How do Banks' Stock Returns Respond to Monetary Policy Committee Announcements in Turkey?

Evidence from Conventional and Unconventional Policy Episodes

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Abstract

Using a methodology that is robust to endogeneity and omitted variables problems, it is found that the stock returns of all banks that are listed in Istanbul Stock Exchange respond significantly to the monetary policy surprises on Monetary Policy Committee (MPC) meeting days prior to May 2010. It is also shown that stock returns of banks for which interest payments constitute an important share in their balance sheets respond more aggressively to the changes in policy rates. Finally, the estimation results suggest that since the Central Bank of the Republic of Turkey has started adopting an unconventional monetary policy regime in May 2010, with various instruments and flexible timing, aggregate and individual bank indices have not responded significantly to the surprises on MPC meeting days.

Keywords: Monetary Policy; Stock Market; Banking System, Emerging Markets; Identification through Heteroscedasticity

JEL Classification: E43; E44; E52

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1. Introduction

Measurement of the reaction of asset prices to monetary policy changes is complicated due to endogeneity and omitted variables bias problems. In the literature, to overcome these problems, the most commonly adopted estimation method is the event study (ES) approach.[1] Rigobon and Sack (2004) (henceforth, RS) develop and use the heteroscedasticity-based estimation technique as an alternative to the event study (ES) approach. This technique is considered more reliable as it is valid under much weaker assumptions.[2] The results from the heteroscedasticity-based estimation in RS suggest a significant negative impact of monetary policy on stock indices in the United States. Recently, an increasing number of studies have investigated the impact of monetary policy on stock indices using the heteroscedasticity-based methods and find similar results with RS (See Ehrmann et al. (2011) for the United States and the Euro Area; Bohl et al. (2008) for the largest four European countries and Kholodilin et al. (2009) for all the European countries). Rosa (2011) documents the effects of changes in US monetary policy on stock prices in 51 countries.

Studies using the heteroscedasticity-based methods developed by RS as an alternative to the ES approach are rare for emerging markets.[3] The aim of this study is to measure the response of individual banks' stock returns to monetary policy in Turkey, using the heteroscedasticity-based GMM method suggested by RS and then relate the results to some bank specific characteristics. Duran et al. (2012) find that an increase in the policy rate leads to a decline in aggregate stock indices. In addition, monetary policy has the greatest impact on the financial sector index, 70 percent of which consists of bank stocks. As a complement to Duran et al. (2012), focusing on the sample period prior to May 2010, we show that an increase in the policy rate leads to a significant decline in all of the individual banks' stock prices that are listed in the Istanbul Stock Exchange (ISE). We also detect heterogeneity in this response. Intuitively, we provide evidence which suggests that banks that are dependent on money market funding and which incur higher interest rate payments are more likely to give larger response to the monetary policy surprises.

The conduct of monetary policy in Turkey has changed considerably in May 2010. Central Bank of the Republic of Turkey (hereafter CBRT) had implemented a traditional inflation targeting policy until then. In this period, sole objective of the CBRT was to keep inflation low and at stable levels. We name the period before May 2010 as "the conventional monetary policy episode". However, the global financial

[1] This method basically compares asset prices immediately after monetary policy announcements with those immediately before, and attributes the changes to monetary policy surprises. For details and two notable examples using the ES approach, see Kuttner (2001) and Gürkaynak et al. (2005).
[2] For a comparison of assumptions under the ES and the GMM approaches, see Rigobon and Sack (2004).
[3] Duran et al. (2012) focuses on the aggregate stock indices in Turkey. Rezessy (2005) and Goncalves and Guimaraes (2011) apply the heteroskedasticity-based methodology to the asset prices in Hungary and Brazil, respectively.

crisis, erupted with the collapse of the Lehman Brothers in 2008, has changed the shape of the central banking. As the financial crisis deepened, interest rates in advanced economies have declined following the very low or negative growth rates. On the other hand, interest rates in emerging markets were relatively high and their economic growth prospects were strong. In such an environment liquidity released by advanced economies' central banks was channeled to emerging markets. This caused overvaluation of domestic currencies, rapid growth in domestic credits and current account imbalances. Therefore, many emerging market central banks including Turkey have been forced to modify their monetary policy approach to cope with the challenges caused by the excessive capital inflows. In 2010, CBRT has begun to reshape its monetary policy. In order to discourage volatile short-term capital inflows and excessive credit growth, CBRT has increasingly used a policy mix composed of an interest rate corridor, reserve requirements and a liquidity policy.[4] We name the period after May 2010 as "the unconventional monetary policy episode".

The margin between the overnight lending and borrowing rates of the CBRT is defined as the "interest rate corridor", which constitute the upper and lower bounds for the overnight market rate. Before May 2010, the overnight borrowing rate of the CBRT was the policy rate; whereas since May 2010, the CBRT has adopted the weekly repo funding rate as its primary policy rate. Now, the CBRT can adjust the width of the overnight interest rate corridor when necessary, and at the same time can adjust the corridor around the policy rate in an asymmetrical way. In the traditional inflation targeting framework, the policy rates were generally fixed for one month. However, under the new framework, market rates can be changed on a daily basis by adjusting the quantity of funds provided through one-week repo auctions. Hence, the overnight rate can be targeted anywhere inside the corridor. In other words, under the new framework, the short rates can be amended at any time, not only during the MPC days. Hence, we question whether the MPC surprises are still important in the period of unconventional monetary policy implemented since May 2010. For this purpose, we compare the responses of banks' stock indices to MPC surprises in conventional and unconventional policy episodes. Interestingly, we find that, once the CBRT has begun following an unconventional policy approach, the effect of MPC surprises became insignificant. Note that this does not mean that the transmission from monetary policy rate to financial markets is completely broken. Our findings only suggest that the monetary policy surprises on MPC meeting days have lost their significance in the unconventional policy episode. Since the monetary policy now has flexible timing and many important decisions, announcements and actions are made in days other than MPC meeting days, the policy rate can still significantly affect the asset markets in other days.

The plan of the remainder of the paper is as follows. We present the methods employed in Section 2. Section 3 describes the data. We discuss the empirical evidence in Section 4 and finally Section 5 concludes.

[4] For details of the new monetary policy framework, please see CBRT (2013).

2. Methodology

Following RS, the dynamics of the short-term interest rate and stock prices are assumed to be as follows:

$$\Delta i_t = \beta \Delta s_t + \gamma z_t + \varepsilon_t \tag{1}$$

$$\Delta s_t = \alpha \Delta i_t + z_t + \eta_t \tag{2}$$

where Δi_t is the change in the policy rate, Δs_t is the change in the stock price and z_t is a vector of exogenous variables which affect both Δi_t and Δs_t. Equation (1) can be interpreted as a monetary policy reaction function, where the policy rate responds to the asset price and a set of variables z_t, which may or may not be observed. Equation (2) represents the asset price equation, which captures the response of asset price to the monetary policy and other variables z_t. In our setup, z_t is taken as a single unobservable variable, which represents all the omitted common factors in both equations. Since z_t is an unobservable variable, its coefficient is normalized to one in Equation (2). The setup is flexible enough to include observable common factors as well. The variable ε_t is the monetary policy shock and η_t is the asset price shock. The shocks ε_t and η_t are assumed to be serially uncorrelated and to be uncorrelated with each other and with the common shock z_t.

In this paper, the parameter of interest is α, which measures the impact of a change in the policy rate Δi_t on the change in the asset price Δs_t. The ES approach estimates only Equation (2) with OLS. Therefore, the ES estimate of α is as follows:

$$\hat{\alpha}_{ES} = (\Delta i_t' \Delta i_t)^{-1} \Delta i_t' \Delta s_t \tag{3}$$

The mean of $\hat{\alpha}_{ES}$ is:

$$E(\hat{\alpha}_{ES}) = \alpha + (1 - \alpha\beta) \frac{\beta \sigma_\eta + (\beta + \gamma)\sigma_z}{\sigma_\varepsilon + \beta^2 \sigma_\eta + (\beta + \gamma)^2 \sigma_z} \tag{4}$$

where E(.) is the expectation operator and σ_x represents the variance of shock x. According to Equation (4), estimating Equation (2) with OLS may suffer from both the presence of simultaneity bias (if $\beta \neq 0$ and $\sigma_\eta > 0$) and omitted variables bias (if $\gamma \neq 0$ and $\sigma_z > 0$). To overcome these problems, researchers applying the ES approach use the asset price changes directly after the announcement of the monetary policy committee (MPC) decision. In that case, the assumptions required by the ES approach is that in the limit, the variance of the policy shock becomes infinitely large relative to the variance of other shocks, that is $\sigma_\varepsilon / \sigma_\eta \to \infty$ and $\sigma_\varepsilon / \sigma_z \to \infty$ on policy dates. That is, it is assumed that within the policy day, the effects of the asset price shock and the common shock (simultaneity and omitted variables problems) on the monetary policy decision are negligible.

The heteroscedasticity-based identification technique suggested by RS does not require such a strong assumption. In this approach, we only need to observe a rise in the variance of the policy shock when the MPC decision is announced, while the variances of other shocks remain constant, given that the parameters α, β and γ are stable. Since the GMM technique requires weaker assumptions, it can give more reliable estimates than the ES approach.

Two subsamples, denoted by *P* and *N* are essential to implement the GMM technique. *P* stands for the policy dates (days when the MPC decisions are announced) and *N* stands for the non-policy dates (days immediately preceding the policy days). There are two assumptions for the heteroscedasticity-based identification method as follows:

(i) The parameters of the model, α, β and γ are stable across the two subsamples.

(ii) The policy shock is heteroscedastic and the other shocks are homoscedastic, which are represented by the following equations:

$$\sigma_{\varepsilon}{}^{P} > \sigma_{\varepsilon}{}^{N} \tag{5}$$

$$\sigma_{z}{}^{P} = \sigma_{z}{}^{N} \tag{6}$$

$$\sigma_{\eta}{}^{P} = \sigma_{\eta}{}^{N} \tag{7}$$

Under the assumptions (i) and (ii), a detailed analysis of the heteroscedasticity-based identification approach is presented below.

Reduced form equations for (1) and (2) are as follows:

$$\Delta i_t = \frac{1}{1-\alpha\beta}\left[(\beta+\gamma)z_t + \beta\eta_t + \varepsilon_t\right] \tag{1'}$$

$$\Delta s_t = \frac{1}{1-\alpha\beta}\left[(1+\alpha\beta)z_t + \eta_t + \alpha\varepsilon_t\right] \tag{2'}$$

The covariance matrices of the variables in each subsample are the following:

$$\Omega_P = \frac{1}{(1-\alpha\beta)^2}\begin{bmatrix} \sigma_{\varepsilon}{}^{P} + (\beta+\gamma)^2\sigma_{z}{}^{P} + \beta^2\sigma_{\eta}{}^{P} & \alpha\sigma_{\varepsilon}{}^{P} + (\beta+\gamma)(1+\alpha\gamma)\sigma_{z}{}^{P} + \beta\sigma_{\eta}{}^{P} \\ . & \alpha^2\sigma_{\varepsilon}{}^{P} + (1+\alpha\gamma)^2\sigma_{z}{}^{P} + \sigma_{\eta}{}^{P} \end{bmatrix}$$

$$\Omega_N = \frac{1}{(1-\alpha\beta)^2}\begin{bmatrix} \sigma_{\varepsilon}{}^{N} + (\beta+\gamma)^2\sigma_{z}{}^{N} + \beta^2\sigma_{\eta}{}^{N} & \alpha\sigma_{\varepsilon}{}^{N} + (\beta+\gamma)(1+\alpha\gamma)\sigma_{z}{}^{N} + \beta\sigma_{\eta}{}^{N} \\ . & \alpha^2\sigma_{\varepsilon}{}^{N} + (1+\alpha\gamma)^2\sigma_{z}{}^{N} + \sigma_{\eta}{}^{N} \end{bmatrix}$$

The heteroscedasticity-based GMM technique uses a comparison of the covariance matrices on the policy and the non-policy dates.[5] Under the assumptions (i) and (ii) of the model, the difference in the covariance matrices Ω_P and Ω_N is as follows:

$$\Delta\Omega = \Omega_P - \Omega_N = \frac{(\sigma_\varepsilon^{\ P} - \sigma_\varepsilon^{\ N})}{(1-\alpha\beta)^2}\begin{bmatrix} 1 & \alpha \\ \alpha & \alpha^2 \end{bmatrix}$$

Denoting $\lambda = \dfrac{(\sigma_\varepsilon^{\ P} - \sigma_\varepsilon^{\ N})}{(1-\alpha\beta)^2}$, (8) becomes the following:

$$\Delta\Omega = \lambda\begin{bmatrix} 1 & \alpha \\ \alpha & \alpha^2 \end{bmatrix} \qquad (8')$$

Thus, the impact of policy changes on the asset prices, namely the parameter α, can be identified from the change in the covariance matrix $\Delta\Omega$.

There are two parameters to be estimated, namely; α, the parameter of interest, and λ, a measure of the degree of heteroskedasticity that is present in the data. In RS, these coefficients are estimated in two different ways: by GMM estimation and IV regression. However, as shown in RS, IV estimation makes use of only two equations in (8´) at a time, resulting in multiple estimates of α. On the other hand, GMM utilizes all three orthogonality conditions in (8´). That is, there is an improvement in efficiency from incorporating the additional moment conditions into the estimation in the GMM approach compared to the IV approach. Thus, in this paper, GMM estimation will be used to obtain an estimate of the asset price response to the monetary policy changes. Besides, in the GMM approach, the overidentification restrictions enable us to test the model as a whole.[6]

Implementation Through GMM

As we have stated above, there are two parameters to be estimated, α, the parameter of interest, and $\lambda = \dfrac{(\sigma_\varepsilon^{\ P} - \sigma_\varepsilon^{\ N})}{(1-\alpha\beta)^2}$, a measure of the degree of heteroscedasticity that is present in the data. This coefficient can be used to test whether the change in the volatility is enough to identify parameter α. Hence, in order to estimate α with this approach, we need λ to be statistically significant.

[5] For details of the heteroscedasticity-based identification methods, see Rigobon (2003).
[6] Notice that, in (8') there are three moment conditions and two parameters to estimate. Therefore, in GMM, overidentification restrictions enable us to test the model as a whole.

Under assumptions (i) and (ii) of the heteroscedasticity-based identification, the sample estimate of the difference in the covariance matrix is:

$$\Delta\hat{\Omega} = \hat{\Omega}_P - \hat{\Omega}_N \tag{9}$$

where

$$\hat{\Omega}_j = \frac{1}{T_j}\sum_{t\in T}\delta_t^{\,j}\left[\Delta i_t \quad \Delta s_t\right]'\left[\Delta i_t \quad \Delta s_t\right] \text{ for } j = P, N$$

and δ_t^j are dummy variables taking on the value 1 for the days in each subsample and $T^j = \sum_{t\in(1,T)}\delta_t^j$ are sample sizes of the subsamples, for $j = P, N$. The assumptions imply that the following moment conditions hold:

$$E[b_t] = 0$$

where

$$b_t = vech(\Delta\hat{\Omega} - \Delta\Omega)\text{, or}$$

$$b_t = vech\left(\left(\frac{T}{T^P}\delta_t^{\,P} - \frac{T}{T^N}\delta_t^{\,N}\right)\left[\Delta i_t \quad \Delta s_t\right]'\left[\Delta i_t \quad \Delta s_t\right] - \lambda\left[1 \quad \alpha\right]'\left[1 \quad \alpha\right]\right)$$

The GMM estimator is based on the condition that $\lim_{T\to\infty}\frac{1}{T}\sum_{t\in(1,T)}b_t = 0$.

The intuition behind GMM is to choose an estimator for $\Delta\Omega$, $\Delta\hat{\Omega}$, that sets the three sample moments as close to zero as possible. Since there are more moment conditions than unknowns, (8´) is overidentified and it may not be possible to find an estimator setting all three moment conditions to exactly zero. In this case we take a 3X3 weighting matrix W_3 and use it to construct a quadratic form in the moment conditions. The estimates of α and λ will be obtained by minimizing the following loss function:

$$\left[\hat{\alpha}_{GMM}, \hat{\lambda}\right] = \arg\min\left[\sum_{t\in[1,T]}b_t\right]' W_3\left[\sum_{t\in[1,T]}b_t\right] \tag{10}$$

Practically, GMM estimation proceeds in two steps. Initially GMM estimation with an identity-weighting matrix, i.e. taking $W_3 = I_3$, is conducted to obtain a consistent estimator of coefficients. In the second step, W_3 is formed based on obtained residuals. Accordingly, W_3 the optimal weighting matrix equal to the inverse of the estimated covariance matrix of the moment conditions is obtained. The efficient GMM estimator is obtained based on (10).

3. Data

We use daily data from the İstanbul Stock Exchange (ISE). The policy rate is proxied by the yield on government bonds with one-month maturity, which is traded in a relatively more liquid market among the other alternative short rates. We take stock return indices ISE 100, ISE Bank and individual indices for 16 Banks: Akbank (AKBNK), Alternatifbank (ALNTF), Denizbank (DENIZ), Finansbank (FNBNK), Garanti Bankası (GARAN), İş Bankası (ISCTR), Kalkınma Bankası (KLNMA), Şekerbank (SKBNK), Türkiye Ekonomi Bankası (TEBNK), Tekstil Bankası (TEKST), Türkiye Sınai Kalkınma Bankası (TSKB), Yapı ve Kredi Bankası (YKBNK), Albaraka Türk (ALBRK), Asya Bankası (ASYAB), Halk Bankası (HALKB) and Vakıflar Bankası (VAKBN). We take the daily change of the interest rate in basis points while the stock returns are in daily percentage changes of the return indices. The sample covers the January 2005- January 2013 period with 99 policy decisions. There are four exceptions due to data availability: the data for ALBRK, ASYAB, HALKB and VAKBN start from July 2007, May 2006, May 2007 and December 2005 respectively. The conventional and unconventional policy episodes include 65 and 34 MPC announcements, respectively.

While the ES methodology uses only changes in the asset prices on policy dates, the heteroscedasticity-based GMM estimates compare the changes in asset prices before and after the announcement of the policy decision. The data are plotted in levels in Figure 1. The major bank return index, ISE-Bank generally moves in opposite direction with the short-rate. However, this relationship has weakened in recent years, with the short rate generally following a flat course except for the period of additional monetary tightening in the first half of 2012.

[Figure 1]

The descriptive statistics for the daily changes of the policy rate and stock returns are reported in Table 1. The standard deviations of the policy rate and the bank returns are generally higher on policy days when compared with the nonpolicy days (this evidence is stronger in the conventional policy period). Though the correlations between the policy rate and the stock returns of banks are positive and small in absolute value (between 0.03 and 0.14) one day before the policy announcement, they all become negative and larger in absolute value (between -0.10 and -0.38) after the announcement of the policy decision. The correlations in policy and nonpolicy days differ even more sharply during the conventional policy episode. The fact that the interaction between the policy rate and the financial markets change considerably on the days when the policy shock arrives enables the parameter α to be estimated using the GMM method.

[Table 1]

4. Empirical Results

The full sample estimates for the parameter α using both the ES approach and the heteroskedasticity-based GMM method are reported in the second and fourth columns of Table 2. According to the GMM method, which is theoretically more reliable, the responses of aggregate indices and most of the individual stock indices to a rise in the short-term rate are significant and negative. According to the GMM estimates, a 100 basis points increase in the short-term interest rate decreases ISE-100 by 2.8% and ISE-Bank by 3.3%. It is interesting to see that the GMM method gives consistently higher and more significant parameter estimates than the ES approach. The results at the bank level suggest strong heterogeneity in the responses of individual banks. While TEKST gives the largest significant response (with a coefficient of around -8.2), DENIZ and FNBNK give low and insignificant responses (with coefficients of around -1.6 and -1.4 respectively).

[Table 2]

The diagnostics for the estimates are also reported in Table 2. The results of the tests confirm that the assumptions of the GMM method are more reliable. The fact that λ is significant suggests that the increase in the volatility of the policy date is sufficiently large for the GMM estimation. The over-identification test results, reported in the fifth column, do not point to model misspecification.[7] The difference between the ES and the heteroscedasticity-based GMM likely reflects a bias in the ES estimates. The potential biasedness of the event-study estimates compared to the GMM method is tested and reported in the last column. The empirical results for the stock indices suggest that the ES estimates are not statistically biased for ISE-100, but are biased for ISE-Bank and some of the individual bank returns compared to the GMM estimates.

In 2010, there is a substantial change in the way CBRT conducted its monetary policy. Under the new framework, called a policy mix, CBRT has started to implement its policy with flexible timing, multiple instruments and targets. The policy mix has included an active use of reserve requirements, an interest rate corridor of overnight borrowing and lending rates, as well as a liquidity management strategy. In this period, the CBRT has adopted financial stability as its supplementary objective besides price stability. Variables like credit growth and foreign exchange rate were set as intermediate targets while CBRT pursues its objective of financial stability. Under this new framework, the policy rate has not been the main instrument of the monetary policy. It has been less actively used. Besides, other policy instruments like the interest rate corridor and liquidity management were often used on a daily basis. Since monetary policy now had flexible timing, the policy surprises on MPC days might have lost their importance. In that respect, it would be interesting and informative to see whether the monetary policy surprises on MPC days have lost their significance in affecting the banks' stock returns. In order to see this, we first carry out rolling

[7] The overidentification restrictions are rejected only for FNBNK, at 10 percent significance level.

window GMM estimations for the ISE-Bank index. We report these estimation results in Figure 2.

[Figure 2]

In Figure 2, we see that there is indeed a breakpoint in the first half of 2010. In May 2010, CBRT has adopted the 1 week repo rate as its policy rate. Before this date, the overnight borrowing rate was the policy rate. The policy rate can only be changed at an MPC meeting and MPC meeting are usually held once a month. However, by changing the maturity of the policy rate from overnight to weekly frequency, and setting a wide corridor of overnight lending and borrowing rates, CBRT now had more room to affect the overnight repo rate, which is determined at ISE. This was done by setting high reserve requirement ratios and hence using an effective short-term liquidity policy.

In Table 3, we report the estimation results for the conventional policy episode. In this period, the monetary policy surprises are significant at conventional levels for all banks and the estimated coefficients are higher in magnitude than the full sample estimates. The estimated coefficients now range from -1.82 (for DENIZ) to -9.49 (for TEKST). For the conventional period, the ES estimates are found to be biased for the responses of most banks compared to the GMM estimates. We again observe heterogeneity in the responses of banks to monetary policy surprises.

[Table 3]

Next, we test whether the heterogeneity in banks responses is significant. In order to carry out this analysis, we subtract the ISE-Bank return from the individual bank returns and repeat the estimations with this data. The results are reported in Table 4. According to these results 8 out of 16 banks face statistically significant heterogeneity at conventional levels. Among these, 4 banks are affected significantly more seriously than average (namely, TEKST, HALKB, TSKB and ISCTR) and 4 banks are affected significantly less (namely, DENIZ, FNBNK, KLNMA and ASYAB) from the monetary policy surprises on MPC days.

[Table 4]

Then, we question whether the heterogeneity in banks responses is related to banks' level of interest payments or not. We report two bank specific characteristics related to banks' interest burden in Figures 3 and 4. These data are from ISE and at quarterly frequency. We average these two characteristics over the first period (2005Q1-2010Q2). The first bank specific characteristic "interest paid to money market operations/total assets" is plotted in Figure 3. All the banks that are affected significantly less from the MPC decisions are net lenders in the money market, whereas all banks except HALKB which are affected significantly more from the MPC surprises are net borrowers from the money market.

[Figure 3]

The second bank specific characteristic is "total interest payments/total interest receipts" and period averages are plotted in Figure 4. Again, all the banks that are affected significantly less from the MPC decisions are net lenders overall, whereas all banks except TSKB which are affected significantly more from the MPC surprises are net borrowers overall.

[Figure 4]

Finally, in Table 5, we report the estimation results for the unconventional policy episode. These results suggest that the MPC surprises have lost their significance not only for the aggregate indices but also for the individual bank indices. Note that this does not mean that the transmission from monetary policy rate to financial markets is completely broken in this period. Our findings only suggest that the monetary policy surprises on MPC meeting days have lost their significance in the unconventional policy episode. Since the monetary policy now has flexible timing and many important decisions, announcements and actions are made in days other than MPC meeting days, the policy rate can still significantly affect the asset markets in other days. Hence, the methodology we use might not be suitable for the second subsample. Under our current methodology, one implicit assumption is that monetary policy surprises generally arrive on MPC meeting days. Obviously, this has not been the case in Turkey recently. Measuring the impact of monetary policy in the unconventional policy episode necessitates using a modified methodology, which is out of the scope of this paper.

[Table 5]

5. Conclusion

This study estimates the impact of monetary policy committee (MPC) announcements on banks' stock returns in Turkey using the heteroscedasticity-based GMM technique suggested by Rigobon and Sack (2004), which takes into account both the simultaneity and the omitted variables problems. The empirical results show that, in the conventional policy episode of traditional inflation targeting, increases in the policy rate on MPC days lead to significant declines in stock returns of all individual banks. Comparing the results with the more widely applied event study method, we find that the event study gives biased results for most of the bank stock returns. We also detect heterogeneity in the responses of bank indices to MPC surprises. It is shown that the stock returns of banks which are dependent on money market funding and for which interest payments constitute an important share in their balance sheets respond more aggressively to the changes in policy rates.

Turkey is one of the many countries in the world which adopted an unconventional policy approach after the global financial crisis. One interesting finding in this study is that since the Central Bank of the Republic of Turkey has started adopting an unconventional monetary policy regime in May 2010, with various instruments and flexible timing, aggregate and individual bank indices have stopped giving significant responses to the surprises on MPC meeting days.

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Table 1. Standard deviations and correlations with the policy rate

	Standard Deviations				Correlations with the Policy Rate			
	Full Sample (Jan05-Jan13)		Conventional Period (Jan05-Apr13)		Full Sample (Jan05-Jan13)		Conventional Period (Jan05-Apr13)	
	Policy Days	Nonpolicy Days	Policy Days	Nonpolicy Days	Policy Days	Nonpolicy Days	Policy Days	Nonpolicy Days
Policy Rate	0.32	0.15	0.32	0.15	-	-	-	-
Stock Returns								
ISE 100	2.14	1.82	2.16	1.85	-0.33	-0.12	-0.40	-0.10
ISE Bank	2.65	2.26	2.65	2.28	-0.31	-0.12	-0.37	-0.12
AKBNK	3.47	2.65	3.78	2.62	-0.18	0.05	-0.24	0.07
ALTNF	3.44	3.54	3.60	3.45	-0.29	0.06	-0.32	0.07
DENIZ	3.46	3.51	3.60	3.71	-0.10	0.03	-0.15	-0.02
FNBNK	3.24	2.38	3.42	2.54	-0.11	0.06	-0.13	0.10
GARAN	3.12	3.11	3.37	3.21	-0.27	0.12	-0.36	0.14
ISCTR	3.18	2.50	3.45	2.50	-0.27	0.14	-0.35	0.21
KLNMA	2.90	2.34	3.05	2.40	-0.13	0.05	-0.20	0.11
SKBNK	3.56	3.63	3.87	3.84	-0.26	0.06	-0.32	0.08
TEBNK	3.42	2.68	3.69	2.83	-0.14	0.10	-0.18	0.08
TEKST	3.70	2.78	3.96	2.94	-0.38	0.09	-0.50	0.12
TSKB	2.92	2.70	3.02	2.77	-0.32	0.14	-0.45	0.23
YKBNK	2.65	2.81	2.74	2.89	-0.22	0.14	-0.26	0.16
ALBRK	2.27	1.85	2.29	1.69	-0.14	0.03	-0.19	0.13
ASYAB	2.44	2.79	2.51	3.02	-0.18	0.05	-0.30	0.14
HALKB	3.67	2.63	4.18	2.68	-0.16	0.03	-0.31	0.11
VAKBN	3.28	2.79	3.67	2.92	-0.30	0.07	-0.36	0.07

Notes: The policy rates is daily changes in basis points and the stock market returns are in daily percent changes.

Table 2. Estimation Results and Diagnostic Tests
<u>Full Sample</u> (January 2005-January 2013)

	$\hat{\alpha}_{ES}$		$\hat{\alpha}_{GMM}$		$\hat{\lambda}_{GMM}$		*OIR Test*	*GMM vs. ES*	*Number of Obs.*
ISE-100	-2.14***	*(0.64)*	-2.77***	*(0.79)*	0.084***	*(0.022)*	0.42	1.85	99
ISE-BANK	-2.54***	*(0.80)*	-3.31***	*(0.89)*	0.085***	*(0.021)*	0.58	3.58*	99
AKBNK	-2.00*	*(1.08)*	-2.91**	*(1.20)*	0.082***	*(0.022)*	0.89	2.99	99
ALNTF	-3.11***	*(1.04)*	-4.16***	*(1.51)*	0.075***	*(0.021)*	0.24	0.93	99
DENIZ	-1.02	*(1.08)*	-1.55	*(1.10)*	0.078***	*(0.022)*	0.10	9.99***	99
FNBNK	-1.07	*(1.01)*	-1.43	*(1.14)*	0.081***	*(0.022)*	2.81*	0.51	99
GARAN	-2.67***	*(0.94)*	-4.00***	*(1.06)*	0.077***	*(0.022)*	0.12	7.67***	99
ISCTR	-2.68***	*(0.96)*	-4.47***	*(1.36)*	0.082***	*(0.022)*	0.51	3.51*	99
KLNMA	-1.06	*(0.91)*	-1.97**	*(0.90)*	0.087***	*(0.022)*	1.38	32.1***	99
SKBNK	-2.91***	*(1.08)*	-4.07***	*(1.30)*	0.074***	*(0.020)*	0.12	2.56	99
TEBNK	-1.45	*(1.07)*	-2.59**	*(1.09)*	0.081***	*(0.022)*	1.02	28.4***	99
TEKST	-4.38***	*(1.08)*	-8.16***	*(2.00)*	0.093***	*(0.020)*	0.84	5.01**	99
TSKB	-2.98***	*(0.87)*	-4.39***	*(1.35)*	0.077***	*(0.021)*	0.02	1.88	99
YKBNK	-1.82**	*(0.81)*	-2.68***	*(0.90)*	0.075***	*(0.022)*	0.56	4.85**	99
ALBRK	-1.03	*(1.00)*	-2.04**	*(0.83)*	0.054***	*(0.019)*	1.52	3.23*	68
ASYAB	-1.31	*(0.80)*	-1.65**	*(0.75)*	0.082***	*(0.025)*	0.89	1.44	83
HALKB	-2.17	*(1.59)*	-3.06*	*(1.82)*	0.053***	*(0.018)*	0.91	1.04	70
VAKBN	-3.01***	*(1.04)*	-4.30***	*(1.11)*	0.083***	*(0.024)*	0.13	10.7***	88

Notes: The standard errors are in parentheses. ***, ** and *, indicate the significance levels at 1%, 5% and 10% levels respectively. GMM over-identification test has a $\chi^2(1)$ distribution. $F_{1,T-1}$ distribution is used for the Hausman-type biasedness test.

Table 3. Estimation Results and Diagnostic Tests
<u>Conventional Policy Episode</u> (January 2005-April 2010)

	$\hat{\alpha}_{ES}$		$\hat{\alpha}_{GMM}$		$\hat{\lambda}_{GMM}$		*OIR Test*	*GMM vs. ES*	*Number of Obs.*
ISE-100	-2.69***	*(0.73)*	-3.26***	*(0.89)*	0.098***	*(0.029)*	0.04	1.24	65
ISE-BANK	-3.11***	*(0.89)*	-3.66***	*(0.99)*	0.098***	*(0.029)*	0.05	1.67	65
AKBNK	-2.88**	*(1.38)*	-4.15***	*(1.42)*	0.104***	*(0.031)*	1.18	16.6***	65
ALNTF	-3.45***	*(1.29)*	-4.74***	*(1.82)*	0.092***	*(0.029)*	0.05	0.99	65
DENIZ	-1.67	*(1.34)*	-1.82*	*(1.09)*	0.094***	*(0.030)*	0.04	0.03	65
FNBNK	-1.31	*(1.19)*	-2.62**	*(1.26)*	0.103***	*(0.031)*	2.78*	10.4***	65
GARAN	-3.81***	*(1.17)*	-5.37***	*(1.16)*	0.093***	*(0.030)*	0.06	91.9***	65
ISCTR	-3.75***	*(1.20)*	-6.21***	*(1.54)*	0.104***	*(0.030)*	0.39	6.47**	65
KLNMA	-1.44	*(0.99)*	-2.64***	*(0.96)*	0.104***	*(0.030)*	0.40	25.3***	65
SKBNK	-3.85***	*(1.38)*	-5.26***	*(1.55)*	0.087***	*(0.026)*	0.13	4.22**	65
TEBNK	-2.10	*(1.37)*	-3.32**	*(1.33)*	0.100***	*(0.031)*	0.87	14.4***	65
TEKST	-6.16***	*(1.30)*	-9.49***	*(1.90)*	0.106***	*(0.021)*	0.11	5.81**	65
TSKB	-4.22***	*(0.99)*	-5.76***	*(1.33)*	0.081***	*(0.025)*	0.40	2.97*	65
YKBNK	-2.21**	*(0.98)*	-3.05***	*(1.06)*	0.090***	*(0.030)*	0.46	4.42***	65
ALBRK	-1.43	*(1.30)*	-3.07***	*(0.89)*	0.068**	*(0.027)*	1.56	2.91*	33
ASYAB	-2.13**	*(0.90)*	-2.85***	*(0.78)*	0.099***	*(0.038)*	1.98	2.43	47
HALKB	-5.01**	*(2.54)*	-8.16***	*(2.17)*	0.062***	*(0.026)*	0.59	5.78**	35
VAKBN	-3.97***	*(1.37)*	-5.52***	*(1.34)*	0.109***	*(0.035)*	0.17	41.8***	53

Notes: The standard errors are in parentheses. ***, ** and *, indicate the significance levels at 1%, 5% and 10% levels respectively. GMM over-identification test has a $\chi^2(1)$ distribution. $F_{1,T-1}$ distribution is used for the Hausman-type biasedness test.

Table 4. Estimation Results and Diagnostic Tests
<u>For the Deviations of Individual Bank Returns from the ISE Bank Return</u>
<u>Conventional Policy Episode</u> (January 2005-April 2010)

	$\hat{\alpha}_{ES}$		$\hat{\alpha}_{GMM}$		$\hat{\lambda}_{GMM}$		*OIR Test*	*GMM vs. ES*	*Number of Obs.*
AKBNK	0.233	*(1.111)*	-0.455	*(0.800)*	0.085***	*(0.028)*	1.033	0.795	65
ALNTF	-0.328	*(1.175)*	-0.502	*(1.338)*	0.086***	*(0.028)*	0.045	0.074	65
DENIZ	1.439	*(1.137)*	1.669**	*(0.804)*	0.078***	*(0.028)*	4.459**	0.082	65
FNBNK	1.783	*(1.367)*	2.524**	*(1.085)*	0.089***	*(0.028)*	0.278	0.795	65
GARAN	-0.736	*(1.020)*	-1.103	*(0.922)*	0.087***	*(0.028)*	0.415	0.707	65
ISCTR	-0.636	*(0.908)*	-1.375*	*(0.815)*	0.087***	*(0.028)*	0.016	3.432*	65
KLNMA	1.583	*(0.959)*	1.559***	*(0.567)*	0.083***	*(0.028)*	0.687	0.001	65
SKBNK	-0.746	*(1.200)*	-1.331	*(1.105)*	0.074***	*(0.027)*	1.313	1.558	65
TEBNK	1.022	*(1.109)*	1.224	*(0.963)*	0.086***	*(0.028)*	0.247	0.136	65
TEKST	-3.017***	*(1.145)*	-4.060**	*(2.105)*	0.086***	*(0.028)*	0.003	0.349	65
TSKB	-1.114	*(1.164)*	-1.762*	*(1.063)*	0.088***	*(0.028)*	0.258	1.855	65
YKBNK	0.895	*(0.953)*	0.845	*(1.124)*	0.086***	*(0.028)*	0.012	0.007	65
ALBRK	2.142	*(1.572)*	1.972	*(1.237)*	0.051**	*(0.023)*	0.546	0.031	33
ASYAB	1.507*	*(0.885)*	1.220*	*(0.700)*	0.102***	*(0.035)*	2.268	0.281	47
HALKB	-1.364	*(1.811)*	-4.328***	*(1.346)*	0.069***	*(0.021)*	2.691	5.980**	35
VAKBN	-0.299	*(1.119)*	-0.822	*(1.099)*	0.091***	*(0.033)*	1.251	5.962**	53

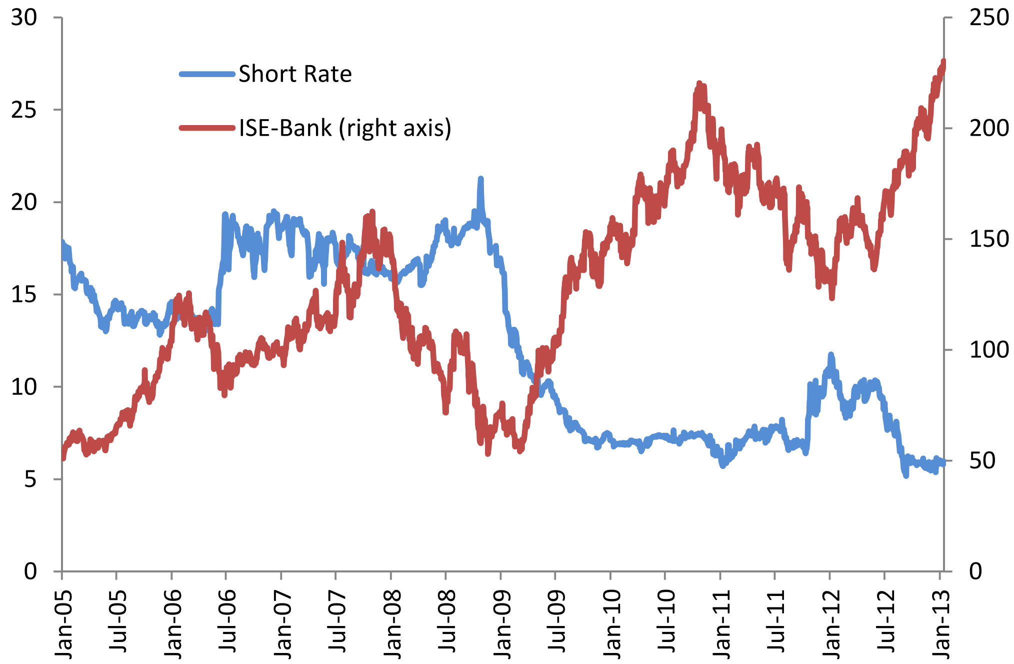
Notes: The standard errors are in parentheses. ***, ** and *, indicate the significance levels at 1%, 5% and 10% levels respectively. GMM over-identification test has a $\chi^2(1)$ distribution. $F_{1,T-1}$ distribution is used for the Hausman-type biasedness test.

Table 5. Estimation Results and Diagnostic Tests
<u>Unconventional Policy Episode</u> (May 2010-January 2013)

	$\hat{\alpha}_{ES}$		$\hat{\alpha}_{GMM}$		$\hat{\lambda}_{GMM}$		*OIR Test*	*GMM vs. ES*	*Number of Obs.*
ISE-100	-0.08	*(1.26)*	-0.10	*(1.17)*	0.050**	*(0.023)*	0.81	0.00	34
ISE-BANK	-0.45	*(1.69)*	-0.71	*(1.84)*	0.052**	*(0.024)*	1.00	0.12	34
AKBNK	1.27	*(1.38)*	1.08	*(1.83)*	0.034	*(0.021)*	1.18	0.03	34
ALNTF	-1.85	*(1.72)*	-1.77	*(1.72)*	0.041*	*(0.023)*	0.37	0.38	34
DENIZ	1.38	*(1.79)*	-0.34	*(3.21)*	0.043**	*(0.022)*	0.11	0.42	34
FNBNK	-0.15	*(1.99)*	1.44	*(2.11)*	0.047**	*(0.024)*	0.19	4.96**	34
GARAN	1.54	*(1.35)*	1.00	*(1.95)*	0.032	*(0.020)*	1.39	0.15	34
ISCTR	1.28	*(1.37)*	1.84	*(1.71)*	0.034*	*(0.020)*	0.33	0.29	34
KLNMA	0.33	*(2.10)*	3.05	*(2.23)*	0.046*	*(0.024)*	1.25	13.66***	34
SKBNK	0.55	*(1.41)*	1.38	*(1.37)*	0.043*	*(0.024)*	0.23	5.97**	34
TEBNK	0.95	*(1.46)*	-0.01	*(1.72)*	0.042*	*(0.024)*	0.23	1.09	34
TEKST	2.20	*(1.50)*	3.24*	*(1.74)*	0.044*	*(0.023)*	0.00	1.43	34
TSKB	1.63	*(1.60)*	3.40	*(2.42)*	0.045**	*(0.023)*	0.01	0.96	34
YKBNK	-0.39	*(1.49)*	-0.61	*(1.64)*	0.043*	*(0.024)*	0.14	0.11	34
ALBRK	-0.47	*(1.56)*	-0.35	*(1.60)*	0.044*	*(0.024)*	0.12	0.10	34
ASYAB	1.37	*(1.59)*	3.24	*(2.03)*	0.052**	*(0.024)*	0.69	2.18	34
HALKB	1.77	*(1.50)*	2.95	*(2.49)*	0.039**	*(0.020)*	0.06	0.36	34
VAKBN	0.15	*(1.33)*	0.04	*(1.43)*	0.042*	*(0.023)*	0.66	0.04	34

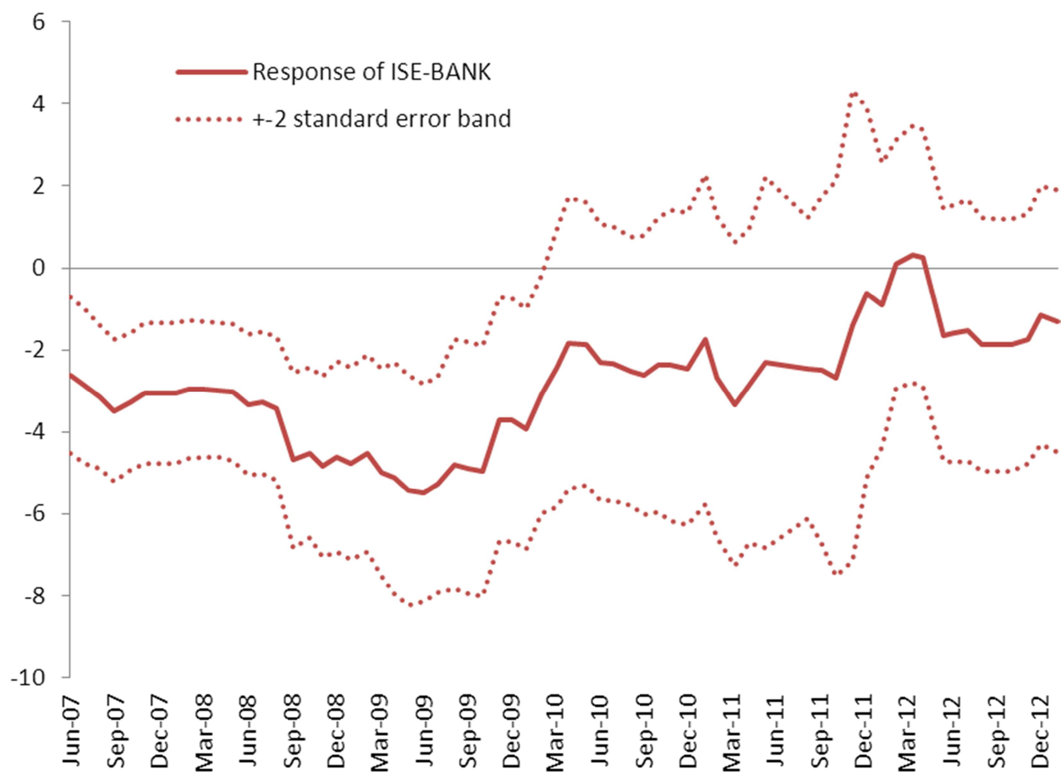
Notes: The standard errors are in parentheses. ***, ** and *, indicate the significance levels at 1%, 5% and 10% levels respectively. GMM over-identification test has a $\chi^2(1)$ distribution. $F_{1,T-1}$ distribution is used for the Hausman-type biasedness test.

Figure 1. Short Rate and the ISE-Bank Return Index



Note: Short rate is taken as the 1 month t-bill rate.

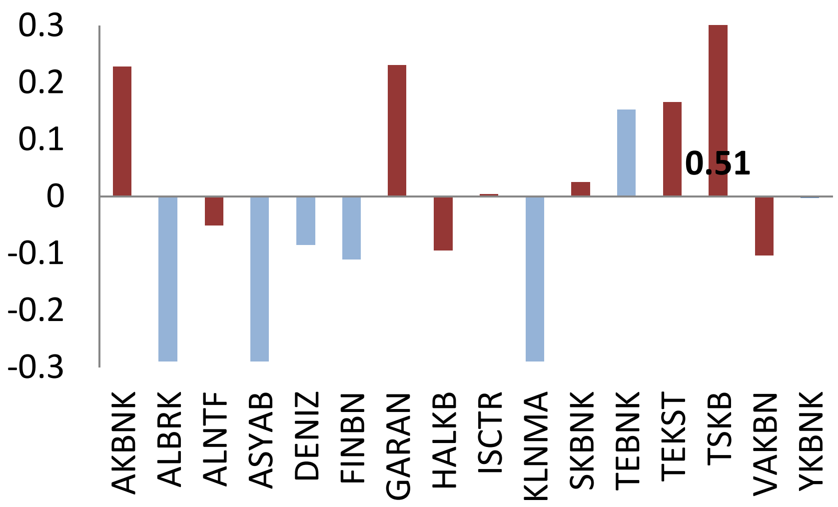
Figure 2. Rolling Window GMM Estimates of the Response of ISE-BANK to Monetary Policy



Notes: Each window includes 30 observations. The first window is January 2005-June 2007.

Figure 3. Interest Paid to Money Market Operations/Total Assets (%)

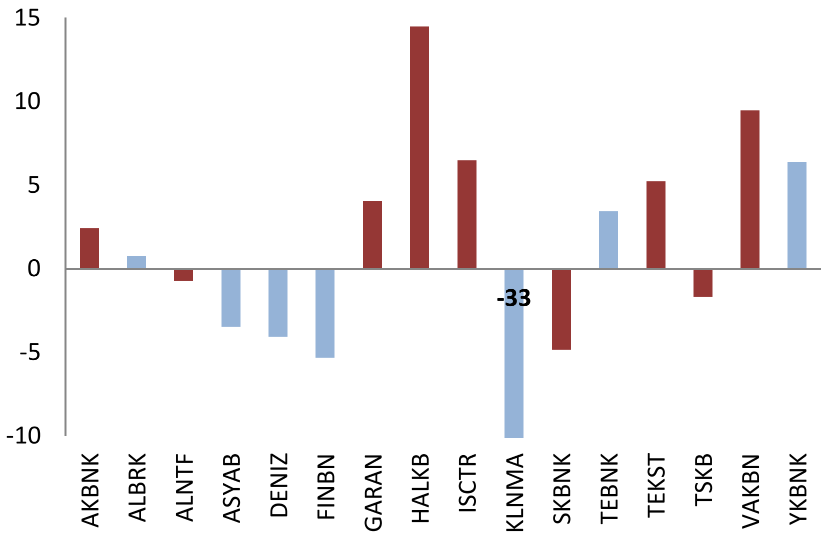
(Difference from averages of all banks for 2005Q1-2010Q2)



Note: The values for banks whose stock prices are affected more from monetary policy than the ISE-Bank are marked in dark red, others are marked in light blue.

Figure 4. Total Interest Payments/Total Interest Receipts (%)

(Difference from averages of all banks for 2005Q1-2010Q2)



Note: The values for banks whose stock prices are affected more from monetary policy than the ISE-Bank are marked in dark red, others are marked in light blue.