



The Effects of Anticipated and Unanticipated Federal Funds Target Rate Changes on Domestic Interest Rates: International Evidence

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Abstract: This paper assesses the effects of anticipated and unanticipated United States Federal Funds target rate changes on the domestic interest rates of a set of countries for the period from June 1989 to August 2008. The empirical evidence provided here suggests that *i.* unanticipated changes have a greater effect than anticipated changes; and *ii.* evidence from developed markets is stronger than that from developing/emerging markets.

Keywords: Interest rates, International transmission mechanism, Fed Funds target rates, and Monetary policy.

JEL Codes: E43, E52, C22

1. Introduction

Financial markets have become more integrated with globalization. This fact has increased interest in research on the effects of the United States' monetary policy changes on other open economies. As regards foreign monetary policy shocks, a growing body of research suggests that changes to US monetary policy can have significant impacts on other countries' economies. For example, Cushman and Zha (1997) examined how US monetary policy affected the Canadian economy and concluded that a contractionary monetary policy in the US caused a small and brief increase in Canadian interest rates and a larger and longer-lasting appreciation of Canadian currency. Kim and Roubini (2000) considered the effects of US interest rate shocks on the economies of the G-7 countries and reported that as the US Federal Funds (Fed Funds) rate increases, the G-7 countries' short-term interest rates increase.

The effects of US policy changes are also investigated on the US economy as well. Gurkaynak (2005) examined how future FOMC meetings affected expected interest rates using FOMC announcements. He defined several 'surprises' at different horizons, timing, level, and slope components of unanticipated policy actions are defined. Then he argued that these components have differing effects on asset prices. In another study, Hsin (2007) investigated how Treasury yield curve is affected by the FED funds rate and found positive effect of unexpected federal funds rate on the treasury rate movements. Similarly, Lee (2006) analyzed the effect of FED funds target rate changes on the volatility of interest rate and reported large and significant effects for short term interest rates.

Another group of studies examined the effect on non-industrialized countries as well. For example, Borensztein, Zettelmeyer and Philippon (2001) examined how US monetary policy shocks affected the interest rates of various countries (including developed ones) and reported that a one unit shock to US interest rates has positive and statistically significant effects on the interest rates of Argentina, Australia, Canada, Chile, Hong Kong, New Zealand and Singapore. In a similar work, Parrado (2001) investigated the dynamic effects of foreign monetary policy shocks (Fed Funds interest rate) on Chilean macroeconomic variables and found that foreign monetary policy innovations have short-lived effects on domestic interest rates and no major influence on other Chilean macroeconomic variables. In contrast to Parrado (2001), Al-Jasser and Banafe (2005) argued that Saudi Arabia's financial market is highly integrated with external financial markets, and in particular the US market, and they reported that US interest rates is the dominant factor in determining Saudi interest rates.

Wongswan (2009) considered both developed and developing markets. He examined how the equity indexes in Asia, Europe, and Latin America are affected via U.S. monetary policy announcements. He reported large and significant effects for foreign equity indexes at short time horizon.

In the literature, foreign monetary policy effects on domestic economies are mostly examined by using structural VAR models, as in Kim and Roubini (2000), Rapallo (1998), Parrado (2001), and Ghironi and Rebucci (2002), whereas orthogonalized residuals for short-term interest rates are used to identify monetary policy, as in Cushman and Zha (1997). Identification of monetary policy using VAR is often criticized for its shortcomings¹. On the other hand, Kuttner (2001) suggests using market driven data to calculate the change in the stance of monetary policy by observing Federal Funds futures data.

This paper examines the effects of the changes in the Federal Reserve's short-term target interest rates as a stance of change in monetary policy on the interest rates for a set of developed economies (Australia, Austria, France, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom) and for a set of developing/emerging economies (Bulgaria, China, India, Malaysia, the Philippines, Romania, Russia, the Slovak Republic, Sri Lanka and Taiwan). The empirical evidence provided here suggests that unanticipated changes have a greater effect than anticipated changes; as the maturity of assets increases, the effect of unanticipated and anticipated changes decreases; and the presence of these effects is stronger in developed markets than in developing or emerging markets. The rest of the paper is structured as follows: Section 2 presents the data and methodology used and Section 3 provides a brief conclusion.

¹ For example, Rudebusch (1998) notes that monetary VARs have a *time-invariant, linear structure*. The typical VAR reaction function imposes a simple constant linear structure; the instability of this reaction function is taken for granted in non-VAR literature. Another shortcoming concerns *the scope of the information set*, which is the debate about which variables should be included in a monetary VAR. For example, in contrast to others, Christiano et al. (1996a, 1996b) suggest that commodity prices should be included. The third shortcoming that Rudebusch discusses is *the use of final, revised data*, which concerns the attention given only to the number and ordering of the variables in VARs. But in fact, monetary VARs use more than the variables they include. Policymakers must rely on preliminary data and fail to use final estimates. Another shortcoming is *the long distributed lags*. The interest rate equations in typical VARs misrepresent the endogenous policy. The lagged variables included in the equation indicate that monetary policy reacts to old information. In addition to these shortcomings, VAR models are often associated with some well-known puzzles, as follows: i. *the liquidity puzzle*: positive money aggregate (such as M1, M2, ...) shock is associated with increases rather than decreases in nominal interest rates. ii. *the price puzzle*: positive innovations in interest rates increase rather than decrease the price level. iii. *the exchange rate puzzle*: positive innovations in interest rates are associated with depreciation rather than appreciation in the exchange rate.

2. Data and Methodology

In this study, Federal Funds futures rates, Federal Funds target rates from the US and the three-month, six-month, 12-month and 10-year daily interest rates for a set of developed and developing countries are used. The description of the data from individual countries is reported in the appendix. The data regarding the Federal Funds futures rates are obtained from *Datastream* and *Bloomberg* and the interest rates are gathered from *Datastream*. The Federal Funds futures rate is defined as 100 minus the settlement price of the 30-day Fed Funds futures contract. The data from the Federal Funds target rates are obtained from Kenneth Kuttner and updated from the website <http://www.federalreserve.gov/fomc>. The period under study is June 6, 1989 through August 05, 2008. The Fed Funds futures market became operational at the beginning of this period and we ended the sample before September 2008 in order to avoid the financial crises that resulted from the collapse of Lehman Brothers. A total of 184 Federal Open Market Committee meetings occurred within this period and in 81 of them FOMC decided to change the target rate (either increasing or decreasing it).

The method suggested by Kuttner (2001) is used to calculate the anticipated and unanticipated Federal Funds target rate changes. Kuttner (2001) measured the monetary policy surprises (based on the dates of FOMC meetings) by using the event study approach. In such models, the observed changes in the short maturity interest rate on event days are considered to be exogenous monetary shocks. There are other methods that could be used to calculate these anticipated and unanticipated changes. For example, Cochrane and Piazzesi (2002) use the change in the one-month Eurodollar rate. However, due to data availability, similar to Bernanke and Kuttner (2005) and Poole and Rasche (2000), we use the Federal Funds rate.

Kuttner (2001) suggests that the anticipated and unanticipated components of a FOMC decision on the FED's target is obtained from the change in the futures contract price relative to the day prior to the policy action. This means that if an event takes place on day t of month n , it is possible to calculate the unanticipated, or unanticipated, target rate change by considering the change in the "spot-month" (the month in which the target is changed) futures contract rate on the day of the rate change, which is later multiplied by the number of the days in the month affected by the change:

$$\Delta \tilde{r}_t^u = \frac{m}{m-t} (f_{n,t}^0 - f_{n,t-1}^0) \quad (1)$$

In Equation 1 $\Delta\tilde{r}^u$ stands for the unanticipated target rate change, $f_{n,t}^0$ is the spot-month futures rate on day t of month n , and m is the number of days in the month. If the rate change occurs on the first day of the month, the latter is replaced by $f_{n-1,m}^1$, which means the one-month futures rate from the last day of the previous month.

The anticipated component of the rate change $\Delta\tilde{r}_t^e$ is calculated by subtracting the unanticipated change from the actual $\Delta\tilde{r}_t$:

$$\Delta\tilde{r}_t^e = \Delta\tilde{r}_t - \Delta\tilde{r}_t^u \quad (2)$$

Kuttner (2001) examined the effect of FOMC meeting target changes on US interest rates only. Here, we consider the interest rates of 24 countries. The equation can be written as follows:

$$\Delta R_t = \alpha + \beta_1 \Delta\tilde{r}_t^e + \beta_2 \Delta\tilde{r}_t^u + \varepsilon_t \quad (3)$$

where R represents the yields of the interest rates of each country for different maturities.

Table 1 reports the effects of anticipated and unanticipated (surprise) changes in Fed Funds target rate changes on the interest rate changes for the 13 developed countries listed earlier. The effects are estimated for the three-month, six-month, 12-month and 10-year interest rates of the countries when available. For each interest rate, we report the estimated coefficients of *i.* expected change of federal funds rate (Expected), *ii.* unexpected change of federal funds rate (Surprise), and *iii.* difference of the latter parameter from the former (Difference) to see whether the effect of the Surprise is more than the Expected.

Table 1 suggests that both the anticipated and unanticipated changes have statistically significant effects on the three-month interest rates for Austria, France, Italy, New Zealand, Norway, Portugal, Sweden and Switzerland.² For Spain only the Expected changes have a statistically significant effect and for Australia and the UK the effect on Surprise is positive and statistically significant. When the difference between the Surprise and Expected changes are considered, the coefficients are positive for all but Japan and Spain. Of these positive coefficients, the effect is statistically significant for Australia, Sweden, Switzerland and the UK. For the six-month interest rates, the effect on the Expected and Surprise changes is statistically significant only for the Netherlands. For Australia and France, only the unanticipated change has a statistically significant effect on the interest rate. When the differences between the Unexpected and Surprise changes are considered, Australia, France,

² The level of significance is at the 10 % level, unless otherwise mentioned.

the Netherlands and the UK have positive effects and the effect is also statistically significant for all but the UK. The effects of target rate changes on the anticipated and unanticipated changes of the 12-month interest rates are positive and statistically significant for Austria, France, Japan, New Zealand, the Netherlands, Portugal, Sweden and Switzerland. For Italy and Norway only the anticipated changes have and for the UK only the unanticipated change has a positive and statistically significant effect. When the difference between the changes in the unanticipated and anticipated changes are considered, the effect is positive for Austria, France, the Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland and the UK. The effect is also statistically significant for all these countries but for Spain. For the 10-year interest rates of Italy and Sweden both the anticipated and unanticipated changes have positive and statistically significant effects. For Australia, France, Japan and Spain only the unanticipated changes have positive and statistically significant effects. For New Zealand the effect of the anticipated component is negative and statistically significant. When the differences between the unanticipated and anticipated changes are considered, the interest rates of Australia, Austria, France, Italy, Japan, New Zealand, Spain and Sweden have positive effects, but these positive effects are statistically significant for New Zealand only.

The main findings of Table 1 and the study done by Kuttner (2001) have common points. With a few exceptions, unanticipated changes have a greater impact on the countries' interest rates compared to anticipated changes. In most countries, the response of the three-month interest yield to the unanticipated element of the rate change is more than twice as large as the effect of the anticipated change. Moreover, the statistically significant unanticipated effects are positive for all of the maturities, as also indicated by Kuttner (2001).

In order to assess the effects of the US target rate changes on developing/emerging markets, we repeat the exercise for these countries. The set of countries considered are Bulgaria, China, India, Malaysia, Philippines, Romania, Russia, the Slovak Republic, Sri Lanka and Taiwan. Table 2 also reports the effects of anticipated, unanticipated and the difference between unanticipated and anticipated changes for these countries. For three-month interest rates, none of the estimated coefficients of the Expected and Surprise changes as well as for the Differences are statistically significant. With the estimated coefficients for the difference between the unanticipated and anticipated components, the effects are positive for China, India, the Philippines, the Slovak Republic and Taiwan. For six-month interest rates, the difference between anticipated and unanticipated interest rates is positive for Taiwan. For 12-month interest rates, both the anticipated and unanticipated changes have positive and

statistically significant effects for India. When the difference between anticipated and unanticipated change is taken, we observe positive effects for India, the Philippines and the Slovak Republic. For India, the effect is also statistically significant. Where 10-year interest rates are concerned, we report positive effects for India when the difference between anticipated and unanticipated change is taken.

The first thing to be noted is that the statistical evidence from developing/emerging economies is weaker. Secondly, similar to the findings in Table 1, the effects of unanticipated changes are greater than anticipated changes in most cases in the countries reported in Table 2.

In Table 1 and Table 2, we consider all the FOMC meeting dates in which the target rate changes occurred in order to calculate the anticipated and unanticipated changes similar to Kuttner (2001). We also made the same analyses covering all the FOMC meeting dates starting from 1989. In order to save space, these results are not reported but they are available from the authors upon request. The basic conclusion of this paper was robust.

3. Conclusion

This paper attempts to estimate the effect of Federal Funds rates on the interest rates of developed and developing/emerging countries. Fed Funds futures rates are used to separate unanticipated changes in the target rate from anticipated changes, as how Kuttner (2001) used his market-based measure. The estimates from the international markets for the June 1989 and August 2008 period are in line with Kuttner's US findings. The responses of the unanticipated component of Fed Funds policy changes are great and highly significant compared to the anticipated component. Moreover, the significant effects are greater in the developed countries that we studied, indicating that the effects of anticipated and unanticipated changes on interest rates decrease with maturity.

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Table 1: The Effects of Change in Fed Funds Target Rates on Developed Countries' Interest Rates (excluding the days on which FOMC meetings occurred but the target rates were not changed)

	3-Month			6-Month			12-Month			10-Year		
	Expected	Surprise	Difference	Expected	Surprise	Difference	Expected	Surprise	Difference	Expected	Surprise	Difference
Australia	0.01960 (1.02613)	0.17608*** (3.82050)	0.15648*** (3.49573)	0.00425 (0.17862)	0.18239*** (3.54948)	0.17814*** (4.25759)				-0.04336 (-1.20018)	0.13470** (1.92340)	0.17805 (0.25528)
Austria	0.04312*** (2.76495)	0.12086** (2.08231)	0.07774 (1.58399)				0.03263** (2.59713)	0.12987*** (3.23308)	0.09724*** (3.04398)	0.01138 (0.56061)	0.06816 (1.49129)	0.05677 (1.09604)
France	0.03242** (2.20995)	0.09084* (1.744)	0.05841 (1.35073)	0.02370 (1.55156)	0.09275** (2.03542)	0.06906* (1.84446)	0.04445** (2.55838)	0.18987*** (3.57045)	0.14543*** (3.39934)	0.03048 (1.43202)	0.10131** (2.06049)	0.07083 (1.33604)
Italy	0.04929** (2.22848)	0.16065*** (3.32027)	0.11136 (0.14248)				0.05187*** (2.74684)	-0.01236 (-0.14119)	-0.06423 (-0.76600)	0.03857** (1.97229)	0.11971** (2.30960)	0.08114 (1.47348)
Japan	0.00626 (1.56650)	0.00371 (1.36267)	-0.00255 (-0.66941)				0.00761** (2.34982)	0.00609** (2.45566)	-0.00152 (-0.57038)	0.01404 (1.03677)	0.04941** (2.02317)	0.03536 (1.39386)
Netherlands	0.02607 (1.17419)	0.02859 (0.66435)	0.00253 (0.00362)	0.03676*** (2.88501)	0.12611*** (3.16535)	0.08935** (2.45697)	0.04349*** (2.68380)	0.18560** (2.13137)	0.14211* (1.69204)			
New Zealand	0.06466* (1.83284)	0.18360** (2.68459)	0.11894 (0.17053)				0.05063** (2.07741)	0.21241*** (3.96904)	0.16177*** (3.51835)	-0.06560** (-2.17693)	0.05251 (0.99738)	0.11811** (2.46387)
Norway	0.06881** (2.52062)	0.17275** (2.33805)	0.10394 (1.46704)				0.04919* (1.69135)	-0.00253 (-0.02372)	-0.05172 (-0.55023)			
Portugal	0.06810*** (2.97080)	0.18496*** (3.82378)	0.11686 (0.14356)				0.05783*** (3.70466)	0.18882*** (3.94579)	0.13099*** (3.27825)			
Spain	0.03371** (2.18379)	0.03024 (1.11656)	-0.00348 (-0.15947)				0.02785 (1.07205)	0.04327 (0.82184)	0.01543 (0.02098)	0.02428 (1.25360)	0.09136* (1.83326)	0.06708 (1.20109)
Sweden	0.04036** (2.35313)	0.17417** (2.73830)	0.13381** (2.26795)				0.05404*** (3.00155)	0.21979*** (3.73755)	0.16576*** (3.29416)	0.07212*** (2.69191)	0.17228*** (3.31707)	0.10016 (0.14361)
Switzerland	0.04487*** (2.89130)	0.15052*** (3.62019)	0.10566** (2.60843)				0.07323*** (3.60429)	0.13097*** (4.51960)	0.05775** (2.33965)			
UK	0.02475 (1.23110)	0.14984** (2.36568)	0.12509* (1.76557)	0.12094 (1.43237)	0.21973 (1.34241)	0.09879 (0.14164)	0.02115 (0.99080)	0.18729** (2.60349)	0.16614** (2.41902)			

Note: ***, ** and * indicate the 1%, 5% and 10% significance levels, respectively. t-statistics are reported under the estimated coefficients in parentheses.

Table 2: The Effects of Change in Fed Funds Target Rates on Developing/Emerging Countries' Interest Rates (excluding the days on which FOMC meetings occurred but the target rates were not changed)

	3-Month			6-Month			12-Month			10-Year		
	Expected	Surprise	Difference	Expected	Surprise	Difference	Expected	Surprise	Difference	Expected	Surprise	Difference
Bulgaria	-0.00502 (-1.48751)	-0.00659 (-0.76260)	-0.00156 (-0.19974)									
China	0.37799 (1.13710)	0.42950 (0.58478)	0.05151 (0.05084)									
India	0.00653 (0.20939)	0.10370 (0.80132)	0.09716 (0.89145)				0.05414** (2.22415)	0.15578** (2.14605)	0.1016* (1.68106)	0.03611 (1.46522)	0.07646 (1.48530)	0.04035 (0.96237)
Malaysia	-0.00016 (-0.01462)	-0.01212 (-0.53535)	-0.01196 (-0.83600)				-0.00250 (-0.30613)	-0.01765 (-1.23625)	-0.01515 (-1.59571)			
Philippines	0.00940 (0.26009)	0.06757 (0.96396)	0.05817 (0.08340)				0.00865 (1.20984)	0.07172 (1.26855)	0.06307 (1.13711)			
Romania	-0.00262 (-0.00731)	-0.46310 (-0.62109)	-0.46048 (-0.57967)				-0.04048 (-0.20032)	-0.23383 (-0.72950)	-0.19335 (-1.02831)			
Russia	-0.32660 (-0.93259)	-0.89300 (-1.61909)	-0.56640 (-1.48258)									
Slovak Republic	-0.01511 (-0.19764)	-0.00909 (-0.08756)	0.00603 (0.14440)				0.06228 (1.17844)	0.06761 (1.07336)	0.00533 (0.33079)			
Sri Lanka	0.02241 (0.94559)	-0.00013 (-0.0026)	-0.02254 (-0.02884)				0.01750 (1.27526)	0.00001 (0.00075)	-0.01749 (-1.02841)			
Taiwan	0.00932 (0.39277)	0.07815 (1.13915)	0.06883 (1.16541)	0.01125 (0.87819)	0.01697 (0.42216)	0.00571 (0.16160)						
	(1.23110)	(2.36568)	(1.76557)	(1.43237)	(1.34241)	(0.14164)	(0.99080)	(2.60349)	(2.41902)			

Note: ***, ** and * indicate the 1%, 5% and 10% significance levels, respectively. t-statistics are reported under the estimated coefficients in parentheses.

Appendix

Table A1: Description of the Interest Rates Used in the Study

Countries	Maturity	Description
Australia	3-month	Australia Dealer Bill 90-day - Middle Rate
	6-month	Australia Dealer Bill 180-day – Middle Rate
	10-year	Australia Bond Yield 10-year - Middle Rate
Austria	3-month	Austria Vibor 3-month- Offered Rate
	12-month	Austria Vibor 12-month - Offered Rate
	10-year	Austria Benchmark Bond 10-year (Ds) - Red. Yield
Bulgaria	3-month	Bulgaria Interbank 3-month - Middle Rate
China	3-month	Chi Interbank 3-month - Offered Rate
France	3-month	France Interbank 3-month – Offered Rate
	6-month	France Interbank 6-month – Offered Rate
	12-month	France Interbank 1-year - Offered Rate
	10-year	France Benchmark Bond 10-year (Ds) - Red. Yield
India	3-month	India T-Bill Secondary 91-day – Red. Yield
	12-month	India T-Bill Secondary 1-year – Red. Yield
	10-year	India T- Bond 10-year - Red. Yield
Italy	3-month	Italy Interbank 3-month - Offered Rate
	12-month	Italy T-Bill Net 12-month - Middle Rate
	10-year	Italy Benchmark Bond 10-year (Ds) - Red. Yield
Japan	3-month	Tokyo Interbank Euroyen 3-month - Offered Rate
	12-month	Tokyo Interbank Euroyen 1-year - Offered Rate
	10-year	Japan Benchmark Bond -Ryld.10-year (Ds) - Red. Yield
Malaysia	3-month	Malaysia Interbank 3-month – Middle Rate
	12-month	Malaysia Interbank 1-year – Middle Rate

Table A1 (continued): Description of the Interest Rates Used in the Study

Countries	Maturity	Description
Netherlands	3-month	Nthrland EU-Gldr 3-m(Ft/Icap/Tr) - Middle Rate
	6-month	Netherland Interbank 6-month - Offered Rate
	12-month	Nthrland EU-Gldr 1-y (Ft/Icap/Tr) - Middle Rate
New Zealand	3-month	New Zealand Interbank 3-m - Middle Rate
	12-month	New Zealand Govt.Bd. Yield 1-year – Red. Yield
	10-year	New Zealand Govt.Bd. Yield 10-Year - Red. Yield
Norway	3-month	Norway Interbank 3-m (Effective) - Middle Rate
	12-month	Norway Interbank 12-m (Effective) - Middle Rate
Portugal	3-month	Portugal Lisbor 3-month - Offered Rate
	12-month	Portugal Lisbor 1-year - Offered Rate
Romania	3-month	Romanian Interbank 3-month – Middle Rate
	12-month	Romanian Interbank 12-month - Middle Rate
Russia	3-month	Russia Interbank 31- to 90-day - Middle Rate
Slovak Republic	3-month	Slovak Rep. Interbank 3-m - Middle Rate

	12-month	Slovak Rep. Interbank 1-year - Middle Rate
Spain	3-month	Spain Interbank 3-month - Middle Rate
	12-month	Spain Interbank 12-month - Middle Rate
	10-year	Spain Benchmark Bond 10-y (Ds) - Red. Yield
Sri Lanka	3-month	Sri Lanka Treasury Bill 3-month - Middle Rate
	12-month	Sri Lanka Treasury Bill 12-month - Middle Rate
Sweden	3-month	Sweden Treasury Bill 90-day - Middle Rate
	12-month	Sweden Treasury Bill 360-day - Middle Rate
	10-year	Sweden Benchmark Bond 10-yr (Ds) - Red. Yield

Table A1 (continued): Description of the Interest Rates Used in the Study

Countries	Maturity	Description
Switzerland	3-month	Swiss 3-month Libor (Snb) – Middle Rate
	12-month	Switzerland EU-Frc-1-y (Ft/Icap/Tr) - Middle Rate
	10-year	Switzerland Benchmark Bond 10-y (Ds) - Red. Yield
Taiwan	3-month	Taiwan Money Market 90-day - Middle Rate
	6-month	Taiwan Money Market 180-day - Middle Rate
UK	3-month	UK Interbank 3-month -Middle Rate
	6-month	UK Interbank 6-month - Middle Rate
	12-month	UK Interbank 1-year - Middle Rate