *Journal of Econometrics*, 68, 29-52.

- Basistha, A. & Kurov, A. (2008). Macroeconomic cycles and stock market's reaction to monetary policy. *Journal of Banking & Finance*, 32, 2606-2616.
- Baum, C. F. (2006). *An introduction to modern econometric using stata*, College Station, Texas, A Stata Press Publication, StataCorp LP.
- Belsley, D. A. (1991). *Conditioning diagnostics: Collinearity and weak data in regression*, New York, Wiley.
- Belsley, D. A., Kuh, E. & Welsch, R. E. (1980). *Regressions Diagnostics : Identifying influential data and sources of collinearity*, New York, Wiley.
- Bernanke, B. S. & Blinder, A. S. (1992). The federal funds rate and the channel of monetary transmission. *The American Economic Review*, 82, 901-921.
- Bernanke, B. S. & Kuttner, K. N. (2005). What explains the stock market's reaction to the Federal Reserve policy? *The Journal of Finance*, 60, 1221-1257.
- Bjørnland, H. C. & Leitemo, K. (2009). Identifying the interdependence between US monetary policy and the stock market. *Journal of Monetary Economics*, 56, 275-282.
- Blundell, R. & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.
- Bredin, D., Hyde, S., Nitzsche, D. & O'reilly, G. (2007). UK stock returns and the impact of domestic monetary policy shocks. *Journal of Business Finance & Accounting*, 34, 872-888.
- Bredin, D., Hyde, S., Nitzsche, D. & O'reilly, G. (2009). European monetary policy surprises: The aggregate and sectoral stock market response. *International Journal of Finance and Economics*, 14, 156-171.
- Calderon, C. A., Chong, A. & Loayza, N. V. (2002). Determinants of current account deficits in developing countries. *Contribution to Macroeconomics*, 2, 1-31.
- Caporale, G. M., Cipollini, A. & Demetriades, P. O. (2005). Monetary policy and the exchange rate during the Asian crisis: identification through heteroscedasticity. *Journal of International Money and Finance*, 24, 39-53.
- Christiano, L. J., Eichenbaum, M. & Evans, C. (1996). The effects of monetary policy shocks: Evidence from the flow of funds. *Review of Economics and Statistics*, 78, 16-34.
- Clare, A. D. & Priestley, R. (1998). Risk factors in the Malaysian stock market. *Pacific-Basin Finance Journal*, 6, 103-114.
- Conover, C. M., Jensen, G. R. & Johnson, R. R. (1999). Monetary environments and international stock returns. *Journal of Banking & Finance*, 23, 1357-1381.
- Dedola, L. & Lippi, F. (2005). The monetary transmission mechanism: Evidence from the industries of five OECD countries. *European Economic Review*, 49, 1543-1569.
- Ehrmann, M. & Fratzscher, M. (2004). Taking Stock: Monetary policy transmission to equity markets. *Journal of Money, Credit, and Banking*, 36, 719-737.
- Ehrmann, M. & Fratzscher, M. (2006). Global financial transmission of monetary policy shocks. *European Central Bank (ECB) Working Paper No. 616*. Frankfurt, Germany: European Central Bank (ECB).
- Fama, E. F. & French, K. R. (1992). The cross-section of expected stock returns *The Journal of Finance*, XLVII, 427-465.
- Fama, E. F. & French, K. R. (1996). Multifactor explanations of asset pricing anomalies. *The Journal of Finance*, 51, 55-84.
- Ganley, J. & Salmon, C. (1997). The industrial impact of monetary policy shocks: some stylised facts. *Bank of England 1997, Working Paper*. London: Bank of England.
- Grinblatt, M. & Moskowitz, T. J. (2004). Predicting stock price movements from past returns: the role of consistency and tax-loss selling. *Journal of Financial Economics*, 71, 541-579.
- Habibullah, M. S. & Baharumshah, A. Z. (1996). Money, output and stock prices in Malaysia: an application of cointegration tests. *International Economic Journal*, 10, 317-333.
- Hayakawa, K.. (2009). First difference or forward orthogonal deviations- which transformation should be used in dynamic panel data models?: a simulation study. *Economics Bulletin*, 29, 1-9.
- Hayo, B. & Uhlenbrock, B. (2000). Industry effects of monetary policy in Germany. In: Hagen, J. V. & Waller, C. (eds.) *Regional Aspects of Monetary Policy in Europe*. Boston: Kluwer.
- Ibrahim, M. H. (1999). Macroeconomics variables and stock prices in Malaysia: an empirical analysis. *Asian Economic Journal*, 13, 219-231.
- Ibrahim, M. H. & Aziz, H. (2003). Macroeconomics variables and the Malaysian equity market. *Journal of Economic Studies*, 30, 6-27.
- Jegadeesh, N. (1990). Evidence of predictable behavior of security returns. *The Journal of Finance*, 45, 881-898.

- Jegadeesh, N. & Titman, S. (1993). Returns to buying winners and selling losers: implications for stock market efficiency. *The Journal of Finance*, XLVIII, 65-91.
- Jensen, G. R. & Johnson, R. R. (1995). Discount rate changes and security returns in the U.S., 1962-1991. *Journal of Banking & Finance*, 19, 79-95.
- Jensen, G. R. & Mercer, J. M. (2002). Monetary policy and the cross-section of expected stock return. *The Journal of Financial Research*, XXV, 125-139.
- Kashyap, A. K., Stein, J. C. & Wilcox, D. W. (1993). Monetary policy and credit conditions: evidence from the composition of external finance. *American Economic Review*, 83, 78-98.
- Kuttner, K. N. (2001). Monetary policy surprises and interest rates: Evidence from the Fed funds futures market. *Journal of Monetary Economics*, 47, 523-544.
- Lastrapes, W. D. (1998). International evidence on equity prices, interest rates and money. *Journal of International Money and Finance*, 17, 377-406.
- Lau, S. T., Lee, C. T. & Mcinish, T. H. (2002). Stock returns and beta, firms size, E/P, CF/P, book-to-market, and sales growth: evidence from Singapore and Malaysia. *Journal of Multinational Financial Management*, 12, 207-222.
- Patelis, A. D. (1997). Stock return predictability and the role of monetary policy. *The Journal of Finance*, 52, 1951-1972.
- Peersman, G. & Smets, F. (2005). The industry effects of monetary policy in the Euro area. *The Economic Journal*, 115, 319-342.
- Perez-Quiros, G. & Timmermann, A. (2000). Firm size and cyclical variations in stock returns. *Journal of Finance*, 55.
- Rapach, D. E. (2001). Macro shocks and real stock prices. *Journal of Economics and Business*, 53, 5-26.
- Rigobon, R. (2003). Identification through heteroscedasticity. *The Review of Economics and Statistics*, 4, 777-792.
- Rigobon, R. & Sack, B. (2004). The impact of monetary policy on asset prices. *Journal of Monetary Economics*, 51, 1553-1575.
- Roodman, D. (2009). Practitioners' Corner: A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71, 135-158.
- Shaharudin, R. S. & Fung, H. S. (2009). Does size matter? A study of size effect and macroeconomic factors in Malaysian stock returns. *International Research Journal of Finance and Economics*, 101-16.
- Thorbecke, W. (1997). On stock market return and monetary policy. *The Journal of Finance*, 52, 635-654.
- Wang, J., Meric, G., Liu, Z. & Meric, I. (2009). Stock market crashes, firm characteristics, and stock returns. *Journal of Banking & Finance*, 33, 1563-1574.

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	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.

Table 2: Number of Firms by Categorisation

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

TABLE 3: 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									
$r_{i,t-1}$	0.032	0.042	0.445	0.076	0.036	0.036**	0.108	0.038	0.005***
$r_{i,t-2}$	0.043	0.018	0.015**	0.065	0.031	0.037**	0.161	0.038	0.000***
Domestic Market Return	1.099	0.049	0.000***	1.201	0.1556	0.000***	1.316	0.133	0.000***
Small Minus Big (SMB)	0.963	0.077	0.000***	0.603	0.204	0.003***	1.849	0.266	0.000***
High Minus Low (HML)	0.064	0.108	0.556	-0.027	0.299	0.928	-0.343	0.217	0.113
International Market Return	0.297	0.044	0.000***	0.143	0.060	0.018**	0.132	0.095	0.000***
Domestic Monetary Policy Shocks	-0.045	0.026	0.090*	-0.004	0.011	0.706	-0.087	0.051	0.091*
International Monetary Policy Shocks	-0.080	0.131	0.000***	-0.062	0.025	0.014**	-0.032	0.022	0.136
Book-Value-Market Value	0.137	0.0226	0.000***	0.003	0.031	0.909	0.105	0.038	0.006***
Lagged of real sales growth	0.007	0.009	0.453	0.033	0.011	0.002***	0.002	0.006	0.798
Financial leverage	0.011	0.009	0.191	0.018	0.030	0.554	-0.011	0.017	0.521
Liquidity	0.035	0.015	0.026**	0.031	0.042	0.458	-0.036	0.032	0.256
Number of observations		2695			1297			952	
Observations per group		7.86			7.67			5.50	
Number of firms		343			169			173	
Number of instrument		274			105			97	
AR(1) -p-value		0.000			0.000			0.000	
AR(2) -p-value		0.441			0.686			0.324	
Hansen test-p-value		0.203			0.153			0.318	

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

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

Instrument for orthogonal deviation equation:

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

The estimation also collapses the instruments matrix as proposed by Calderon et al. (2002) and Roodman (2009) except for the whole sample.

TABLE 4: Augmented Fama-French Multifactor Model by Subsector of Economy: System GMM Estimation (one-step estimation)

Explanatory variable	Consumer product			Industrial product			property			services		
	coef.	Robust std. error	p-value	coeff.	Robust std. error	p-value	coef.	Robust std. error	p-value	coeff.	Robust std. error	p-value
Lagged Dependent Variable												
$r_{i,t-1}$	0.088	0.063	0.160	0.086	0.036	0.018**	0.156	0.057	0.006***	0.008	0.084	0.919
$r_{i,t-2}$	-	-	-	-	-	-	0.174	0.050	0.000***	0.132	0.072	0.068*
Domestic Market Return	1.021	0.176	0.000***	1.318	0.116	0.000***	1.411	0.282	0.000***	1.187	0.166	0.000***
Small Minus Big (SMB)	0.957	0.288	0.001***	0.630	0.258	0.015**	1.624	0.310	0.000***	0.906	0.342	0.008***
High Minus Low (HML)	0.331	0.333	0.321	-1.163	0.312	0.000***	0.696	0.469	0.138	0.578	0.764	0.449
International Market Return	0.027	0.103	0.794	0.143	0.118	0.227	0.276	0.144	0.055*	0.050	0.136	0.717
Domestic Monetary Policy Shocks	-0.061	0.065	0.314	-0.032	0.012	0.008***	-0.064	0.083	0.444	-0.008	0.020	0.665
International Monetary Policy Shocks	-0.003	0.021	0.872	-0.091	0.025	0.000***	-0.073	0.041	0.081*	-0.002	0.009	0.849
Book-Value-Market Value	-0.014	0.024	0.558	0.000	0.026	1.000	0.009	0.051	0.859	-0.006	0.094	0.949
Lagged of Real sales growth	0.238	0.139	0.088*	-0.032	0.069	0.642	0.015	0.039	0.692	0.032	0.035	0.354
Financial leverage	-0.059	0.035	0.093*	0.013	0.028	0.635	0.012	0.030	0.700	0.103	0.089	0.249
Liquidity	-0.044	0.061	0.468	-0.033	0.048	0.497	0.022	0.058	0.712	0.034	0.054	0.535
Number of observations		362			546			398			567	
Observations per group		6.70			6.66			6.86			6.83	
Number of firms		54			82			58			83	
Number of instrument		28			44			28			36	
AR(1) -p-value		0.001			0.000			0.000			0.000	
AR(2) -p-value		0.793			0.735			0.251			0.258	
Hansen test-p-value		0.610			0.135			0.125			0.520	

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

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

**Instrument for orthogonal deviation equation:**

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

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