ADB

ADB Working Paper Series on Regional Economic Integration

The Impact of Monetary Policy on Financial Markets in Small Open Economies: More or Less Effective During the Global Financial Crisis?

Steven Pennings, Arief Ramayandi, and Hsiao Chink Tang

No. 72 | January 2011

Asian Development Bank

ADB Working Paper Series on Regional Economic Integration

The Impact of Monetary Policy on Financial Markets in Small Open Economies: More or Less Effective During the Global Financial Crisis?

Steven Pennings[+], Arief Ramayandi[++], and Hsiao Chink Tang[+++]

No. 72 | January 2011

The authors thank Jonathan Kearns and Noritaka Akamatsu for helpful discussions and suggestions. Discussions and data assistance from staff of Bank Indonesia, Bank of Korea, Bank Negara Malaysia and Bank of Thailand are very much appreciated. Aleli Rosario provided research assistance.

[+]Steven Pennings is PhD Candidate, Department of Economics, New York University, 19W. 4th Street, 6FL, New York, NY 10012 , United States. Tel: 1 (212) 998 8900, email: steven.pennings@nyu.edu

[++]Arief Ramayandi is Economist, Economic Research Department, Asian Development Bank, 6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines. Tel: (632) 632 5024, email: aramayandi@adb.org

[+++]Hsiao Chink Tang is Economist, Office of Regional Economic Integration, Asian Development Bank, 6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines. Tel: (632) 632 5637, email: hctang@adb.org

Asian Development Bank

The ADB Working Paper Series on Regional Economic Integration focuses on topics relating to regional cooperation and integration in the areas of infrastructure and software, trade and investment, money and finance, and regional public goods. The Series is a quick-disseminating, informal publication that seeks to provide information, generate discussion, and elicit comments. Working papers published under this Series may subsequently be published elsewhere.

January 2011
Publication Stock No.

Contents

Figures

Appendix Tables

Abstract

This paper estimates the impact of monetary policy on exchange rates and stock markets for eight small open economies: Australia, Canada, the Republic of Korea, New Zealand, the United Kingdom, Indonesia, Malaysia and Thailand. On average across these countries, a one percentage point surprise rise in official interest rates leads to a 1% appreciation of the exchange rate and a 1% fall in stock market indices. The effect on exchange rates is notably weaker in the non-Organization for Economic Cooperation and Development (OECD) countries with a managed float. For the OECD countries, there is no robust evidence of a change in the effect of policy during the global financial crisis. For the non-OECD countries, there is some evidence of a stronger effect of policy on stock markets during the crisis, although further research is needed to investigate whether this is a result of measurement issues.

Keywords: Monetary policy effectiveness, exchange rate, stock prices, crisis, Asian economies

JEL Classification: E44, E52, G14

1. Introduction

Policymakers, market commentators and academics have differing opinions on the effect of monetary policy on the economy during the global financial crisis. For example, Krugman (2008) argues that "we are already… [in] a state of affairs like that of the 1930s in which the usual tools of monetary policy…have lost all traction". In contrast, Mishkin (2009) argues that monetary policy is, if anything, more effective during the crisis. He argues that commercial interest rates during the crisis are high because risk spreads have risen over and above the policy rate, and hence if the US Federal Reserve's policy rate had not been cut, commercial rates would have been even higher. Moreover, as lower interest rates reduce the risk of a serious depression, the Federal Reserve's monetary policy also reduces the macroeconomic risk component of the risk premium, further lowering interest rates. In other words, monetary policy reduces the risk of the negative feedback loop between macroeconomic conditions and risk spreads known as financial accelerator (Bernanke, Gertler and Gilchrist 1999).

Both Mishkin and Krugman are referring to the full transmission mechanism of monetary policy[1] to real variables: a two-part process consisting of, first, the transmission from the central bank's policy rate to financial markets, and then, second, from financial markets to real activity (the final goal). Most empirical studies use a vector autoregression (VAR) methodology to examine the full transmission mechanism from policy to real variables.[2] However, with many estimated parameters, quarterly data, and long lags, the financial crisis is simply too short to be examined using a standard VAR.

The alternative and less ambitious approach pursued here is to examine the first stage of the transmission mechanism, from the policy rate to a range of financial variables. Financial variables are much more appropriate for shorter samples because (i) they are available at high frequencies, and (ii) they respond almost instantaneously to publicly available information, such as, interest rate announcements. In contrast, most real variables only respond with long and variable lags to monetary policy.

This paper follows an event study approach to examine the effect of monetary policy announcements (the "events") on exchange rates and the stock market indices for eight small open economies: Australia, Canada, New Zealand (NZ), the United Kingdom (UK), Indonesia, the Republic of Korea, Malaysia and Thailand. While empirically tractable, an event study skirts many of the key issues in the debate on the effectiveness of monetary policy during the crisis, such (i) the degree to which policy rates are passed on to borrowers, (ii) credit constraints, (iii) the impact of the lower bound[3] and (iv) soaring liquidity and risk premia in interbank markets. However, to the extent that these factors affect the (perceived) future profitability of firms, they will be captured in the stock market's response to a policy change. Hui et al. (2009) find rising liquidity and counterparty risk premia in interbank markets lead to a failure of covered interest parity

---

1 That is, the effect of a change in overnight (or similar) interest rates by a central bank.

2 For example, see Berkelmans (2005) for Australia and Tang (2006) for Malaysia

3 When nominal interest rates approach zero.

during the crisis—suggesting a change in the relationship between interest rates and exchange rates. As such, this paper examines some of the key issues indirectly.
The key to the event study approach is to use a short window around a monetary policy decision to isolate causality. In general, the policy interest rate responds to the same economic data and financial conditions as other financial variables, leading to a simultaneity problem. As such, a standard regression—outside the short window around monetary policy changes—of the financial variable on the policy rate is difficult to interpret as both the policy rate and financial variable could be responding to the same excluded economic variables or causality could be running from the financial variable to the policy variable. However, if policy makers do not respond to new information on the day of the policy announcement, then the change in the policy rate *on the day of the announcement*, is relatively exogenous to movements in financial variables on the same day.[4] As such, a regression of the change in the financial variable on change in the policy rate isolates causality from the policy rate to the financial variable.

The other cornerstone of this approach is to examine *unanticipated* changes in monetary policy (often known as monetary surprises) rather than actual changes in the policy rate. Rational expectations suggest anticipated changes in the policy rate have no impact on financial variables as verified empirically by Kuttner (2001) for the United States (US).[5] This paper uses changes in 1-month market interest rates in each country on the day of the announcement as the measure of the monetary policy surprise. Interbank loans, bank bills and bankers' acceptances are traded in many more countries than futures or other derivatives commonly used to identify monetary policy surprises. In doing so, this paper is able to examine the effect of policy in countries that have been overlooked by the literature.

To preview some of the results, the crisis may have strengthened the effect of policy surprises on stock markets in non-Organization for Economic Cooperation and Development (OECD) countries, although there is little robust evidence that it has changed the effect of policy on exchange rates, and the effect of policy in OECD countries. To our knowledge, this is the first paper that uses the event study methodology to provide estimates of the effect of domestic monetary policy for Asian countries such as the Republic of Korea, Indonesia, Malaysia and Thailand, and provides updated estimates of the effect of monetary policy of financial markets in Australia, NZ, Canada and the UK. On the whole, including the crisis period, a one percentage point surprise rise in interest rates appreciates the exchange rate by around 1–3% in most countries with a freely floating exchange rate (more for Australia, less in the Republic of Korea), and a 0.5% appreciation for countries with a managed float (Thailand, Malaysia and Indonesia). The same surprise lowers stock markets by around 1–1.5% in most developed and developing countries.

---

[4] If economic data are released on the same day as the monetary policy decision then one needs to be careful that financial variable is not responding to the economic release partially known by policymakers. See Section 3.

[5] Actual policy changes comprise both the anticipated and unanticipated (surprise) changes, but financial markets should only respond to the latter on the day of announcement.

The rest of the paper is as follows. Section 2 reviews the literature, while Section 3 discusses methodological issues such as the selection of countries, the crisis period and the removal of influential observations. Section 4 discusses data issues and presents descriptive statistics. Section 5 presents the main results, while Section 6 discusses a number of extensions. Section 7 concludes.

2. Literature Review

2.1 Monetary Policy Shocks and the Expectations Hypothesis

Theory suggests that agents are forward looking and have rational expectations. This means an anticipated change in the policy interest rate will only have small effects on financial variables as the change is already "priced in". For the US, Kuttner (2001) estimates the effect of changes in the fed funds rate on the treasury bills, notes and bonds using the event study approach. His main contribution is to separate anticipated changes from unanticipated changes using the change in the 1-month fed fund futures yield on the day of the announcement.[6] He finds that although in general interest rates (3-month and longer) only respond weakly (with a coefficient of 26.8 bps for the 3-month rate) to changes in short rates, they respond strongly (coefficient of 79.1 bps) to unanticipated changes and negligibly to anticipated changes, in line with theory. Kuttner's finding underlines the importance of measuring the response of financial variables to monetary policy *shocks*, something of focus in this paper.

One of the criticisms of this approach has been that empirical tests of the expectations hypothesis generally fail, even with the use of fed fund futures (Piazzesi and Swanson 2004). That is, fed fund futures are not unbiased predictors of the fed fund rate, and some proportion of the forecast errors are predictable ex ante. That said, risk premia tend to change only at business cycle frequencies. So Kuttner's approach of identifying monetary policy shocks using the change in the futures rate on the day is still relevant since it differences out the term premium. Because interbank loans, bank bills, bankers' acceptances and similar instruments involve an exchange of principal and are not exchange-traded unlike futures, they are likely to have even larger term premia than futures contacts, making Kuttner's differencing approach particularly important.

A number of other papers in the literature have used the change in market interest rates to identify monetary policy shocks. For example, Zettelmeyer (2004) uses the 1-day change around a monetary policy announcement in the 3-month market interest rate in Canada, Australia and NZ to identify the effect of a monetary policy shock on the exchange rate. Kearns and Manners (2005) use the daily change in 1-month and 3-month bank bills, bankers' acceptances, wholesale bills and the London Interbank Offer Rates (LIBOR) to identify the size of the monetary policy shock for Australia, Canada,

[6] The fed fund futures contract pays out based on the difference between the futures rate and the average of the fed fund rate over the life of the contract. Based on the expectations hypothesis, in equilibrium, these must be equal.

NZ, and the UK, respectively. However, unlike Zettelmeyer whose dependent variable is the daily change in exchange rate, Kearns and Manners use intraday change.

2.2 Mechanisms Involving the Exchange Rate

The uncovered interest parity (UIP) condition states that a change in the difference between domestic and foreign interest rates implies changes in the expected appreciation or depreciation of the exchange rate. UIP suggests that if foreign interest rate is held constant over the coming year (and the expected exchange rate one year ahead is also constant), a one percentage point increase in the domestic interest rate (a one percent monetary surprise) will appreciate the exchange rate expectation instantaneously by the same amount. In practice, however, movements in risk premia seem to be more important in affecting the exchange rate (Fama 1984). Fama also finds, on average, high yielding currency tends to appreciate rather than depreciate. Clarida et al. (2009) and Brunnermeier et al. (2008) have also documented the correlation between market's assessment of risk and return to currency speculation. If market's perception of risk is more (or less) sensitive to monetary policy during crisis, then a different relationship between monetary policy and exchange rates can be expected.

There are many ways a crisis can change the effect of policy on the exchange rate. One is through liquidity. Brunnermeier and Pedersen (2009) present a model where initial losses can lead to "liquidity spiral" of funding problems for traders, forced sales, prices that deviate from fundamentals and further margin calls. In a similar environment, a negative monetary policy shock (a fall in interest rates) can have standard first round effects of a depreciation of the home currency. But if tight funding conditions cause margin calls for speculators taking long positions in the home currency—and other participants are unable to raise funds to move against the change—then there can be a second round depreciation and hence a larger effect of monetary policy during crisis.

A closely related mechanism is that high-bid ask spreads during crisis may make it more difficult for market participants to take advantage of deviations from fundamental prices. Bid-ask spreads in foreign exchange markets widened markedly during the global financial crisis. For example, the spread of the Australian dollar widened to 3.5 times its pre-crisis level as "risk retrenchment and the unwinding of leveraged position … generated one-sided markets" Debelle (2009). Burnside et al. (2006) report that deviations from UIP can become unprofitable to take advantage of relative to the risk taken due to buy-sell spreads in the foreign exchange markets, and the effect of order flow on spreads.[7]

Hui et al. (2009) report that the close relationship between the futures price of foreign exchange and interest rate differences across countries—covered interest parity—was

[7] Debelle (2009) notes that during the crisis, the "Australian dollar was reportedly used as a proxy for trades in the Korean won during New York trading hours when the won was not traded, and as a proxy for the Brazilian real during Asian time when the real was not traded".

disrupted during the crisis. While it is difficult to know whether this makes monetary policy more or less effective, it suggests that mechanisms linking exchange rates and interest rates work differently during the crisis.

2.3 Empirical Evidence on the Effect of Monetary Policy on Exchange Rates

The exchange rate is a key component in the monetary transmission mechanism for an open economy, for example, to real variables such as net exports. As discussed earlier, UIP suggests a positive interest rate surprise should lead to an appreciation of the exchange rate. For the developed small open economies considered in this paper, a positive interest rate surprise generates a statistically significant appreciation in the exchange rate. Kearns and Manners (2005) find that a 100 basis points (bps) surprise, which is much larger than the average surprise, leads to a 1–2% appreciation of the exchange rate, depending on the country being considered. Zettelmeyer (2004) gets broadly similar results.

Kearns and Manners also decompose monetary policy surprises into timing surprises (where expectations of future rates do not change, but the policy change occurs earlier than previously expected) and levels surprises (where the policy change also increases expected policy rates several months out). They do this by adding an extra variable for the change in the second futures contract that starts two to three months away. As expected, a levels surprise leads to a much larger exchange rate impact than a timing surprise. Assuming no further expected change in rates, Kearns and Manners find, across all countries, the appreciation is around twice as large as predicted by UIP, although the changes for Australia are in line with UIP.

2.4 Stock Market and Monetary Shocks

Bernanke and Kuttner (2005) use the event study approach to investigate the interaction between monetary surprises and stock market index. They apply the same estimation procedure as the papers above and find that a 25 bps surprise cut in the fed funds rate raises the stock market by 1%. Like those studies, they report a larger effect for levels surprises than timing surprises. They also find that the results are particularly sensitive to a number of outliers, which they identify and remove statistically, a methodology also adopted here.

In theory, the value of a share is equal to the present discounted value of its cash flows. In the model of Campbell (1991), adapted by Bernanke and Kuttner (2005), a surprise increase in the policy rate can decrease stock prices in three ways by: (i) decreasing expected future dividends, (ii) increasing the future risk-free rate or (iii) increasing the equity premium (above the risk free rate) required to hold equities. For Bernanke and Kuttner's (2005) study, most of the adjustment is through the premium in expected returns investors require to hold equities (the equity premium).

As with exchange rates, the impact of monetary policy on stock prices during crisis can be different in a number of direct and indirect ways. An interest rate rise leading to first

round falls in stock prices can lead to a second round of selling induced by margin calls. In times of crisis, balances in the margin accounts will fall, while credit is tighter, so any second round effects due to "liquidity spirals" are likely to be stronger. If monetary policy has a stronger effect due to the financial accelerator mechanism as argued by Mishkin (2009), then a rate cut during crisis leads to a larger-than-normal rise in expected future dividends, and hence a larger-than-normal rise in stock prices. Conversely, if interest rates cuts are not passed on to firms, then the effect of policy on future profitability is weaker, and so policy changes during crisis have a smaller effect on stock prices. Policy announcements during crisis that involve keeping rates lower for longer, such as in the US during the global financial crisis, may reduce the expected risk free rate by more than is normally expected. Policy may also have a stronger effect on risk premia during crisis as argued by Mishkin (2009). This may be particularly important as Bernanke and Kuttner's (2005) result suggest that most of the impact of monetary policy changes for the US is through expected equity premia.

There are not many papers investigating the effect of domestic monetary policy surprises on Asian stock markets using the event study approach. Instead, studies have looked at the effect of foreign (US and European) monetary policy shocks. Wongswan (2009) finds a significant effect of US monetary surprises on the stock markets for Indonesia, the Republic of Korea, and Malaysia, but not for Thailand. Kim and Nguyen (2009) find US and EU monetary policy shocks have a significant negative impact on the majority of the 12 Asian stock markets, with news announcements generating greater volatility.

3. Methodology

This paper analyzes the instantaneous impact of an unanticipated change in monetary policy on the exchange rate and the stock market index. The monetary policy committee typically sets the overnight interest rate for a month or more (until the next policy meeting), meaning that the day before the announcement the expected return on the sequence of overnight loans for one month will reflect the expected policy rate over the coming month ($E_{t-1d} i^P_{1m,t}$; where d denotes days and m denotes months). Clearly after the announcement, the expected policy rate is equal to the actual policy rate ($E_t i^P_{1m,t} = i^P_{1m,t}$). With this, a change in the policy rate can be written as follows:

$$\Delta i^p_t \equiv i^P_{1m,t} - i^P_{1m,t-1d} = (E_{t-1d} i^P_{1m,t} - i^P_{1m,t-1d}) + (i^P_{1m,t} - E_{t-1d} i^P_{1m,t}) = \Delta i^a_t + \Delta i^{un}_t \quad (1)$$

Δi^a_t is the anticipated component of the monetary policy change, which should not affect financial markets on the announcement day, and Δi^{un}_t is the unanticipated (surprise) element of the policy change on the day of policy announcement, which affects financial markets on the day of announcement. As investors must be indifferent between holding this sequence of overnight loans for one month and investing at the 1-month market rate ($i^{IB}_{1m,t}$), the expectations hypothesis suggests that 1-month market rate must equal the

expected policy rate over the coming month ($E_t i^P_{1m,t}$), plus a constant term premium (TP), that is, $i^{IB}_{1m,t} = E_t i^P_{1m,t} + TP$.[8] Therefore, the surprise element of monetary policy change can be represented by the following relationship:

$$\Delta i^{un}_t \equiv i^P_{1m,t} - E_{t-1d} i^P_{1m,t} = (E_t i^P_{1m,t} + TP) - (E_{t-1d} i^P_{1m,t} + TP) \approx \Delta i^{IB}_t \quad (2)$$

Our baseline model, as shown in Equation 3, tests whether the unanticipated change in the monetary policy (Δi^{un}_t) on the day of the policy announcement affects the financial variable (Δf_t) of interest: the exchange rate, e, or the stock market index, s:

$$\Delta f_t = \alpha + \beta \Delta i^{un}_t + \varepsilon_t; \; f = e, s \; . \quad (3)$$

To test if policy changes have a different effect during crisis, we estimate Equation 4, which adds an interaction term between the unexpected change in monetary policy and a crisis dummy variable ($d_{C,t}$) taking a value of one during the global financial crisis and 0 otherwise. If monetary policy has a different effect on financial markets during the crisis, then $\gamma \neq 0$. Note that the total effect of policy surprises during the crisis is $\beta + \gamma$. As a robustness check, $d_{C,t}$ is also added as an additional variable (Equation 5). Other extensions investigating (i) the persistence of monetary policy shocks, (ii) the effect of time-varying risk premia and (iii) the efficiency of financial markets are discussed in Section 6.

$$\Delta f_t = \alpha + \beta \Delta i^{un}_t + \gamma \Delta i^{un}_t . d_{C,t} + \varepsilon_t; \; f = e, s \quad (4)$$

$$\Delta f_t = \alpha + \beta \Delta i^{un}_t + \gamma \Delta i^{un}_t . d_{C,t} + \delta d_{C,t} + \varepsilon_t, \; f = e, s \quad (5)$$

3.1 Selection of Countries

We extend the sample of developed, small and open economies studied in Kearns and Manners (2005)—Australia, NZ, Canada and the UK—to include Indonesia, the Republic of Korea, Malaysia and Thailand. Besides allowing the study of monetary policy in these Asian economies, doubling the number of countries approximately doubles the number of observations during the crisis period. This is crucial given that the definition of the crisis period used here typically only includes six observations per country.

We follow Kearns and Manners in selecting countries which have liquid financial markets and a credible inflation targeting regime. Admittedly, this is not always possible. Of all the major Asian economies considered, only the Republic of Korea and the Philippines are classified as independent floaters and follow an inflation targeting framework like the

[8] These conditions can be derived by taking logs of the actual compounded return and applying the approximation $\ln(1+i)n \approx ni$ where n=periods. Trading-day and compounding rules complicate the derivation but to not materially affect the expression.

original four developed economies.[9] The Philippines, however, is not included in the study. Its treasury bill and interbank rates are highly volatile and appear to be disconnected from the policy rate, which hinders the extraction of any meaningful information. Thailand and Indonesia are also selected because they are the remaining inflation targeters in the region, although the IMF classified them as managed floaters. Malaysia is also chosen despite being neither an independent floater nor an inflation targeter. It follows a managed floating exchange rate system, but adopts many features of the inflation targeting framework. For example, the sequence of policy meetings is set in advance on the central bank's website, the policy instrument is well-defined (the overnight policy rate) and monetary policy decisions are publicly announced. Hence, it is much easier for the markets to anticipate what decision is (or was) made, and when then next one will be—making monetary policy surprises easier to identify.

India, Singapore, Hong Kong, China, the People's Republic of China (PRC), and Japan were considered but not included. India has a managed floating exchange rate regime, but it uses various policy instruments, which complicate a clear identification of monetary policy changes. Singapore and Hong Kong, China are essentially exchange rate targeters, the former follows an unspecified basket of currency, while the latter has a currency board with the US. PRC, on the other hand, uses various policy instruments and also pegs its currency against the US dollar. Japan was also excluded due to its near zero interest rates over the sample period.

3.2 Crisis Periods

Two crisis periods are used. The standard or narrower one runs from 15 September 2008 to 15 March 2009. The broader period starts from 1 January 2008 to end-May/June 2010, the time of data collection.

The standard period in essence captures events during the peak of the global financial crisis.[10] It starts from the day when Lehman Brothers filed for Chapter 11 until the trough in the MSCI world equity market index. This period also saw the rescue of American International Group, the failure and takeover of Washington Mutual and Wachovia, and the near collapse of the money market where the LIBOR and the overnight indexed swap (OIS) spread rose to over 300 bps. By January 2009, financial markets had stabilized somewhat, largely as a result of central bank provision of liquidity, yet the crisis was far from over. From January to March 2009, world equity markets fell further, bank credit spreads increased, and GDP contracted sharply. It was not until mid-March that some "green shoots" started to appear (according to commentators including the US Federal Reserve Chairman Bernanke)[11], and equity markets started to recover. As such, 15 March 2009 is the end of the standard crisis period. Practically, late 2008 has too few policy decisions to be a useful end-point for the crisis.

---

[9] Based on the IMF classification, http://www.imf.org/external/np/mfd/er/2008/eng/0408.htm

[10] It is consistent with Stages 3 and 4 of the global financial crisis, also its peak, as defined by BIS (2009a).

[11] See US Federal Reserve Chairman Bernanke's remarks, http://www.npr.org/bogs/mpney/2009/03/bernanke _sees_green_shoots.html

The broader crisis starting date of 1 January 2008 is a compromise between June 2007 and March 2008, two other potential starting dates used by Bank for International Settlements (2009a,b). This start date recognizes risk aversion and concerns about the solvency of financial institutions from the repercussions of the US subprime mortgage crisis well before the failure of Lehman Brothers. When it became clear that the US housing market had peaked in 2007, market participants began to worry about the value of mortgage backed securities and their related assets, and the solvency of highly leveraged financial institutions holding these securities. Such concerns hit new highs when Bear Sterns failed in March 2008 and the credit default swap spreads of many financial institutions widened markedly. The end-date is chosen to account for the overhang of the crisis, where there is still a general pessimism about the state of the global recovery. The continued deleveraging process among householders, unresolved mortgage problems, stubbornly high unemployment, and lingering sovereign debt problems are fallouts of the crisis that continue to dent confidence.

3.3 Removal of Outliers

It is important to remove observations when monetary policy might respond to financial variables within the observation window (a simultaneity problem) or when policy and financial variables both respond to the same piece of news (an omitted variable problem) (Zettelmeyer 2004). Both the simultaneity and omitted variable problems lead to biased estimates. However, for the countries considered here, all have fixed meeting dates, typically every month or two. This means a policy change usually reflects news released since the last policy meeting, rather than a spontaneous response to news released on the same day. As such, it seems less important to manually exclude suspect observations.

That said, important events can be influential in small samples, particularly during crisis when monetary policy changes are larger and not as well anticipated as usual. This implies the outlying observations may be the sole driver of the estimation results. To avoid such a risk, this paper follows Bernanke and Kuttner's (2005) method of calculating influence statistics to remove outliers. The influence statistic for a particular observation is $\Delta\mathbf{b}'\Sigma^{-1}\Delta\mathbf{b}$, where $\Delta\mathbf{b}$ is the change in the estimated coefficient vector when a particular observation is excluded from the regression, and $\sum$ is the estimated variance-covariance matrix of the original regression on the full sample. The influence statistic is always positive (due to the quadratic form) and will be close to zero when the coefficients do not change much from the exclusion of a particular observation, or when the coefficients are imprecisely estimated (a "small" $\sum^{-1}$). Bernanke and Kuttner (2005) plot the distribution of influence statistics and exclude those observations with an influence statistic greater than 0.3. In this paper, 0.3 is also used as a cut off. Although it is somewhat arbitrary, it turns out that the 0.3 benchmark removes only a few of the most influential observations in each regression— never more than three. Most of the observations removed have influence statistics that are so large that they would have been removed under any reasonable metric (see Table A1). Fixing the 0.3 benchmark also safeguards against data mining, which is always a concern when excluding observations.

The size of some of the influence statistics shows how critical it is to exclude outliers. In some cases, an influential observation is excluded because financial market movements are clearly caused by a third factor. For example, in Thailand, 3 December 2008 was the date of the largest ever cut in rates by a largely unanticipated 100 bps, but also the reopening of Bangkok's Suvarnabhumi airport after a week-long sit in by anti-government protesters.[12] However, in others cases, there is no clear news event driving an outlier or there is some ambiguity in terms of timing. For example, on 12 December 2008, Bank of Korea (BOK) announced new and expanded foreign exchange swap lines with PRC and Japan. It happened after the day of an influential observation which saw the policy rate cut by 100 bps, but the exchange rate appreciated by 2.5%. Yet discussions on the swap arrangements would have been conducted beforehand and as such the announcement would have been anticipated. Hence, sometimes, it may be difficult to judge on news alone whether the influential observation can be excluded.[13]

As a robustness check, a robust regression algorithm is also employed.[14] The robust method has two disadvantages: heteroskedasticity robust standard errors cannot be used (as the observations have already been reweighted); and it is difficult to summarize the reweighting mechanism, which is why the main results are presented using Bernanke and Kuttner's (2005) approach.

While noise in financial variables will not affect estimates in large samples, if macro variables such as GDP and consumer price index are partially known by the central bank (and so influence policy), but may not be known by the markets, then the estimates can be biased. For Australia, timing conventions make this potentially a large problem—GDP was released on the same day as the monetary policy decision in 30 out of the 137 decisions considered. However, the exclusion of these observations does not significantly affect results for Australia (not reported). For Malaysia, on nine out of the 43 monetary policy release dates, the central bank released GDP estimates at the same time as the monetary policy decision.[15] Excluding these observations does not materially affect the estimates.[16]

---

[12] See http://www.timesonline.co.uk/tol/news/world/asia/article5277798.ece. The Baht rallied in response to this news, as the closure of the airport had crippled Thailand's tourist industry, a major export earner. This observation has a high influence statistic because it is an outlier in terms of the dependent and independent variable.

[13] Possible further work is to investigate outliers using a shorter event window.

[14] This is done via Stata's rreg command. The algorithm initially screens for outliers using Cook's distance greater than one as a threshold. It then uses two iterative procedures (Huber weights and a biweight method) to down weigh influential observations and then re-estimates influential observations, as suggested by Li (1985). Monte Carlo simulations by Hamilton (1991) suggest that this robust regression is almost (95%) as efficient as ordinary least squares (OLS) with ideal data (normal errors, fixed X), but more than twice as efficient with fat tailed errors and random X which would best describe the data used here.

[15] Bank Negara Malaysia (BNM) announces the GDP in its quarterly "Economic and Financial Developments in the Malaysian Economy" press releases.

[16] Further work can be extended to investigate this issue for the other six countries.

4. Data

Policy rates, market interest rates, exchange rates and stock price data are collected for the eight countries. Table 1 lists the policy rates and their sample sizes. The sample size for each country corresponds to the longest available series conditional on a relatively constant monetary policy framework over the sample. Each observation in the sample is a monetary policy decision, not a policy change as in some other studies. As the non-OECD countries in the sample adopted inflation targeting after the OECD countries, their sample sizes are smaller than that of the OECD countries. As such, pooled results are often more closer to the results of the OECD countries. The number of decisions is reasonable for all countries, although the number of policy changes is very small for Malaysia. In each country, the sample size is small in the standard crisis period. As such, each individual country's estimates during the crisis should be interpreted with care. Pooling across all countries, however, gives 35 policy changes (40 decisions), which may be large enough to produce reliable econometric estimates. In the broad crisis period, the number is larger —70 policy changes (194 decisions).

The market interest rates for Indonesia, the Republic of Korea, Malaysia and Thailand are the interbank offered rates in each country. For Australia, Canada, NZ and the UK, we follow Kearns and Manners (2005) in using the bank bill, bankers' acceptances, wholesale bill and LIBOR rates, respectively. The exchange rates are nominal exchange rates, US dollar per local currency, such that an increase reflects of an appreciation of the local currency. The stock price indexes are the main stock price index in each country. (Details of the data collected, sources and timing of the policy changes are reported in Table A2).

Great care needs to be taken with timing. In some countries, such as Malaysia, the policy announcement is at 6 pm local time, after markets have closed. This means the one-day change in the interbank rate, exchange rate and stock index need to be lagged by a day. In Canada, a 9 am decision time means no lags are needed. Sometimes some market prices are sampled before the announcement, and some after. For example, in the UK, the LIBOR rate is quoted at 11 am, before the monetary policy announcement, usually, at 12 pm (a one day lag) whereas exchange rates and stock prices are measured in the night and afternoon respectively.[17] For most countries, the timing is clear from the data source. However, for the Republic of Korea, interbank rates are sampled at around the same time as the policy announcement (10.40–11 am local time), and so the timing is determined graphically. For most of the countries, market interest rates move closely with the policy rate on the day of the announcement, but do not respond with a one-day lag—suggesting no lag is needed.[18]

---

[17] In Australia, the timing of monetary policy announcement changed from Wednesdays to Tuesdays in February 2008.

[18] Until March 2006, the interbank rate seemed to respond more strongly to policy changes with a one day lag. We were unable to find any information on whether the procedures of Korean Federation of Banks, who collects the data, had changed around this period. However, excluding observations before March 2006 do not affect key results of the paper (see Section 5.4 Other Robustness Tests for more details).

4.1 Data Issues in Asian Countries

The data used for Australia, Canada, NZ and the UK are uncontroversial. However, Indonesia, Thailand and the Republic of Korea have changed their policy instruments in recent years, and liquidity operations by the central banks may have affected the market interest rates, thus adding noise to the measure of monetary surprise.

In Indonesia, for example, changes to Bank Indonesia's (BI) standing facilities (Fasilitas Bank Indonesia, FASBI) may have affected the policy (BI) rate and/or the interbank rates in ways unfamiliar to us, which may warrant further investigation. Under the current arrangement, BI lends to (borrows from) commercial banks at the BI rate +(–) 50 bps. [19] However in June 2006, the overnight FASBI rate for deposits was set at the BI rate –5 percentage points, while the 1-week facility was set at the BI rate –2 percentage points.[20]

In Thailand, the target policy rate has undergone several changes, which may have affected the measurement of expectations from the 1-month interbank rate. The first reform in January 2007 changed the policy instrument from 14-day repo rate to the 1-day repo rate primarily to reduce volatility. The second reform was the decentralization of the repo market, where previously the Bank of Thailand was the principal broker. Other reforms included changing the timing of reserve maintenance periods and establishing a ±50 bps borrowing and lending window around the policy rate to prevent volatility.

In the Republic of Korea, too, there was a major change in the target policy rate. In March 2008, BOK changed the target policy rate from the call rate (the rate on uncollateralized loan from commercial banks to the central bank) to the Bank of Korea base rate, which is "the reference rate applied in transactions such as repurchase agreements between the bank and counterpart financial institutions" (Bank of Korea 2008). This was to address the disconnect between the call rate, which was fixed at the target, and other short-term interest rates. The change is envisioned to lead to a more liquid short-term interbank market and hence interbank rates that better reflect expectations.

4.2 Descriptive Statistics

Table 2 presents the average absolute value of each of the variables on the day of the monetary policy announcement or the day after, depending on timing issues. For all countries except Malaysia, the absolute change in the 1-month market interest rate (Δi_t^{un}) is much smaller than the change in the policy rate (Δi_t^{P}). This shows that, in general, markets predict most of the monetary policy changes—perfect surprises would

[19] See Bank Indonesia's webpage, http://www.bi.go.id/web/en/Moneter/Operasi+Moneter/Standing+Facilities/

[20] See Asian Bonds Online's webpage, http://asianbondsonline.adb.org/indonesia/structure/buying_selling/description.php

have the same two values, whereas perfectly anticipated changes would have the change in market interest rates (monetary policy surprise) close to zero. The average surprise is also quite small—about five bps for OECD countries and 7.5 bps for non-OECD countries. This should be kept in mind when interpreting the results: a point estimate of one (β=1) in the regressions below would mean that a monetary policy surprise only moved markets by 0.05%. The average change in the expected future 2-month rate ($\Delta i_{F,t}^{un}$) is typically similar to the change in the 1-month rate. This means on average a monetary policy surprise changes the level of interest rates going forward, rather than just changing the timing of rates, at least out to three months. For all countries, except Australia and NZ, the stock markets are more volatile than the exchange rates; the difference is particularly large for the developing countries.

Using the standard crisis period, the right side of Table 2 characterizes policy during the crisis as much more volatile than before the crisis. The average policy decision shows a much greater change in the policy rate—around six times greater (than the full sample) for OECD countries and, three times greater for non-OECD countries. However, movements in market interest rates are much larger too—five times larger in OECD countries, and four times larger in non-OECD countries. Changes in the expected future 2-month rates are similar to changes in the 1-month rates, providing some evidence that, as before, most rate changes shift the level of rates, rather than merely changing the timing of rates changes over coming months.[21]

Figures 1 to 8 show the policy change on meeting dates for each country, and the change in the market interest rate (the monetary surprise measure). The first thing to note is that the size of cuts in the policy rate during the crisis is unprecedented in recent history for all countries, except Indonesia and Canada. This can lead to unreliable estimates in small samples. For example, the first rate cut during the crisis, such as, the 1.5 percentage point rate cut on 6 November 2008 in the UK, or the one percentage point cut in October 2008 in Australia, is a long way from the average changes in their respective market interest rates. So, if there are extreme movements in the stock markets and/or the exchange rates on the same day (as they are likely during the crisis), then the observations become extremely influential.

For developed countries, it is easy to spot the unanticipated (surprise) and anticipated component of policy rate changes—the latter being the difference between the policy rate and the market interest rate changes. As seen in Figure 1, Australian policy decisions were generally well anticipated by markets—the bank bill rate (monetary surprise) changes were small. Most of the time, a 25 bps spike in the policy rate barely moved the bank bill rate, for example, on 2 March 2005. Sometime markets expected a rate change that did not happen. For example, on 6 April 2005, when markets thought there was a 60% chance of a change, and the bank bill rate moved, but the policy rate did not. Sometimes policy changes surprised the market, and so bank bill rates moved with the policy rate, such as on 2 December 1998. Looking across a range of countries, one striking feature of the global financial crisis is that central banks responded to the

[21] The exception is NZ, which has a larger change in expected 2-month interest rate than 1-month interest rate. This might be due to movements in risk premia during the crisis (discussed in more detail later).

crisis much more strongly than what markets anticipated. For Australia, only half of the first interest rate cut was anticipated by markets.

The policy response to the crisis for most of the Asian countries was large and somewhat unanticipated by markets. For example, Thailand cut rates by one percentage point in October 2008, and about three-quarters of this was unexpected. The majority of the policy change was also unexpected in the Republic of Korea. Monetary policy in Indonesia and Malaysia did not respond as fast to the crisis. The first rate move by Bank Indonesia after the failure of Lehman Brothers was in fact a 25 bps rate rise on 7 October 2008, while Bank Negara Malaysia only cut rates on 24 November 2008 by only 25 bps. It was not until January 2009 that both central banks cut rates aggressively, which was largely unexpected by their respective interbank markets.

Looking over the whole sample, interbank markets and monetary policy operate quite differently in different Asian countries. In Malaysia, there were few changes in monetary policy. Movements in the interbank rates suggest there was almost no anticipation by the market of policy changes (Figure 7). This may be a result of the infrequent rate changes by the central bank—when rates do change, they tend to surprise the market. In contrast, Indonesia (Figure 5) experienced many rate changes, but most changes took the market by surprise, except the rate cuts in late 2006. In Thailand, most rate rises were at least partially anticipated by the interbank market, such as rate rises in 2005–06, and the market half anticipated rate cuts in 2003. Bank of Thailand (2007) reports that "during the second half of 2005 … market players strongly expected the [Monetary Policy Committee] MPC to raise the policy rate", which corroborates the evidence from Figure 8 that the rate raises in late 2005 were well anticipated.

5. Results

The main results are presented in Table 3. The first two columns are results from Equation 3, and the rest of the columns from Equation 4, which includes an interaction crisis dummy based on either the standard or broad crisis period. The results here exclude observations whose influence statistics are greater than 0.3.

5.1 Baseline (Without Crisis Interaction Term)

From the first column of Table 3, Panel A, across all countries in the sample, a 100 bps monetary surprise raises the exchange rate by around 1.1% and is statistically significant. For the OECD group, its pooled regression shows a 100 bps monetary surprise leads to a statistically significant appreciation of around 1.4%. All (except the Republic of Korea) report a positive and statistically significant effect. For most of these countries, the estimated coefficients are in the range of 1–3%, similar to Kearns and Manners (2005), at the lower end, and Zettelmeyer (2004), at the higher end. The coefficient for Australia is much larger than for the other OECD countries and more than double the estimates presented by Kearns and Manners (2005). While an estimate of 5.4 might seem unrealistically large (a 100 bps surprise leads to a 5.4 percent appreciation), it is important to note that a typical monetary policy surprise is very small—the mean absolute surprise is only 4 bps. As such, the mean response of the

exchange rate is only 0.2%, which is highly plausible.[22] The insignificant result for the Republic of Korea is due to the exclusion of several influential observations and the exact size of the cut-off. For example, with an influence cut-off of one (rather than 0.3), the coefficient on the exchange rate is positive (2.1) and significant at the 5% level.

The non-OECD countries in the sample (Indonesia, Malaysia and Thailand) have a coefficient of around 0–0.5 (a 100 bps surprise appreciates the exchange rate by 0.5%)—less than half of most of the OECD countries.[23] To some extent a small coefficient is not a surprise as the exchange rates of all three are only partially market determined—a managed float rather than a free float. As such, actual, perceived or possible interventions might weaken the link between policy surprises and exchange rate. The sample sizes for these countries are also smaller.

Results from Panel B shows a 100 bps monetary surprise cut leads to a stock market rally of 1% in the pooled OECD regression and 1.5% in the pooled non-OECD regression. The size of the coefficient is smaller than the estimate produced by Bernanke and Kuttner (2005) for the US, although not substantially so when they remove the outliers. Individually, a surprise cut raise stock prices in most countries, but only in Malaysia and NZ are the coefficients statistically significant.

Even when influential observations are included, the baseline results are fairly similar for most countries (Table A3). For example, apart from larger standard errors, the coefficient for Australia in the exchange rate regression is much smaller (0.5 and insignificant, rather than 5.4 and significant without outliers), due to the inclusion of the October and November 2008 outliers. On these two days, the Reserve Bank of Australia cut rates sharply (larger than was anticipated by markets) and the exchange rate appreciated sharply by 1% and 2.65% respectively. The other big change is the UK for the stock market regression, where the inclusion of the 6 November 2008 observation moves the estimated coefficient from –0.6 to +2—this was the date of the big rate cut in the UK, but stock markets fell by 5%. The observation for the Republic of Korea on 11 Dec 2008 (when rates were cut by 1% but the exchange rate appreciated by 2.5%) is also extremely influential.

A robust regression, an alternative way of down weighting influential observations (Table A4) produces very similar coefficients to those in Table 3. This shows that the results are not sensitive to the specific methodology of excluding outliers.

5.2 Monetary Policy with Interaction Crisis Dummy

The second and third sets of columns in Table 3 report the effect of a surprise change in monetary policy on exchange rates and stock markets during crisis (Equation 2). Here the crisis dummy is interacted with the monetary surprise variable taking a value of one for the period, 15 September 2008 to 15 March 2009 (standard crisis period) or 1

[22] The first rate cut of the crisis was a –50 bps surprise, which with a coefficient of five would suggest a 2.5% depreciation of the Australian dollar.

[23] The Malaysian coefficient is not statistically significant from zero.

January 2008 to May/June 2010 (broad crisis period), and zero otherwise. The same influential observations (calculated based on Equation 1) are excluded as in the baseline regression. Redefining influential observations under the standard crisis period produced implausible results for individual countries—more crisis observations were deemed influential, further reducing the sample size during the crisis (see below for further discussion). γ is the coefficient of interest.

For the exchange rate regressions (Panel A), the interaction term is generally insignificant. It should be noted that for any particular country, the number of observations during the crisis is small—less than six per country for the standard crisis period—readers should not place too much weight on these individual country results. In contrast, the different pooled regressions have a reasonable number of crisis observations (up to 40 across all countries) and so are more reliable. The pooled regressions suggest a significantly weaker effect of policy on exchange rates during the crisis compared with outside the crisis, but only during the standard crisis period. It turns out that these results are not robust to using the longer (broad) definition of the crisis.

For the stock market regressions in Panel B, all individual countries (with the exception of Thailand) have an insignificant interaction term. The pooled OECD regression shows monetary surprise has no significant impact during the crisis. For the pooled non-OECD regression, the interaction term is negative and significant under both crisis periods, suggesting that policy might have a stronger effect on the stock market during the crisis. Thailand is very influential in this regression. If Thailand is excluded, the combined Malaysian-Indonesian coefficient is not significant. However, the significance of the Malaysian-Indonesian coefficient is sensitive to influential observations and whether a crisis dummy variable is included (to be discussed in the next section).

5.3 Influential Observations and Dummy Variables During the Crisis

Two criticisms of the above results are apparent and are dealt with in Table 4. First, influential observations are removed before the interaction term is included. As many of the influential observations are found during the crisis, it is possible that we might have removed the very observations that drive a different effect of monetary policy during the crisis. Second, a dummy variable for the crisis is not included, only the interaction term is included. This imposes the restriction that average change in the financial variable on a day during the crisis is the same as the average change on a day outside the crisis, which seems unlikely.

Table 4 adds a crisis dummy to Equation 4 in Table 3 for the three pooled regressions—we now estimate Equation 5. All observations are taken into account (including influential observations) to make sure that results are not driven by excluded observations during the crisis. Results for individual countries are not reported—it is not meaningful to explain less than six crisis observations with two variables.

Overall, the inclusion of the crisis dummy variable does not seem to be essential. For both the OECD and non-OECD samples, the crisis dummy variable is usually insignificant—only significant in the stock market regressions under the standard crisis period. That said, in terms of the impact of monetary policy (γ) during crisis on exchange

rates (Panel A), compared to the pooled results from Table 3, both the OECD and non-OECD pooled regressions now show an insignificant policy impact in the standard crisis period. On the other hand, the stronger effect of monetary policy on stock markets for the non-OECD countries remains robust in both crisis periods. In another regression (not reported), the effect of policy on stock markets for the non-OECD countries are no longer driven just by Thailand, giving a sense of robustness.[24]

Similar results are obtained from regressions with different combinations of the crisis dummy and influential observations, such as (i) crisis dummy and the excluded original influential observations calculated using Equation 3; (ii) crisis dummy and the excluded new influential observations calculated using Equation 5 with a cut off of 0.3; and (iii) no crisis dummy but influential observations calculated using Equation 5 with a cutoff raised or lowered to keep the number of influential observations the same in aggregate. [25]

5.4 Other Robustness Tests

Table A3 shows the same regressions as Table 3, but without removing influential observations. Many individual country estimates of γ are quite different, such as for Australia, stressing that these are small sample results that are very sensitive to outliers. Most pooled results are similar to those in Table 3, except that policy in the OECD countries during the standard crisis period has a significantly weaker effect on financial markets—a more negative effect on exchange rates and more positive effect on stock markets. However, as these results are driven by a few outliers, too much weight should not be put on them.

Robust regressions (Table A4) produce broadly similar results to Table 3. Results confirmed are that (i) the effect of policy surprises on exchange rates during the crisis (γ) is never significant during the broad crisis period, but is sometimes or weakly significant during the standard crisis period; and (ii) the effect of policy surprises on stock markets is stronger for the non-OECD countries, but not for the OECD countries. While the interaction coefficient for the broad crisis period is no longer significant for the non-OECD countries, the estimated coefficient (–2.06) is very similar to that in Table 3 (–1.78) or Table 4 (–2.56). [26]

Instead of classifying countries into OECD and non-OECD groups, countries can also be classified as Western and Asian. This involves moving the Republic of Korea from the

[24] That is, when Equation 5 is estimated using the pooled data from only Malaysia and Indonesia, the interaction term is still negative and significant, but only in the standard crisis period.

[25] Cutoffs cannot be compared across models as adding additional variables can increase or lower influence statistics. Instead, we raised or lowered the cutoff until the number of observations excluded calculated based on Equation 5 is the same as the number of observations excluded calculated based on Equation 3.

[26] Not much weight should be put on small differences in significance across the estimation methods. The robust estimates do not have heteroskedasticity robust standard errors because observations have already been reweighted. For OLS regressions in Table 3 or Table 4, robust standard errors are about 40% smaller than non-robust standard errors (not reported).

OECD group to the Asian group. As the Republic of Korea has less developed financial markets than the other Western countries, is newly industrialized and has more recent changes to its monetary policy framework, there is some justification for the alternative grouping.

Reclassifying the Republic of Korea into the Asian group changes the interpretation of some results. First, it provides more support for the case that policy has a statistically significantly weaker effect on exchange rates for Western countries during the crisis—the negative γ interaction term in the equivalent of Tables 3 and 4 are now significant at the 5 percent level for the standard crisis period (not reported). Second, it provides less support for the case that policy in Asian countries has a statistically significant stronger impact on stock markets during the crisis—the negative γ interaction term in Tables 3 and 4 for the Asian countries in the stock market regressions is significant less often. These results are to be expected given the small and insignificant γ interaction term for the Republic of Korea.[27]

6. Extensions

6.1 Persistence of Monetary Policy Shocks

The monetary surprise captured by the change in 1-month market interest rate only indicates a change in the expectation of the policy rate over the coming month, it says nothing about the change in the expectation of the policy rate further in the future. At one end of the spectrum, a rate rise might have no effect on expected future rate. For example, markets might have expected a rate rise this month or next (a timing surprise) and so the rate rise only changes expectation of interest rates over the coming month. On the other hand, a rate rise may not have been expected at all (and is expected to be relatively permanent) and so a 25 bps surprise raises this month's and next month's rate expectations by 25 bps (a levels surprise). If the rate rise is seen by markets as the start of a tightening cycle, then expectations of future rate rises further out may increase even more. Hence, levels surprises should have a larger effect on stock prices and exchange rates than timing surprises.

The definition of the change in expected future rates ($\Delta i^{un}_{F,t}$)used here is the expected change in the policy rate over two months beginning one month in the future, $i^{un}_{F,t} \equiv E_t i^{P}_{2m,t+1m} - E_{t-1d} i^{P}_{2m,t+1m}$.[28] Ideally expectations about future interest rates can be

[27] More specifically: (i) in the pooled Western country's exchange rate regressions, equivalent to Tables 3 and 4, the negative γ interaction term is now significant at the 5% level for the standard crisis period, but not the broad crisis period; and (ii) in the pooled Asian country's stock market regressions, the negative γ interaction term is now insignificant in the equivalent of Table 3 (for both crisis periods) and in the equivalent of Table 4 (for the broad crisis period).

[28] For example, for a monetary policy decision on 1 January, $\Delta i^{un}_{F,t}$ is the difference between the expectation of the average policy rate during February and March formed on 1 January, and expectation of the average policy rate during February and March formed on 31 December.

backed out from the futures market as in Kearns and Manners (2005). However, these data are not available for all the countries considered here. Instead, we can use readily available 3-month and 1-month interbank rates as the expected future two-month rate is related to the slope of the yield curve between maturities of 3-month to 1-month (by the expectations hypothesis). Applying similar steps as in Section 3 yields the measure of the expected future policy change (Equation 6). Equation 7 is the estimated equation that adds the future rate surprise ($\Delta i^{un}_{F,t}$) to Equation 3. A 100 bps pure timing surprise will raise Δi^{un}_{t} by 100 bps but leave $\Delta i^{un}_{F,t}$ unchanged, and so will increase stock markets or exchange rates by $\beta\%$. But a pure levels surprise of 100 bps will raise both Δi^{un}_{t} and $\Delta i^{un}_{F,t}$ and so will raise stock markets or exchange rates by $\beta + \lambda\%$.

$$\Delta i^{un}_{F,t} \approx \frac{3}{2}\Delta i^{IB}_{3m,t} - \frac{1}{2}\Delta i^{IB}_{1m,t} \tag{6}$$

$$\Delta f_t = \alpha + \beta \Delta i^{un}_{t} + \lambda \Delta i^{un}_{F,t} + \varepsilon_t,\ f = e, s \tag{7}$$

Table 5 presents the results of timing and levels surprises. For the OECD countries, the levels surprises matter more than the timing surprises in both the exchange rate and stock market regressions. For the exchange rate regressions, the levels surprise is large and significant in Australia, Canada, NZ and the UK, while the timing surprise is insignificant, as found by Kearns and Manners (2005). For the stock market regressions, results for these countries are more mixed. The levels surprise is only significant in NZ and Canada, while the timing surprise is significant in the UK.

For the pooled non-OECD regressions, the levels surprise is important for stock prices, but not for exchange rates. Individually, only Malaysia records a significant levels surprise in the stock market regression.

That said, to some extent, Equation 7 may have difficulty distinguishing between levels and timing effects as current and future interest rate surprises tend to be positively correlated (Figure 9).

6.2 Changing Risk Premium During Crisis

One defining feature of the crisis is the inability of banks to borrow cheaply from the interbank and money markets. This is reflected in the markedly higher spread of the interbank and money market interest rates over the OIS (which involves no change of principal and so have less credit risk). This study has used the market (interbank and bank bill) interest rates as they are available in all countries, although OIS spreads are arguably a better measure of policy expectations.

The rise in liquidity/risk premium on the interbank rates and similar market interest rates may affect the estimated results in a number of ways. First, if the risk premium is fairly constant on the days of monetary policy decisions, it will be differenced out and has no effect on the estimates. Second, if the risk premium is independent noise added to the (Δi^{un}_{t}) market interest rates, the 1-month change in market interest rates will suffer from the classical measurement error. This biases the coefficient on the change in 1-month

market interest rates toward zero. Finally, if the change in the policy rate is somehow correlated with the size of the risk premium, then estimates during the crisis can be biased and inconsistent. This can happen if both the unexpected policy rate cuts and rising risk premium are caused by disruption in financial markets. One way to separate risk premium from expectations is to use OIS.

As OIS are not available in most countries, Australia's experience is used to assess whether the changing risk premium is empirically important. Figure 10 shows the daily spread of 1-month bank bill rate over 1-month OIS rate; usually the spread is around 10 bps, although during the crisis it was much larger and more volatile, up to 70 bps. Figure 11 shows the change in the 1-month bank bill rate and the change in the 1-month OIS rate on the days of monetary policy announcements. Encouragingly, for most parts, the change in the OIS rate gives an almost identical measure of monetary surprises. Although during the peak of the crisis, the size of monetary surprise is quite different. For example, the November 2008 surprise is –17.5 bps as measured by the OIS rate, but –42 bps for the 1-month bank bill rate.

If Equation 3 is re-estimated for Australia using the OIS rate rather than the bank bill rate over a common sample (different from the one in Table 3), the coefficient (and t-statistic) changes from 5.25 (4.07) to 4.56 (4.33) for the exchange rate regression, and from –0.19 (–0.18) to –1.41(–1.02) for the stock market regression—both insignificant changes. [29] When the crisis interaction term is added (Equation 4) based on the broad crisis period, the estimated coefficient is still statistically insignificant. [30] As such, there is some evidence that the results, at least for the full sample and broad crisis period, do not seem to be sensitive to the use of bank bills rather than OIS.

6.3 Efficiency of Interbank and Money Markets

Rational expectations suggest that anticipated changes in policy rates should have already been "priced into" financial assets. As such, in this paper, the monetary policy surprise is used as an explanatory variable. However, if financial markets are not "efficient", or changes in expectations are poorly measured by the 1-month change in market interest rates, then the anticipated component of the policy change could still affect markets. To test this, Equation 8 adds the anticipated change in the policy rate (Δi_t^a) to the baseline model (Equation 3). Markets are "efficient" if $\theta = 0$.

$$\Delta f_t = \alpha + \beta \Delta i_t^{un} + \theta \Delta i_t^a + \varepsilon_t, \; f = e, s \tag{8}$$

Results presented in Table 6 suggest that for most OECD countries, markets are fairly efficient—to the extent that they only respond to policy surprises. Exceptions are the Republic of Korea, where θ is significant in the exchange rate regression, and the UK,

[29] The common sample is the days of monetary announcements from 4 July 2001 to 1 June 2010 excluding outliers on 8 October 2008 and 4 November 2008 identified earlier. This sample is shorter than the sample used in Table 3 for Australia (which starts in 1998) because OIS rates are only available on the RBA website from mid-2001.

[30] Over the standard crisis period, the results are not robust due to small sample, where one variable explains five crisis observations. For example, the exclusion of one observation changes the coefficient on the interaction term from significantly positive to significantly negative.

where anticipated rate raises stock prices. For the Republic of Korea, this might reflect measurement issues, as removing observations before March 2006, which might have different timing (see footnote 18) makes θ insignificant. For the UK, this might reflect some spurious correlation as θ has the wrong sign.

On the other hand, for the non-OECD countries, there is less evidence supporting an efficient interbank and money market. In particular, in the individual stock market regressions, θ is often large, correctly signed and significant, while β (the monetary surprise coefficient) is not.

7. Conclusions

How monetary policy affects the economy is of key interest to policymakers during normal times and even more so during times of crisis. This paper uses an event study approach to estimate the effect of monetary policy shocks on stock markets (the first stage of the wealth channel) and exchange rates (which affect net exports) for eight small open (OECD and non-OECD) economies. It also asks whether the impact of policy is any different during crisis. To the knowledge of the authors, this is the first paper that uses this approach for monetary policy shocks in Asia,[31] and one of few papers which try to estimate the effect of monetary policy during crisis.

Overall, an unanticipated 100 bps increase in the policy rate causes the exchange rate to appreciate by about 1%, and stock prices to fall by 1%. The effect on exchange rates is notably weaker in the non-OECD countries examined here, all of which have a managed float as against a free-float regime in the OECD countries. For the OECD countries (and exchange rate regressions), there is no robust evidence that monetary policy is more or less effective during the global financial crisis. However for the non-OECD countries, a monetary policy shock has a larger effect on the stock market during the crisis than outside the crisis. This effect seems to be reasonably robust to a range of specifications and econometric methodologies.

The key question then is whether monetary policy is actually more effective for the non-OECD countries during the crisis, or whether its effect is just easier to detect econometrically. After all, these models suggest that effect of policy on stock markets (for the non-OECD countries) is close to zero before the crisis—contrary to theory. One reason might be that interbank rates are a noisy measure of monetary policy expectations. If in normal times monetary policy does not change very much, the noise–to–signal ratio may be quite high, leading to attenuation bias in the estimates (if the measurement error of expectations is classical). However, during the crisis all central banks made large changes to monetary policy, the size of which generally surprised the

[31] Though there are a number of papers estimating the effect of US monetary policy on stock markets in Asia such as Wongswan (2009).

market. For these crisis observations, the noise-to-signal ratio could have been lower, allowing a cleaner estimate of the effect of policy shocks on stock markets.[32]

Further research is needed to clearly establish whether policy is really more effective during the crisis. First, the root of the problem—classical measurement error of expectations— can be addressed by trying an alternative measure of expectations. One possibility is to use surveys of economists before a monetary policy meeting by newswire services like Bloomberg. The sample will most likely be short and even exclude some countries, but it may be informative about how noisy are the measures of expectations using interbank rates. Second, shorter event windows as in Kearns and Manners 2005 can be tried for countries with available data. While this does not solve the measurement error problem, it may otherwise increase the accuracy of the estimation. Third, the issue can be tackled econometrically. For example, one could instrument for the change in expectations, remove observations where liquidity in the interbank market is low (and so prices may not reflect expectations) or add measures of market liquidity to the regression. An alternative approach is to exploit the greater variance of the expectations component of interbank rates on the days of monetary policy announcements to isolate causality, an approach related to that of Rigobon and Sack (2004). Finally, more countries can be added to the sample. If the effect of policy on stock markets during the crisis is really stronger in the non-OECD countries, then similar results in other non-OECD countries may be found. For example, the paper can be extended to include Middle Eastern countries, Latin American countries or Eastern European countries with a similar monetary regime.

[32] Volatility of the liquidity premium in the interbank markets also increased during the crisis. But as long as the size of the signal rose relative to the noise, the attenuation bias will still be smaller during the crisis.

References

Bank of Thailand. 2007. *Inflation Report (January)*. Bangkok.

Bank of Korea. 2008. *Monetary Policy Report (March)*. Seoul.

L. Berkelmans. 2005. Credit and Monetary Policy: An Australian Structural Vector Autoregression. *Reserve Bank of Australia Research Discussion Paper*. 2005-06.

B. S. Bernanke, M. Gertler, and S. Gilchrist. 1999. The Financial Accelerator in a Quantitative Business Cycle Framework. In J. Taylor and M. Woodford, eds. *Handbook of Macroeconomics*. Vol 1. Elsevier.

B. Bernanke and K. Kuttner. 2005. What Explains the Stock Market's Reaction to Federal Reserve Policy? *Journal of Finance.* 60 (3). pp. 1221–1257.

Bank for International Settlements. 2009a. *79th Annual Report 2008/09*. Basel, Switzerland.

———. (2009b). The International Financial Crisis: Timeline, Impact and Policy Responses in Asia and the Pacific. Background paper for The International Financial Crisis and Policy Challenges in Asia and the Pacific, A Wrap-Up Conference of the BIS Asian Research Programme. Bank for International Settlements Representative Office for Asia and the Pacific, Shanghai. 6–8 August.

M. Brunnermeier, and L. Pedersen. 2009 Market Liquidity and Funding Liquidity. *Review of Financial Studies.* 22 (6). pp. 2201–2238.

M. Brunnermeier, S. Nagel, and L. Pedersen. 2008. Carry Trades and Currency Crashes. *NBER Macroeconomics Annual 2008*. Cambridge, MA: NBER.

C. Burnside, M. Eichenbaum, I. Kleshechlski, and S. Rebelo. 2006. The Returns to Currency Speculation. *NBER Working Paper*. 12489.

J. Campbell. 1991. A Variance Decomposition for Stock Returns. *The Economic Journal*. 101. pp. 157–179.

R. Clarida, J. Davis, and N. Pedersen. 2009. Currency Carry Trade Regimes: Beyond the Fama Regression. *Journal of International Money and Finance.* 28 (8). pp. 1375–1389.

G. Debelle. 2009. The Australian Foreign Exchange Market in the Recovery. Speech to the Westpac Research and Strategy Forum. Sydney. 10 December.

E. Fama. 1984. Forward and Spot Exchange Rates. *Journal of Monetary Economics*. 14. pp. 319–338.

L. Hamilton. 1991. How Robust is Robust Regression? *Stata Technical Bulletin*. 2. pp. 21–26. Reprinted in *Stata Technical Bulletin Reprints*. 1. pp. 169–175. College Station, TX: Stata Press.

C. Hui, H. Genberg, and T. Chung. 2009. Funding Liquidity Risk and Deviation from Interest-Rate Parity during the Financial Crisis of 2007-2009. *Hong Kong Monetary Authority Working Paper*. 13/2009.

J. Kearns and P. Manners. 2005. The Impact of Monetary Policy on the Exchange Rate: A Study Using Intraday Data. *Reserve Bank of Australia Research Discussion Paper*. 2005-02.

S. J. Kim and D. Q. T. Nguyen. 2009. The Spillover Effects of Target Interest Rate News from the US Fed and the European Central Bank on the Asia-Pacific Stock Markets. *Journal of International Financial Markets, Institutions and Money.* 19 (3). pp. 415–431.

P. Krugman. 2008. Depression Economics Returns. *New York Times*. 14 November.

K. Kuttner. 2001. Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market. *Journal of Monetary Economics*. 47 (3). pp. 523–544.

G. Li. 1985. Robust Regression. In D. C. Hoaglin, F. Mosteller, and J. W. Tukey, eds. *Exploring Data Tables, Trends, and Shapes.* New York: Wiley. pp. 281–340.

F. Mishkin. 2009. Is Monetary Policy Effective During Financial Crises? *NBER Working Paper.* 14678.

M. Piazzesi and E. T. Swanson. 2004. Futures Prices as Risk-Adjusted Forecasts of Monetary Policy. *NBER Working Paper*. 10547.

R. Rigobon and B. Sack. 2004. The Impact of Monetary Policy on Asset Prices. *Journal of Monetary Economics.* 51. pp. 1553–1575.

H. C. Tang. 2006. The Relative Importance of Monetary Policy Transmission Channels in Malaysia. *Centre for Applied Macroeconomic Analysis Working Paper*. 23/2006. Canberra: Australian National University.

J. Wongswan. 2009. The Response of Global Equity Indexes to US Monetary Policy Announcements. *Journal of International Money and Finance*. 28. pp. 344–365.

J. Zettelmeyer. 2004. The Impact of Monetary Policy on the Exchange Rate: Evidence from Three Small Open Economies. *Journal of Monetary Economics*. 51 (3). pp. 635–652.

Table 1: Policy Rate and Number of Policy Changes (Decisions)

Country	Policy Rate	Sample	Number of Policy Changes (Decisions)		
				Financial Crisis	
			Full sample	Standard Period 9/2008–3/2009	Broad Period 1/2008–6/2010
Australia	Cash rate	2/1998–6/2010	37 (137)	4 (5)	14 (27)
New Zealand	Cash rate	3/1999–5/2010	37 (90)	4 (4)	7 (19)
Canada	Overnight target rate	12/2000–6/2010	39 (77)	4 (4)	9 (20)
United Kingdom	Bank rate	7/1997–5/2010	44 (156)	6 (6)	8 (29)
Korea, Republic of	Bank of Korea base rate (overnight call rate prior to 3/2008)	8/2004–5/2010	16 (71)	6 (7)	7 (30)
Indonesia	Bank Indonesia rate (overnight rate)*	1/2006–6/2010	29 (54)	5 (6)	15 (30)
Malaysia	Overnight policy rate (OPR)	5/2004–5/2010	8 (42)	3 (4)	5 (19)
Thailand	14-day repurchase (repo) rate, 1- day repo rate and 1-day bilateral repo rate.**	6/2002–6/2010	26 (68)	3 (4)	5 (20)

Notes:
For Australia, 1998 reflects the start of public announcements of changes by the Reserve Bank of Australia. For Canada, a fixed decision schedule started in 2000. Sample start dates for New Zealand and the United Kingdom are the same as Kearns and Manners (2005). For Thailand and the Republic of Korea, the start date reflects the availability of interbank rate data from Bloomberg and Datastream, respectively. For Malaysia, all publicly available decisions are used. Decisions for Indonesia are available since July 2005, but observations 2005 are excluded due to extreme volatility in market interest rates during that period associated with a change in the monetary policy framework.

* The BI rate is available since July 2005, before the start of our sample. Previously, the policy rate was 30-day BI certificate (SBI) rate.

** Refer to June 2002–16 January 2007, 16 January 2007–11 February 2008 and 12 February 2008–present, respectively. Since 12 February 2008, with the closure of the Bank of Thailand operated repo market, the policy rate was switched to the 1-day bilateral repo rate.

Table 2: Descriptive Statistics: Average Absolute Value

	Full sample					Standard Crisis Period		
	Δe	Δs	Δi_t^{un}	Δi_t^P	$\Delta i_{F,t}^{un}$	Δi_t^{un}	$\Delta i_{F,t}^{un}$	Δi_t^P
Australia	0.658	0.648	0.040	0.091	0.045	0.263	0.295	0.750
Canada	0.454	0.853	0.046	0.159	0.050	0.128	0.105	0.500
Korea, Republic of	0.498	1.015	0.049	0.081	0.031	0.357	0.239	0.464
New Zealand	0.705	0.526	0.048	0.161	0.068	0.093	0.224	1.125
United Kingdom	0.439	0.907	0.052	0.096	0.036	0.323	0.239	0.750
Indonesia	0.411	1.242	0.122	0.171	0.123	0.286	0.363	0.333
Malaysia	0.199	0.650	0.055	0.065	0.049	0.355	0.325	0.375
Thailand	0.236	1.036	0.051	0.138	0.044	0.369	0.333	0.563
OECD	0.551	0.782	0.047	0.113	0.045	0.255	0.227	0.692
Non-OECD	0.284	1.003	0.075	0.130	0.071	0.329	0.343	0.411
All	0.488	0.834	0.054	0.117	0.051	0.281	0.268	0.594

Note:

Δe and Δs are percentage changes in exchange rate and stock price index respectively. Δi_t^{un} is the percentage point change in 1-month market interest rate. Δi_t^P is the percentage point change in policy rate. $\Delta i_{F,t}^{un}$ is the change in the expected future 2-month policy rate (1-month in the future) as measured by the weighted difference between the change in the 3-month and 1-month market interest rates (Equation 6).

Table 3: Effect of Policy Surprises on Financial Variables

	Equation 3		Equation 4					
			Standard Crisis Period			Broad Crisis Period		
	β	R^2 / n	β	γ	R^2 / n	β	γ	R^2 / n
Panel A: Exchange Rates								
Australia	5.42***	11.9	5.66***	–3.92	12.2	5.04***	1.36	12.0
	[4.86]	135	[5.24]	[–0.44]	135	[4.02]	[0.51]	135
Canada	1.86*	6.3	1.73*	0.80	6.5	2.32*	–1.10	6.9
	[1.88]	77	[1.77]	[0.22]	77	[1.77]	[–0.55]	77
Korea, Republic of	–0.18	0.1	–0.60	0.58	0.2	–0.41	0.30	0.1
	[–0.12]	68	[–0.67]	[0.28]	68	[–0.42]	[0.15]	68
New Zealand	2.62***	5.1	2.37*	2.62	5.6	1.61	3.30	6.9
	[2.04]	90	[1.73]	[0.76]	90	[1.26]	[1.15]	90
United Kingdom	1.00***	1.8	1.34**	–1.57**	2.6	1.36**	–1.48**	2.6
	[2.23]	155	[2.60]	[–2.64]	155	[2.55]	[–2.55]	155
Indonesia	0.54	2.7	0.92*	–1.32*	6.4	0.07	0.63	3.6
	[1.20]	53	[1.85]	[–1.80]	53	[0.10]	[0.76]	53
Malaysia	0.02	0.0	0.40	–1.18	1.5	0.13	–0.25	0.1
	[0.05]	41	[0.65]	[–1.54]	41	[0.20]	[–0.28]	41
Thailand	0.47	1.5	0.33	0.24	1.6	0.28	0.32	1.6
	[1.04]	65	[0.33]	[0.23]	65	[0.27]	[0.29]	65
OECD	1.43***	3.3	2.33***	–1.58*	4.3	2.06***	–0.98	3.6
	[2.84]	530	[4.79]	[–1.67]	530	[4.25]	[–1.13]	530
Non-OECD	0.39*	2.1	0.84**	–0.78**	4.2	0.39	0.00	2.1
	[1.94]	163	[2.48]	[–2.09]	163	[0.97]	[–0.01]	163
All	1.11***	3.0	1.74***	–1.07*	3.7	1.54***	–0.60	3.2
	[3.34]	694	[5.19]	[–1.71]	694	[4.33]	[–1.05]	694
Panel B: Stock Markets								
Australia	0.28	0	0.53	–0.74	0	0.37	–0.18	0
	[0.30]	136	[0.38]	–[0.46]	136	[0.26]	[–0.09]	136
Canada	–1.80	2	–2.52**	5.72	3	–1.75	–0.13	2
	[–1.11]	76	[–2.02]	[0.97]	76	[–1.36]	[–0.03]	76
Korea, Republic of	–0.94	1	–2.36	1.56	1	–1.46	0.56	1
	[–1.45]	69	[–1.06]	[0.66]	69	[–0.62]	[0.22]	69
New Zealand	–3.03***	10	–2.91***	–1.25	10	–2.29**	–2.42	11
	[–2.97]	90	[–2.62]	[–0.70]	90	[–2.36]	[–0.82]	90
United Kingdom	–0.69	0	–1.09	1.82	0	–1.00	1.24	0
	[–0.65]	155	[–0.83]	[0.95]	155	[–0.74]	[0.69]	155

Table 3: *Continued*

	Equation 3		Equation 4					
			Standard Crisis Period			Broad Crisis Period		
	β	R^2 / n	β	γ	R^2 / n	β	γ	R^2 / n
Indonesia	–1.90*	4	–0.99	–2.43	5	–1.25	–0.83	4
	[–1.67]	54	[–0.86]	[–1.13]	54	[–0.59]	[–0.39]	54
Malaysia	–1.17**	2	–0.93	–0.35	2	–0.66	–0.72	2
	[–2.16]	41	[–0.56]	[–0.18]	41	[–0.39]	[–0.38]	41
Thailand	0.49	0	1.22	–4.96***	1	1.41	–5.15***	2
	0.36	64	[0.98]	[–4.70]	64	[1.16]	[–3.16]	64
OECD	–0.97**	1	–1.66**	1.34	1	–1.29	0.54	1
	[–2.03]	530	[–2.51]	[1.37]	530	[–1.81]	[0.57]	530
Non-OECD	–1.53***	3	–0.32	–2.02**	4	–0.15	–1.78*	3
	[–3.02]	164	[–0.45]	[–2.34]	164	[–0.15]	[–1.73]	164
All	–1.16***	1	–1.09**	–0.13	1	–0.88	–0.41	1
	[–3.41]	694	[–2.18]	[–0.20]	694	[–1.52]	[–0.59]	694

Note:
Dependent variable is the percentage change in the USD/local currency exchange rate or the percentage change in the stock market index. β is the estimated coefficient of the change in 1-month market interest rate (Δi_t^{un}). γ is the estimated coefficient of the change in 1-month market interest rate interacted with the crisis dummy ($\Delta i_t^{un}.d_{C,t}$).Robust T-statistics are in parentheses. ***, ** and * reflect significance at the 1%, 5% and 10% levels respectively. Influential observations are excluded. All units are in percentage point, except R^2 in percent and "n" is the number of observations.

Table 4: Include Crisis Dummy and All Observations

	Equation 5: Standard Crisis Period				Equation 5: Broad Crisis Period			
	β	γ	δ	R^2 / n	β	γ	δ	R^2/ n
				Panel A: Exchange Rates				
OECD	2.32***	-1.99	0.21	3.89	2.08***	-1.81*	-0.07	2.66
	[4.77]	[-1.60]	[0.51]	531	[4.28]	[-1.78]	[-0.69]	531
Non-OECD	0.81**	0.10	0.21	6.27	0.35	0.43	0.03	5.41
	[2.39]	[0.14]	[0.92]	164	[0.84]	[0.72]	[0.37]	164
All	1.72***	-1.20	0.21	3.38	1.55***	-1.08	-0.04	2.26
	[5.15]	[-1.40]	[0.71]	695	[4.37]	[-1.62]	[-0.56]	695
				Panel B: Stock Markets				
OECD	-1.60***	1.56	-1.06*	4.87	-1.24*	2.15	-0.12	1.33
	[-2.41]	[0.75]	[-1.91]	531	[-1.73]	[1.35]	[-0.75]	531
Non-OECD	-0.15	-5.30***	-1.91**	11.85	0.31	-2.56**	-0.38	4.89
	[-0.21]	[-2.93]	[-2.16]	164	[0.32]	[-2.24]	[-1.50]	164
All	-1.00	-0.79	-1.28**	4.28	-0.76	0.43	-0.21	0.79
	[-1.99]	[-0.43]	[-2.52]	695	[-1.31]	[0.35]	[-1.59]	695

Note:
Dependent variable is the percentage change in the bilateral US/local currency exchange rate or the percentage in the stock market index. β is the estimated coefficient of the change in 1-month market interest rate (Δi_t^{un}). γ is the estimated coefficient of the change in 1-month market interest rate interacted with the crisis dummy ($\Delta i_t^{un}.d_{C,t}$). δ is the estimated coefficient of the crisis dummy variable ($d_{C,t}$). Robust t-statistics are in parentheses. ***, ** and * reflect significance at the 1%, 5% and 10% levels. All units are in percentage point, except R^2 in percent and "n" is the number of observations.

Table 5: Timing and Levels Surprises

	Panel A: Exchange Rates					Panel B: Stock Markets				
	Equation 3		Equation 7			Equation 3		Equation 7		
	β	R^2/n	Timing β	λ	Levels $\beta+\lambda$	β	R^2/n	Timing β	λ	Levels $\beta+\lambda$
Australia	5.42***	11.9	2.50	4.09**	6.59**	0.28	0.04	-2.22	2.98*	0.77
	[4.86]	135	[1.38]	[2.00]	[5.26]	[0.30]	136	[-1.42]	[1.85]	[0.74]
Canada	1.86*	6.3	-0.08	2.37	2.29**	-1.80	1.61	3.64	-6.70**	-3.07**
	[1.88]	77	[-0.04]	[1.04]	[1.97]	[-1.11]	76	[1.27]	[-2.08]	[2.09]
Korea, Republic of	-0.18	0.1	1.61	-3.39	-1.78	-0.94	1.17	-1.54	0.97	-0.57
	[-0.12]	68	[1.00]	[-0.72]	[0.49]	[-1.45]	69	[-0.64]	[0.26]	[0.36]
New Zealand	2.62**	5.1	-2.27	4.95***	2.67**	-3.03***	9.92	1.50	-4.58**	-3.08***
	[2.04]	90	[-1.35]	[3.30]	[2.33]	[-2.97]	90	[0.85]	[-2.53]	[3.28]
United Kingdom	1.00**	1.8	0.15	1.37	1.52**	-0.69	0.19	-3.55*	4.62	1.07
	[2.23]	155	[0.21]	[1.18]	[2.17]	[-0.65]	155	[-1.71]	[1.60]	[0.69]
Indonesia	0.54	2.7	0.60	-0.11	0.49	-1.90*	3.56	-1.27	-0.90	-2.17
	[1.20]	53	[1.48]	[-0.23]	[0.86]	[-1.67]	54	[-1.04]	[-0.69]	[1.63]
Thailand	0.47	1.5	1.69	-1.46	0.23	0.49	0.09	4.90	-5.92	-1.02
	[1.04]	65	[0.70]	[-0.55]	[0.47]	[0.36]	64	[0.83]	[-0.78]	[0.45]
Malaysia	0.02	0.0	0.33	-0.33	0.00	-1.17**	1.57	2.45	-3.91	-1.45***
	[0.05]	41	[0.27]	[-0.33]	[0.01]	[-2.16]	41	[0.59]	[-0.93]	[3.25]
OECD	1.43***	3.3	-0.33	2.27**	1.94**	-0.97**	0.67	-0.49	-0.64	-1.13**
	[2.84]	530	[-0.38]	[2.17]	[2.98]	[-2.03]	530	[-0.53]	[-0.60]	[2.07]
Non-OECD	0.39*	2.1	0.59*	-0.25	0.33	-1.53***	2.55	-0.77	-0.94	-1.71***
	[1.94]	163	[1.92]	[-0.72]	[1.48]	[-3.02]	164	[-0.82]	[-0.85]	[2.91]
All	1.11***	3.0	-0.05	1.47**	1.42**	-1.16***	1.14	-0.59	-0.74	-1.32***
	[3.34]	694	[-0.09]	[2.14]	[3.52]	[-3.41]	694	[-0.89]	[-0.98]	[3.43]

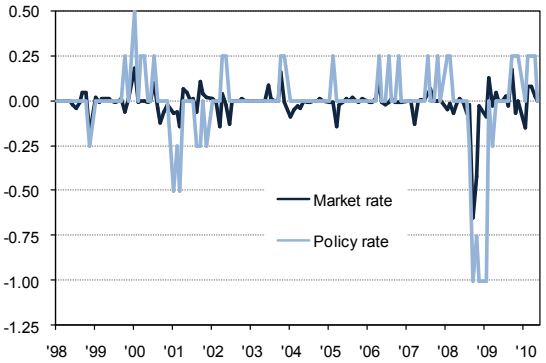
Note:
Dependent variable is the percentage change in the USD/local currency exchange rate or the percentage change in the stock market index. β is the estimated coefficient of the change in 1-month market interest rate (Δi_t^{un}). λ is the estimated coefficient of the change in the expected future 2-month market interest rate one month from now ($\Delta i_{F,t}^{un}$). Influential observations are excluded. Robust T-statistics are in parentheses. ***, ** and * reflect significance at the 1%, 5% and 10% levels respectively. The t-statistic on $\beta+\lambda$ is a Wald test. All units are in percentage point, except R^2 in percent and "n" is the number of observations.

Table 6: Unanticipated and Anticipated Policy Changes

	Equation 8: Exchange rate			Equation 8: Stock Market		
	θ	β	R^2 (%) / n	θ	β	R^2 (%) / n
Australia	-0.53	5.54***	12.9	1.12	-0.17	4.83
	[-1.02]	[5.22]	135	[1.37]	[-0.18]	136
Canada	-0.33	2.01**	7.5	0.60	-2.07	2.73
	[-0.99]	[2.05]	77	[0.76]	[-1.27]	76
Korea, Republic of	-0.59**	0.02	0.4	-0.37	-0.87	1.21
	[-2.09]	[0.01]	68	[-0.23]	[-1.26]	69
New Zealand	-0.29	2.85**	5.9	0.19	-3.18***	10.41
	[-0.60]	[2.02]	90	[0.41]	[-2.76]	90
United Kingdom	-0.52	1.22**	3.3	2.00**	-1.54	5.11
	[-1.23]	[2.56]	155	[2.13]	[-1.35]	155
Indonesia	-0.20	0.54	3.1	-2.37**	1.85*	8.02
	[-0.65]	[1.21]	53	[-2.05]	[-1.79]	54
Malaysia	2.59***	-0.71**	8.2	-1.34	-0.98	1.77
	[3.74]	[-2.52]	41	[-0.63]	[-1.66]	41
Thailand	0.00	0.47	1.5	-3.12***	4.29***	11.23
	[0.02]	[0.84]	65	[-2.82]	[3.01]	64
OECD	-0.46	1.62***	4.4	0.73**	-1.27**	2.13
	[-1.77]	[3.19]	530	[2.01]	[-2.53]	530
Non-OECD	0.01	0.39*	2.1	-1.82***	-1.03**	5.36
	[0.04]	[1.92]	163	[-2.78]	[-2.09]	164
All	-0.39*	1.25***	3.9	0.39	-1.30***	1.47
	[-1.74]	[3.67]	694	[1.18]	[-3.56]	694

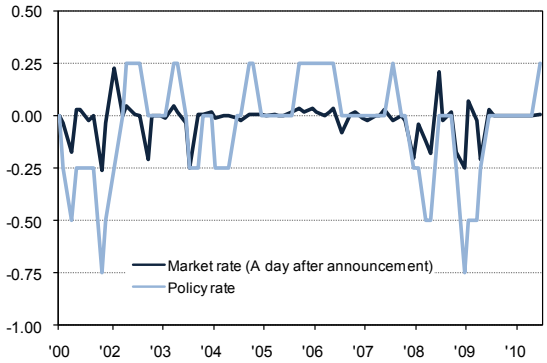
Note:
Dependent variable is the percentage change in the bilateral USD exchange rate or the percentage change in the stock market index. β is the estimated coefficient of the change in the 1-month market interest rate bill (Δi_t^{un}). θ is the coefficient of the anticipated change in the policy rate (Δi_t^{a}). Robust t-statistics are in parentheses. ***, ** and * reflect significance at the 1%, 5% and 10% levels respectively. Influential observations are excluded. All units are in percentage point, except R^2 in percent and "n" is the number of observations.

Figure 1. Australia, Changes in Policy Rate and Market Interest Rate (percentage point)



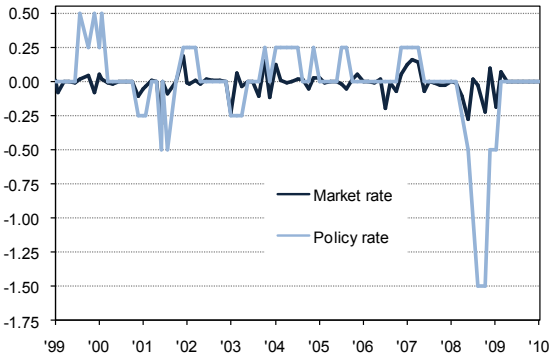
Note: Rate changes based on policy decision day.
Source: Reserve Bank of Australia.

Figure 2. United Kingdom, Changes in Policy Rate and Market Interest Rate (percentage point)



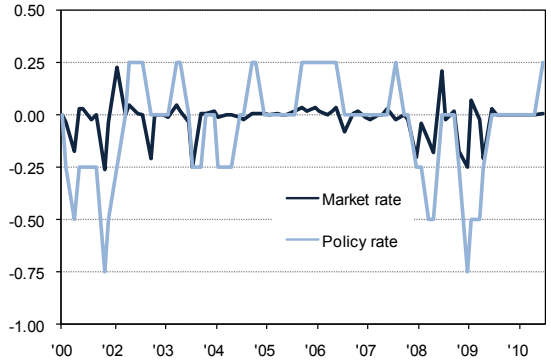
Note: Rate changes based on policy decision day.
Source: Bank of Canada.

Figure 3: New Zealand, Changes in Policy Rate and Market Interest Rate (percentage point)



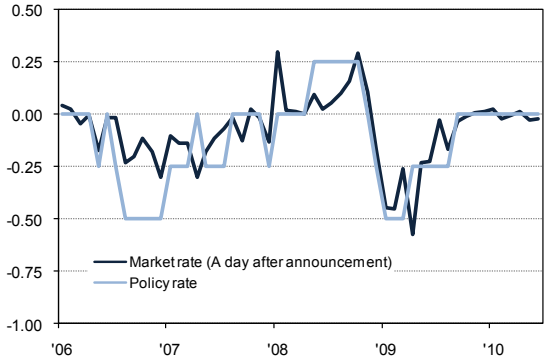
Note: Rate changes based on policy decision day.
Source: Reserve Bank of New Zealand.

Figure 4: Canada, Changes in Policy Rate and Market Interest Rate (percentage point)



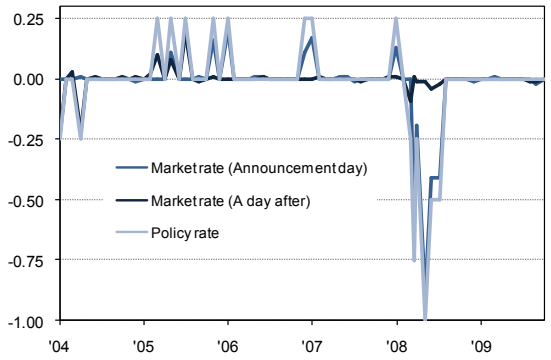
Note: Rate changes based on policy decision day.
Sources: Bank of England and Datastream.

Figure 5: Indonesia, Changes in Policy Rate and Market Interest Rate (percentage point)



Note: Rate changes based on policy decision day.
Sources: Bank Indonesia and Bloomberg

Figure 6: Republic of Korea, Changes in Policy Rate and Market Interest Rate (percentage point)

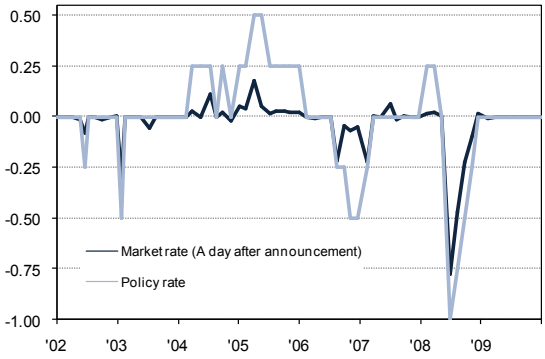


Note: Rate changes based on policy decision day.
Sources: Bank of Korea and Datastream.

Figure 7: Malaysia, Changes in Policy Rate and Market Interest Rate (percentage point)

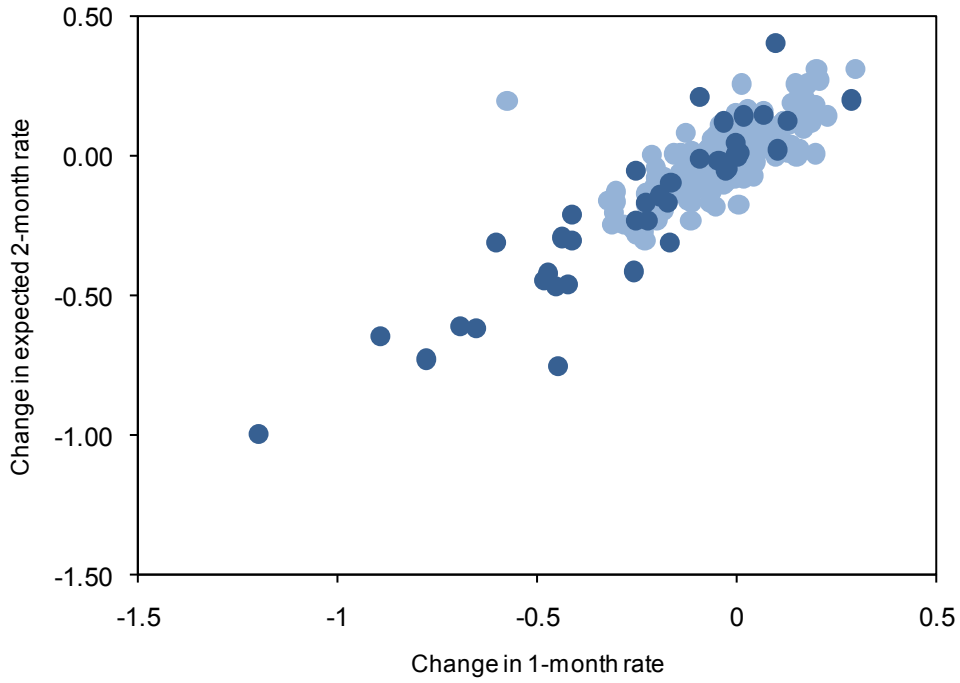
Note: Rate changes based on policy decision day.
Source: Bank Negara Malaysia and Bloomberg.

Figure 8: Thailand, Changes in Policy Rate and Market Interest Rate (percentage point)



Note: Rate changes based on policy decision day.
Sources: Bank of Thailand and Bloomberg.

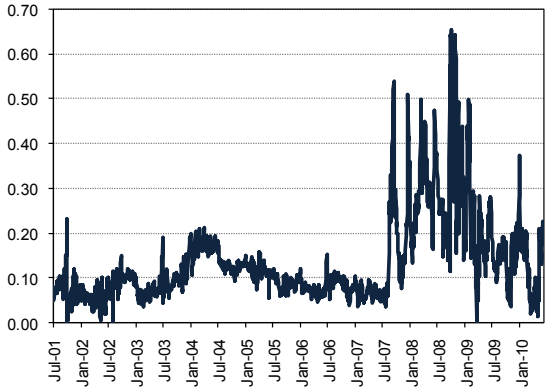
Figure 9: All Countries, Changes in 1-Month and Expected 2-Month Rates (percentage point)



Note: Observations during the financial crisis (9/2008-3/2009) are in darker shade. Rate changes are based on policy decision day.

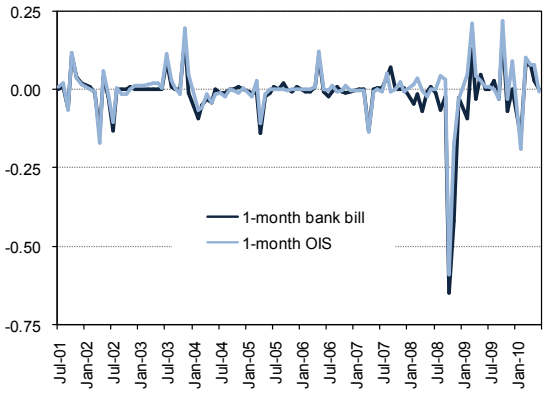
Source: Authors' calculations based on Bloomberg, Datastream, and websites of central banks.

Figure 10: Australia, Daily 1-Month Bank Bill Minus 1-Month OIS Spread
(percentage point)



Source: Reserve Bank of Australia.

Figure 11: Australia, Changes in 1- Month Bank Bill and 1-Month OIS Spread
(percentage point)



Source: Reserve Bank of Australia.

Appendix Tables

Table A1: Details on Excluded Observations

Regression		Country	Date	Influence Statistics	Δf	Δi_t^{IB}
Country	Exchange rate	United Kingdom	06-Nov-2008	0.38	-1.44	-1.20
Country	Exchange rate	Australia	07-Oct-2008	0.78	1.00	-0.65
Country	Exchange rate	Australia	04-Nov-2008	0.88	2.78	-0.42
Country	Exchange rate	Korea, Republic of	09-Oct-2008	0.35	3.70	0.00
Country	Exchange rate	Korea, Republic of	27-Oct-2008	0.73	-3.23	-0.60
Country	Exchange rate	Korea, Republic of	11-Dec-2008	1.76	2.58	-0.89
Country	Exchange rate	Indonesia	07-Jan-2009	0.85	-2.57	-0.44
Country	Exchange rate	Thailand	27-Jun-2003	0.39	-0.69	-0.30
Country	Exchange rate	Thailand	03-Dec-2008	0.84	-0.22	-0.78
Country	Exchange rate	Malaysia	21-Jan-2009	1.27	0.12	-0.69
Country	Exchange rate	Malaysia	24-Feb-2009	0.42	-0.11	-0.48
OECD	Exchange rate	Korea, Republic of	11-Dec-2008	0.71	2.58	-0.89
Non-OECD	Exchange rate	Indonesia	07-Jan-2009	0.70	-2.57	-0.44
All	Exchange rate	Korea, Republic of	11-Dec-2008	0.56	2.58	-0.89
Country	Stock market	United Kingdom	06-Nov-2008	5.01	-5.70	-1.20
Country	Stock market	Canada	21-Oct-2008	0.52	-4.44	-0.17
Country	Stock market	Australia	07-Oct-2008	1.39	1.17	-0.65
Country	Stock market	Korea, Republic of	08-Jun-2006	0.31	-3.45	0.16
Country	Stock market	Korea, Republic of	09-Jan-2009	0.58	-2.05	-0.41
Country	Stock market	Thailand	08-Oct-2008	0.32	-6.88	0.00
Country	Stock market	Thailand	03-Dec-2008	0.72	1.45	-0.78
Country	Stock market	Thailand	14-Jan-2009	0.42	1.31	-0.47
Country	Stock market	Malaysia	21-Jan-2009	0.30	0.64	-0.69
Country	Stock market	Malaysia	04-Mar-2010	0.40	1.22	0.12
OECD	Stock market	United Kingdom	06-Nov-2008	1.42	-5.70	-1.20
Non-OECD	Stock market	None excluded				
All	Stock market	United Kingdom	06-Nov-2008	1.15	-5.70	-1.20

Note:
Δf refers to either the percentage change in the USD/local currency exchange rate or the percentage change in stock price index. Δi^{IB} is the change in the 1-month interest rates on the day of announcement. The excluded outliers are calculated based on Bernanke and Kuttner (2005) with an influence statistic cut-off of 0.3.

Table A2: Data Description, Sources and Timing

Country	Policy Rate and Policy Release	Bank Bill Rate	Exchange Rate	Stock Market Index
Australia	Cash rate. Period: Feb.-'98 to Jun.-'10. Release: 2.30 pm on meeting day (Feb. 2008–present). 9.30 am on day after meeting (before Feb. 2008). Source: Reserve Bank of Australia's website.	30-day and 90-day bank accepted bills. Source: RBA Bulletin, Table F01dHist. Timing: End of Day Rates (from 1995). 1 Day Lag (before Feb 2008). No Lag (Feb 2008 onwards).	USD per AUD. Source: Bloomberg AUD Curncy "Last Price". Timing: No lag (relative to announcement). The exchange rate is quoted at 5 pm New York time which is early morning Sydney time before decisions).	All ordinaries. Source: Bloomberg AS30 Index "Last Price". Timing: Market closes at around 4 pm, which is after announcement (no lag relative to announcement).
Canada	Overnight target rate. Period: Dec.-'00 to Jun.-'00. Release: 9 am on fixed announcement days. Source: Bank of Canada's website.	1-month and 3-month bankers acceptances. Source: Bank of Canada's website. Timing: Calculated around midday according to Bank of Canada—no lag.	USD per CAD Source: Bloomberg CAD Curncy "Last Price". Timing: Quoted about 5 pm, which is after announcement so use change on day—no lag.	S&P/TSX Composite. Source: Bloomberg SPTSX Index "Last Price". Timing: Market closes at 5 pm which is after announcement—no lag.
Korea, Republic of	Bank of Korea base rate and overnight cash rate (prior to Mar. 2008). Period: Aug.-'04 to May-'10. About 10.30-11.00 am. Source: Bank of Korea's website, contacts and CEIC.	1-month and 3-month Seoul Interbank Offered Rates (SIBOR). Source: Datastream KRIBK1M. Timing: Collected 10.40–10.55 am local time.* No lag (identified from graph).	USD per Won Source: Bloomberg KRW Curncy "Last Price". Timing: Market closes 3 pm local time (2 am New York), after the rate decision—no lag.	[Republic of] Korea Composite Stock Price Index (KOSPI). Source: Bloomberg KOSPI "Last Price", Timing: Market closes at 3 pm (2 am New York) which is after announce—no lag.
New Zealand	Cash rate. Period: Mar.-'99 to May-'10. Release: 9 am on scheduled days (meeting the day before). Source: Reserve Bank of New Zealand's website.	1-month and 3-month wholesale bill. Source: RBNZ Table hb2. Timing: 11.10 am . After announcement so use change on day—no lag.	USD per NZD Source: RBNZ Table hb1. Timing: 11.10 am release according to RBNZ. After announcement so use change on day—no lag.	NZSE All Index. Source: Bloomberg NZSE Index "Last Price". Timing: Market closes at 4-5 pm which is after announcement —no lag.
United Kingdom	Bank rate. Period: Jul.-'97 to May-'10. Release: Announced at 12 pm (noon) on	1-month and 3-month London Interbank Offered Rate (LIBOR). Source: Datastream	USD per GBP Source: Bloomberg GBP Curncy "Last Price". Timing: 5 pm New	FTSE100 Index. Source: Bloomberg: UKX Index "Last Price". Timing: Market closes about

Table A2: ***Continued***

Country	Policy Rate and Policy Release	Bank Bill Rate	Exchange Rate	Stock Market Index
	the 2nd day of committee meeting (fixed date). Source: Bank of England's website.	BBGBP1M and BBGBP3M. Timing: LIBOR are quoted at 11 am London time (source: bbalibor.com). Before announcement—1 day lag.	York time which is 10pm London time. After announcement on the day—no lag.	4.30pm which is after announcement—no lag.
Indonesia	Bank Indonesia rate. Period: Jan.-'06 to Jun.-'10. Release: Meeting ends at 12. Results released at 1 pm on day of meeting. Source: Bank Indonesia's website, contacts, and Datastream.	1-month and 3-month Jakarta Interbank Offered Rates (JIBOR). Source: Bloomberg JIIN1M Index & JIIN3M Index. Timing: Rates submitted by banks between 7 am to 11.30 am. Before rate decision—1 day lag (identified from graph).	USD per IDR Source: Bloomberg IDR Curncy "Last Price". Timing: 4 pm local time (5 am New York) is after the decision—no lag.	Jakarta Composite Index Source: Bloomberg JCI Index "Last Price". Timing: Market closes at 4.15 pm local (5.15 am NYC), which is after announcement—no lag.
Malaysia	Overnight policy rate. Period: Aug.-'04 to May-'10. Release: 6 pm of the fixed announcement day. Source: Bank Negara Malaysia's website and Datastream.	1-month and 3-month fixing Kuala Lumpur Interbank Offered Rates (KLIBOR). Source: Bloomberg KLIB1M and KLIB3M Index. Timing: 11 am on the day. Before the rate change hence need 1 day lag (also identified from graph).	USD per MYR Source: Bloomberg MYR Curncy "Last Price". Timing: Not a 24 hour market. Open 8 am-5 pm local time. Close is before 6pm announcement—1 day lag.	FTSE Bursa Malaysia Kuala Lumpur Composite Index. Source: Bloomberg: FBMKLCI "Last Price". Timing: Market closes at 5 pm—before announcement—need 1 day lag.
Thailand	14-day repo rate, 1-day repo rate and 1-day bilateral repo rate. Period: Jun.-'02 to Jun.-'10. Release: 2.30 pm on the Meeting day Source: Bank of Thailand's website.	1-month and 3-month fixing Bangkok Interbank Offered Rates BIBOR). Source: Bloomberg BOFX1M and BOFX3M Index "Last Price". Timing: 11.15 am each day, (quoted as 00.15 in New York). Before policy announcements—1 day lag.	USD per Baht Source: Bloomberg THB Curncy "Last Price". Timing: 5 pm in New York is early the following morning in Thailand, which is after the decision—no lag.	Stock Exchange of Thailand (SET) Index. Source: Bloomberg SET Index "Last Price". Timing: Market closes at 4.45 pm which is after 2.30 pm announcement—no lag.

Note:
All dates are daily. Exchange rates are quoted as USD/local currency.
* See http://www.kfb.or.kr/kfb_eng/koribor/koribor01.htm

Table A3: Effect of Policy Surprises on Financial Variables
(Including Influential Observations)

	Equation 3		Equation 4					
			Standard Crisis Period			Broad Crisis Period		
	β	R^2 / n	β	γ	R^2 / n	β	γ	R^2/ n
				Panel A: Exchange Rates				
Australia	0.56	0.3	5.67***	-8.32***	15.3	5.06***	-6.41***	8.2
	[0.36]	137	[5.26]	[-4.64]	137	[4.05]	[-3.46]	137
Canada	1.86*	6.3	1.73*	0.80	6.5	2.32*	-1.10	6.9
	[1.88]	77	[1.77]	[0.22]	77	[1.77]	[-0.55]	77
Korea, Republic of	-0.24	0.2	-0.87	0.69	0.2	-0.68	0.47	0.2
	[-0.13]	71	[-0.86]	[0.29]	71	[-0.64]	[0.21]	71
New Zealand	2.62**	5.1	2.37*	2.62	5.6	1.61	3.30	6.9
	[2.04]	90	[1.73]	[0.76]	90	[1.26]	[1.15]	90
United Kingdom	1.12***	5.3	1.35***	-0.34	5.4	1.37**	-0.36	5.4
	[5.57]	156	[2.63]	[-0.63]	156	[2.57]	[-0.64]	156
Indonesia	1.17	9.6	0.87*	0.80	10.8	-0.07	1.58	13.4
	[1.61]	54	[1.73]	[0.45]	54	[-0.10]	[1.33]	54
Malaysia	-0.01	0.0	0.40	-0.50	0.7	0.13	-0.17	0.1
	[-0.10]	43	[0.65]	[-0.72]	43	[0.21]	[-0.25]	43
Thailand	0.55**	4.4	1.00	-0.60	5.4	0.99	-0.58	5.4
	[2.03]	67	[1.21]	[-0.73]	67	[1.16]	[-0.68]	67
OECD	0.88	1.4	2.33***	-2.31**	3.7	2.06***	-1.71*	2.5
	[1.36]	531	[4.79]	[-2.14]	531	[4.24]	[-1.69]	531
Non-OECD	0.67*	5.0	0.83**	-0.27	5.2	0.38	0.38	5.3
	[1.94]	164	[2.45]	[-0.43]	164	[0.93]	[0.64]	164
All	0.80*	1.6	1.74***	-1.52**	3.1	1.53***	-1.02	2.2
	[1.87]	695	[5.18]	[-2.11]	695	[4.32]	[-1.54]	695
				Panel B: Stock Markets				
Australia	-0.63	0	0.53	-1.90	1	0.37	-1.42	1
	[-0.81]	137	[0.38]	[-1.25]	137	[0.26]	[-0.90]	137
Canada	-0.48	0	-2.56**	12.31**	10	-1.81	3.19	1
	[-0.25]	77	[-2.04]	[2.01]	77	[-1.39]	[0.72]	77
New Zealand	-3.03***	10	-2.91**	-1.25	10	-2.29**	-2.42	11
	[-2.97]	90	[-2.62]	[-0.70]	90	[-2.36]	[-0.82]	90
Korea, Republic of	-0.71	1	-6.12	6.00	4	-5.96	5.74	3

Table A3: *Continued*

	Equation 3		Equation 4					
			Standard Crisis Period			Broad Crisis Period		
	β	R^2 / n	β	γ	R^2 / n	β	γ	R^2/ n
	[-0.79]	71	[-1.57]	[1.49]	71	[-1.34]	[1.26]	71
United Kingdom	2.45*	5	-1.07	5.16***	10	-0.98	4.95***	10
	[1.74]	156	[-0.81]	[3.50]	156	[-0.72]	[3.21]	156
Indonesia	-1.90*	4	-0.99	-2.43	5	-1.25	-0.83	4
	[-1.67]	54	[-0.86]	[-1.13]	54	[-0.59]	[-0.39]	54
Malaysia	-0.92**	2	0.23	-1.39	2	-0.82	-0.12	2
	[-2.52]	43	[0.12]	[-0.66]	43	[-0.49]	[-0.06]	43
Thailand	-1.73**	2	1.06	-3.69***	4	1.26	-3.91***	5
	[-2.41]	67	[0.82]	[-3.02]	67	[1.00]	[-3.22]	67
OECD	0.33	0	-1.65**	3.15**	2	-1.28*	2.33	1
	[0.31]	531	[-2.49]	[2.06]	531	[-1.79]	[1.52]	531
Non-OECD	-1.53***	3	-0.32	-2.02**	4	-0.15	-1.78*	3
	[-3.02]	164	[-0.45]	[-2.34]	164	[-0.15]	[-1.73]	164
All	-0.32	0	-1.07**	1.23	0	-0.87	0.76	0
	[-0.40]	695	[-2.15]	[0.99]	695	[-1.49]	[0.65]	695

Notes:
Dependent variable is the percentage change in the USD/local currency exchange rate or the percentage change in the stock market index. β is the estimated coefficient of the change in 1-month market interest rate (Δi_t^{un}). γ is the estimated coefficient of the change in 1-month market interest rate interacted with the crisis dummy ($\Delta i_t^{un}.d_{C,t}$). Robust T-statistics are in parentheses. ***, ** and * reflect significance at the 1%, 5% and 10% levels respectively. All units are in percentage point, except R^2 in percent and "n" is the number of observations.

Table A4: Effect of Policy Surprises on Financial Variables (Robust Regression)

	Equation 3		Equation 4					
			Standard Crisis Period			Broad Crisis Period		
	β	R^2 / n	β	γ	R^2 / n	β	γ	R^2 / n
Panel A. Exchange Rates								
Australia	4.96***	14.5%	4.76***	-11.31***	22.2%	4.09***	-3.99**	6.6%
	[4.75]	135	[4.37]	[-6.06]	136	[3.08]	[-2.53]	137
Canada	1.49*	4.7%	1.82***	-13.30*	9.2%	3.28***	-3.44**	14.4%
	[1.92]	77	[2.24]	[-1.76]	75	[3.52]	[-2.41]	77
Korea, Republic of	1.20**	8.2%	-0.65	2.49**	14.6%	-0.35	2.02*	12.0%
	[2.45]	69	[-0.70]	[2.23]	69	[-0.34]	[1.69]	69
New Zealand	2.16*	3.8%	1.80	14.52*	6.7%	0.88	5.38**	10.6%
	[1.87]	90	[1.50]	[1.71]	89	[0.66]	[2.26]	90
United Kingdom	1.04***	5.5%	1.12*	-1.31	2.2%	1.12*	-1.16	2.1%
	[2.99]	156	[1.85]	[-1.02]	155	[1.81]	[-0.94]	155
Indonesia	0.26	0.8%	0.55	-1.08	3.3%	-0.05	0.41	1.2%
	[0.64]	54	[1.09]	[-1.19]	53	[-0.06]	[0.46]	54
Malaysia	0.00	0.0%	0.66	-0.77	2.8%	0.25	-0.29	0.3%
	[-0.01]	43	[1.01]	[-1.06]	43	[0.34]	[-0.36]	43
Thailand	0.44	3.7%	1.26**	-0.86	9.0%	1.27**	-0.87	9.1%
	[1.58]	67	[2.23]	[-1.34]	67	[2.22]	[-1.34]	67
OECD	1.41***	5.0%	1.77***	-0.69	5.1%	1.66***	-0.44	4.9%
	[5.28]	530	[4.35]	[-1.29]	530	[3.72]	[-0.80]	530
Non-OECD	0.20	0.8%	0.49	-0.43	2.0%	0.35	-0.19	1.0%
	[1.14]	164	[1.79]	[-1.23]	163	[0.97]	[-0.45]	164
All	0.82***	3.1%	1.19***	-0.74**	3.0%	1.15***	-0.53	3.0%
	[4.70]	695	[4.23]	[-2.08]	695	[3.52]	[-1.39]	695
Panel B. Stock Markets								
Australia	-0.72	1%	0.99	-3.28	3%	0.26	-1.38	1%
	[-0.88]	137	[0.76]	[-1.73]	136	[0.18]	[-0.77]	137
Canada	-1.49	2%	-2.19	9.37	19%	-1.64	0.75	2%

Table A4: *Continued*

	Equation 3		Equation 4					
			Standard Crisis Period			Broad Crisis Period		
	β	R^2 / n	β	γ	R^2 / n	β	γ	R^2 / n
	[-1.20]	77	[-1.62]	[1.65]	76	[-1.00]	[0.30]	77
Korea, Republic of	-0.29	0%	-3.54	3.17	2%	-2.61	2.48	1%
	[-0.30]	71	[-1.01]	[0.83]	71	[-0.70]	[0.63]	71
New Zealand	-2.00***	8%	-1.77**	No obs	6%	-1.83**	-4.83***	18%
	[-2.70]	90	[-2.23]	No obs	87	[-2.05]	[-2.50]	89
United Kingdom	-0.99	1%	-1.55	0.33	2%	-1.39	1.27	1%
	[-0.98]	155	[-1.35]	[0.09]	154	[-1.20]	[0.55]	155
Indonesia	-1.35	2%	-0.02	-4.48	7%	-0.26	-1.42	2%
	[-0.99]	54	[-0.01]	[-1.51]	54	[-0.10]	[-0.48]	54
Malaysia	-1.14*	7%	-0.88	0.71	7%	-1.00	-0.15	7%
	[-1.79]	43	[-0.50]	[0.27]	42	[-0.54]	[-0.07]	43
Thailand	-1.46	2%	1.60	-4.17	3%	1.66	-3.97	5%
	[-1.23]	67	[0.68]	[-0.56]	65	[0.70]	[-1.48]	67
OECD	-1.00**	1%	-1.48**	0.34	2%	-1.27**	0.43	1%
	[-2.48]	530	[-2.54]	[0.37]	530	[-2.00]	[0.53]	530
Non-OECD	-1.07	2%	0.32	-3.72**	6%	0.57	-2.06	3%
	[-1.64]	164	[0.32]	[-2.48]	164	[0.43]	[-1.39]	164
All	-0.99***	1%	-0.70	-1.25*	2%	-0.64	-0.51	1%
	[-2.98]	694	[-1.42]	[-1.66]	694	[-1.11]	[-0.74]	694

Notes:
Dependent variable is the percentage change in the USD/local currency exchange rate or the percentage change in the stock market index. β is the estimated coefficient of the change in 1-month market interest rate (Δi_t^{un}). γ is the estimated coefficient of the change in 1-month market interest rate interacted with the crisis dummy ($\Delta i_t^{un}.d_{C,t}$). T-statistics are in parentheses. ***, ** and * reflect significance at the 1%, 5% and 10% levels respectively. All units are in percentage point, except R^2 in percent and "n" is the number of observations. Stata's robust regression (*rreg*) is used with default settings. All observations are initially included, although the *rreg* command downweighs influential observations.

ADB Working Paper Series on Regional Economic Integration*

1. “The ASEAN Economic Community and the European Experience” by Michael G. Plummer

2. “Economic Integration in East Asia: Trends, Prospects, and a Possible Roadmap” by Pradumna B. Rana

3. “Central Asia after Fifteen Years of Transition: Growth, Regional Cooperation, and Policy Choices” by Malcolm Dowling and Ganeshan Wignaraja

4. “Global Imbalances and the Asian Economies: Implications for Regional Cooperation” by Barry Eichengreen

5. “Toward Win-Win Regionalism in Asia: Issues and Challenges in Forming Efficient Trade Agreements” by Michael G. Plummer

6. “Liberalizing Cross-Border Capital Flows: How Effective Are Institutional Arrangements against Crisis in Southeast Asia” by Alfred Steinherr, Alessandro Cisotta, Erik Klär, and Kenan Šehović

7. “Managing the Noodle Bowl: The Fragility of East Asian Regionalism” by Richard E. Baldwin

8. “Measuring Regional Market Integration in Developing Asia: a Dynamic Factor Error Correction Model (DF-ECM) Approach” by Duo Qin, Marie Anne Cagas, Geoffrey Ducanes, Nedelyn Magtibay-Ramos, and Pilipinas F. Quising

9. “The Post-Crisis Sequencing of Economic Integration in Asia: Trade as a Complement to a Monetary Future” by Michael G. Plummer and Ganeshan Wignaraja

10. “Trade Intensity and Business Cycle Synchronization: The Case of East Asia” by Pradumna B. Rana

11. “Inequality and Growth Revisited” by Robert J. Barro

12. “Securitization in East Asia” by Paul Lejot, Douglas Arner, and Lotte Schou-Zibell

13. “Patterns and Determinants of Cross-border Financial Asset Holdings in East Asia” by Jong-Wha Lee

14. “Regionalism as an Engine of Multilateralism: A Case for a Single East Asian FTA” by Masahiro Kawai and Ganeshan Wignaraja

15. “The Impact of Capital Inflows on Emerging East Asian Economies: Is Too Much Money Chasing Too Little Good?” by Soyoung Kim and Doo Yong Yang

16. “Emerging East Asian Banking Systems Ten Years after the 1997/98 Crisis” by Charles Adams

17. “Real and Financial Integration in East Asia” by Soyoung Kim and Jong-Wha Lee

18. “Global Financial Turmoil: Impact and Challenges for Asia’s Financial Systems” by Jong-Wha Lee and Cyn-Young Park

19. “Cambodia’s Persistent Dollarization: Causes and Policy Options” by Jayant Menon

20. “Welfare Implications of International Financial Integration” by Jong-Wha Lee and Kwanho Shin

21. “Is the ASEAN-Korea Free Trade Area (AKFTA) an Optimal Free Trade Area?” by Donghyun Park, Innwon Park, and Gemma Esther B. Estrada

22. “India’s Bond Market—Developments and Challenges Ahead” by Stephen Wells and Lotte Schou- Zibell

23. “Commodity Prices and Monetary Policy in Emerging East Asia” by Hsiao Chink Tang

24. “Does Trade Integration Contribute to Peace?” by Jong-Wha Lee and Ju Hyun Pyun

25. “Aging in Asia: Trends, Impacts, and Responses” by Jayant Menon and Anna Melendez-Nakamura

26. “Re-considering Asian Financial Regionalism in the 1990s” by Shintaro Hamanaka

27. “Managing Success in Viet Nam: Macroeconomic Consequences of Large Capital Inflows with Limited Policy Tools” by Jayant Menon

28. “The Building Block Versus Stumbling Block Debate of Regionalism: From the Perspective of Service Trade Liberalization in Asia” by Shintaro Hamanaka

29. “East Asian and European Economic Integration: A Comparative Analysis” by Giovanni Capannelli and Carlo Filippini

30. “Promoting Trade and Investment in India’s Northeastern Region” by M. Govinda Rao

31. “Emerging Asia: Decoupling or Recoupling” by Soyoung Kim, Jong-Wha Lee, and Cyn-Young Park

32. “India’s Role in South Asia Trade and Investment Integration” by Rajiv Kumar and Manjeeta Singh

33. “Developing Indicators for Regional Economic Integration and Cooperation” by Giovanni Capannelli, Jong-Wha Lee, and Peter Petri

34. “Beyond the Crisis: Financial Regulatory Reform in Emerging Asia” by Chee Sung Lee and Cyn-Young Park

35. “Regional Economic Impacts of Cross-Border Infrastructure: A General Equilibrium Application to Thailand and Lao PDR” by Peter Warr, Jayant Menon, and Arief Anshory Yusuf

36. “Exchange Rate Regimes in the Asia-Pacific Region and the Global Financial Crisis” by Warwick J. McKibbin and Waranya Pim Chanthapun

37. “Roads for Asian Integration: Measuring ADB's Contribution to the Asian Highway Network” by Srinivasa Madhur, Ganeshan Wignaraja,and Peter Darjes

38. “The Financial Crisis and Money Markets in Emerging Asia” by Robert Rigg and Lotte Schou-Zibell

39. “Complements or Substitutes? Preferential and Multilateral Trade Liberalization at the Sectoral Level” by Mitsuyo Ando, Antoni Estevadeordal, and Christian Volpe Martincus

40. “Regulatory Reforms for Improving the Business Environment in Selected Asian Economies—How Monitoring and Comparative Benchmarking can Provide Incentive for Reform” by Lotte Schou-Zibell and Srinivasa Madhur

41. “Global Production Sharing, Trade Patterns, and Determinants of Trade Flows in East Asia” by Prema–Chandra Athukorala and Jayant Menon

42. “Regionalism Cycle in Asia (-Pacific): A Game Theory Approach to the Rise and Fall of Asian Regional Institutions” by Shintaro Hamanaka

43. “A Macroprudential Framework for Monitoring and Examining Financial Soundness” by Lotte Schou-Zibell, Jose Ramon Albert, and Lei Lei Song

44. “A Macroprudential Framework for the Early Detection of Banking Problems in Emerging Economies” by Claudio Loser, Miguel Kiguel, and David Mermelstein

45. “The 2008 Financial Crisis and Potential Output in Asia: Impact and Policy Implications” by Cyn-Young Park, Ruperto Majuca, and Josef Yap

46. “Do Hub-and-Spoke Free Trade Agreements Increase Trade? A Panel Data Analysis” by Jung Hur,Joseph Alba,and Donghyun Park

47. “Does a Leapfrogging Growth Strategy Raise Growth Rate? Some International Evidence” by Zhi Wang, Shang-Jin Wei, and Anna Wong

48. “Crises in Asia: Recovery and Policy Responses” by Kiseok Hong and Hsiao Chink Tang

49. “A New Multi-Dimensional Framework for Analyzing Regional Integration: Regional Integration Evaluation (RIE) Methodology” by Donghyun Park and Mario Arturo Ruiz Estrada

50. “Regional Surveillance for East Asia: How Can It Be Designed to Complement Global Surveillance?” by Shinji Takagi

51. “Poverty Impacts of Government Expenditure from Natural Resource Revenues” by Peter Warr, Jayant Menon, and Arief Anshory Yusuf

52. “Methods for Ex Ante Economic Evaluation of Free Trade Agreements” by David Cheong

53. “The Role of Membership Rules in Regional Organizations” by Judith Kelley

54. “The Political Economy of Regional Cooperation in South Asia” by V.V. Desai

55. “Trade Facilitation Measures under Free Trade Agreements: Are They Discriminatory against Non-Members?” by Shintaro Hamanaka, Aiken Tafgar, and Dorothea Lazaro

56. “Production Networks and Trade Patterns in East Asia: Regionalization or Globalization?” by Prema-chandra Athukorala

57. “Global Financial Regulatory Reforms: Implications for Developing Asia” by Douglas W. Arner and Cyn-Young Park

58. “Asia’s Contribution to Global Rebalancing” by Charles Adams, Hoe Yun Jeong, and Cyn-Young Park

59. “Methods for Ex Post Economic Evaluation of Free Trade Agreements” by David Cheong

60. “Responding to the Global Financial and Economic Crisis: Meeting the Challenges in Asia” by Douglas W. Arner and Lotte Schou-Zibell

61. “Shaping New Regionalism in the Pacific Islands: Back to the Future?” by Satish Chand

62. “Organizing the Wider East Asia Region” by Christopher M. Dent

63. “Labour and Grassroots Civic Interests In Regional Institutions” by Helen E.S. Nesadurai

64. “Institutional Design of Regional Integration: Balancing Delegation and Representation” by Simon Hix

65. “Regional Judicial Institutions and Economic Cooperation: Lessons for Asia?” by Erik Voeten

66. "The Awakening Chinese Economy: Macro and Terms of. Trade Impacts on 10 Major Asia-Pacific Countries" by Yin Hua Mai, Philip Adams, Peter Dixon, and Jayant Menon

67. “Institutional Parameters of a Region-Wide Economic Agreement in Asia: Examination of Trans-Pacific Partnership and ASEAN+α Free Trade Agreement Approaches” by Shintaro Hamanaka

68. “Evolving Asian Power Balances and Alternate Conceptions for Building Regional Institutions” by Yong Wang

69. “ASEAN Economic Integration: Features, Fulfillments, Failures and the Future” by Hal Hill and Jayant Menon

70. “Changing Impact of Fiscal Policy on Selected ASEAN Countries” by Hsiao Chink Tang, Philip Liu, and Eddie C. Cheung

71. "The Organizational Architecture of the Asia–Pacific: Insights from the New Institutionalism" by Stephan Haggard

* These papers can be downloaded from: (ARIC) http://aric.adb.org/reipapers/ or (ADB) http://adb.org/Economics/publications.asp?fs=fm_9:999

The Impact of Monetary Policy on Financial Markets in Small Open Economies: More or Less Effective During the Global Financial Crisis?

This paper estimates the impact of monetary policy on exchange rates and stock markets for eight small open economies: Australia, Canada, the Republic of Korea, New Zealand, the United Kingdom, Indonesia, Malaysia and Thailand. On average, across these countries covering crisis and non-crisis periods, a one percentage point surprise rise in official interest rates leads to a 1% appreciation of the exchange rate and a 1% fall in stock market indices. The effect on exchange rates is notably weaker in the non-Organization for Economic Cooperation and Development (OECD) countries with a managed float. For the OECD countries, there is no robust evidence of a change in the effect of policy during the global financial crisis. For the non-OECD countries, there is some evidence of a stronger effect of policy on stock markets during the crisis.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries substantially reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than $2 a day, with 903 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/poverty
Publication Stock No.

Printed in the Philippines