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Global asset prices and FOMC announcements

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A B S T R A C T

This paper analyzes the impact of U.S. monetary policy announcement surprises on foreign equity indexes, short- and long-term interest rates, and exchange rates in 49 countries. We use two proxies for monetary policy surprises: the surprise change to the current target federal funds rate (target surprise) and the revision to the expected path of future monetary policy (path surprise). We find that different asset classes respond to different components of the monetary policy surprises. Global equity indexes respond mainly to the target surprise; exchange rates and long-term interest rates respond mainly to the path surprise; and short-term interest rates respond to both surprises. On average, a hypothetical surprise 25-basis-point cut in the federal funds target rate is associated with about a 1 percent increase in foreign equity indexes and a 5 basis point decline in foreign short-term interest rates. A surprise 25-basis-point downward revision in the expected path of future policy is associated with about a ½ percent decline in the exchange value of the dollar against foreign currencies and 5 and 8 basis point declines in short- and long-term interest rates, respectively. We also find that asset prices' responses to FOMC announcements vary greatly across countries, and that these cross-country variations in the response are related to a country's exchange rate regime. Equity indexes and interest rates in countries with a less flexible exchange rate regime respond more to U.S. monetary policy surprises. In addition, the cross-country variation in the equity market response is strongly related to the percentage of each country's equity market capitalization

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owned by U.S. investors. This result suggests that investors' asset holdings may play a role in transmitting monetary policy surprises across countries.

1. Introduction

The importance of U.S. monetary policy for financial markets is suggested by the amount of private sector resources devoted to forecasting Federal Open Market Committee (FOMC) actions. Any new information about present or future U.S. monetary policy is the subject of immediate scrutiny by global financial news agencies such as Bloomberg and Reuters. This is not surprising, since many studies document large and significant effects of U.S. monetary policy announcements on U.S. financial markets (e.g., Kuttner, 2001; Ehrmann and Fratzscher, 2004; Fleming and Piazzesi, 2005; Gürkaynak et al., 2005; Bernanke and Kuttner, 2005).

In the international context, several papers have studied how U.S. monetary policy influences foreign asset prices (e.g., Husted and Kitchen, 1985; Ehrmann and Fratzscher, 2002, 2006; Faust et al., 2003; Wongswan, 2006, 2009; Andersen et al., 2007). However, these studies focus only on a few countries and a single asset class.[1] This makes the empirical results hard to generalize. In addition, most papers are silent about why foreign asset prices respond to FOMC announcements. This paper examines the impact of U.S. monetary policy announcements on foreign equities, interest rates, and exchange rates in 49 countries—to our knowledge, it is the most comprehensive study of the response of global asset prices to U.S. monetary policy announcements. This should provide more integrated and robust conclusions than the existing literature. Because of our use of comprehensive data, this paper is also able to explore why foreign asset prices respond to FOMC announcements.

Our paper is closely related to two recent studies on the role of financial and economic integration in exposing a country's equity prices to foreign monetary policy (Ehrmann and Fratzscher, 2006; Wongswan, 2009). These studies distinguish between the role of real and financial integration by relating the cross-country variation in responses (to FOMC announcements) to proxies for real and financial linkages, similar to the framework used in this paper. Using daily data, Ehrmann and Fratzscher (2006) examine equity markets' responses in 50 countries and find that a country's real and financial linkages with the world—and not a country's bilateral integration with the United States—are a key determinant of the cross-country variation in the response. Using intraday high-frequency data, Wongswan (2009) examines equity indexes' responses in 15 countries and finds evidence that financial linkages with the United States play an important role in the transmission of U.S. monetary policy to foreign equity indexes. However, these two papers only focus on equity markets and do not examine other asset classes.

This paper extends the existing literature in three important ways. First, we examine the response of foreign equities, interest rates, and exchange rates to FOMC announcement surprises. We study FOMC announcements during the period from February 1994 through March 2005. Our sample of countries is the largest possible, subject to data availability constraints. We have equity market and exchange rate data for 49 countries. Reliable interest rate time series are generally unavailable for developing countries; therefore, our interest rate results are based on data from only 20 of our 49 countries. Because we study the response of different assets, we can examine how the response of each asset is related to the response of the others. For example, a country with a larger exchange rate response may have a smaller interest rate response. In addition, we attempt to use only observations primarily influenced by FOMC announcements, and thus exclude observations that coincided with important country-specific news. For example, we exclude the July 2,

[1] Notable exceptions are Faust et al. (2003) and Andersen et al. (2007) which examine the effect of U. S. monetary policy surprises on foreign exchange rates and foreign interest rates in the United Kingdom and Germany. In addition, Andersen et al. (2007) also examine the effect of U.S. monetary policy on equity markets in those two countries. However, these studies do not explain why asset price responses vary across countries.

1997 FOMC meeting from the Thai data, since it coincided with the Bank of Thailand's decision to float the Thai baht.[2]

Second, this paper uses two proxies for U.S. monetary policy surprises as opposed to the single proxy used in most studies. Gürkaynak et al. (2005) provide evidence that monetary policy surprises contain more than just a surprise in the announced target rate. They show that two factors are needed to capture the full extent of monetary policy surprises, one for the current target rate (target surprise) and another for the expected path of future monetary policy (path surprise). Monetary policy expectations and thus the path surprise are strongly influenced by the statement that accompanies FOMC announcements.[3]

Third, this paper explores why foreign asset prices respond to U.S. monetary policy. To do this, we link the cross-country variation in the asset price response to proxies for real economic linkages (e.g., international trade), financial linkages (e.g., bank lending and U.S. investors' equity holdings of each foreign market),[4] and other linkages (e.g., the exchange rate regime). Proxies for real and financial linkages can be thought of as proxies for the cash flow and discount rate components of equity valuation. U.S. investors' equity holdings of each foreign market can also be interpreted as a proxy for the role of the portfolio channel in transmitting U.S. monetary policy surprises across countries. The portfolio channel is based on theoretical models that emphasize the role of investors' asset holdings in transmitting shocks across markets even when there are no common fundamental factors across countries (e.g., Kyle and Xiong, 2001; Kodres and Pritsker, 2002; Yuan, 2005). For example, U.S. investors may have to liquidate their positions in other countries when they suffer a negative wealth shock as a result of a surprise change in the fed funds rate. Data on U.S. investors' holdings of each foreign equity market are from Thomas et al. (2006).[5]

We find that foreign asset prices *do* respond to FOMC announcements. Moreover, we find that different asset classes respond to different components of the monetary policy surprise. Global equity indexes respond mainly to the target surprise; exchange rates and long-term interest rates respond mainly to the path surprise; and short-term interest rates respond to both surprises. This is the first paper that documents the importance of different components of the FOMC announcement surprise for the reaction of these three asset classes. On average, a hypothetical surprise 25-basis-point cut in the federal funds target rate is associated with about a 1 percent increase in foreign equity indexes and about a 5 basis point decline in foreign short-term interest rates, whereas a surprise 25-basis-point downward revision in the expected path of future policy is associated with about a ½ percent decline in the exchange value of the dollar against foreign currencies and 5 and 8 basis points declines in short- and long-term foreign interest rates, respectively.

[2] We focus only on asset price reactions around FOMC announcements because we want to measure asset price responses that are driven exogenously by monetary policy surprises. Of course, surprises about U.S. monetary policy do not occur only at FOMC meetings. Speeches or remarks from members of the FOMC (e.g., the Chairman's semi-annual testimony before Congress) influence investor expectations of future monetary policy. News about economic fundamentals also influences monetary policy forecasts. However, it is harder to isolate the monetary policy surprise component of these events. Because we ignore non-meeting surprises, our numbers are a lower bound on the economic significance of U.S. monetary policy's effect on foreign asset markets.

[3] See details in Section 2.

[4] We also use proxies for financial integration that have been used in the literature. See details in Section 2.

[5] We do not use foreign investors' holdings of each foreign equity market from the IMF's *Portfolio Investment: Coordinated Portfolio Investment Survey* as there are some problems with the data quality. For example, the data for 2004 suggest that other euro area residents hold 1189 percent of the Luxembourg equity market. It is clear that the majority of those positions are held with Luxembourg custodians, not in Luxembourg equities. The data on U.S. investors' holdings from Thomas et al. (2006) do not suffer from this problem since they combine information from portfolio flows with different snap-shot surveys of actual holdings of U.S. investors in each foreign equity market.

We also find that asset prices' responses to FOMC announcements vary greatly across countries, and that these cross-country variations in the response are related to a country's exchange rate regime. Equity indexes and interest rates in countries with a less (more) flexible exchange rate regime respond more (less) to U.S. monetary policy surprises.[6] Unsurprisingly, exchange rates respond more in countries with more flexible exchange rates regimes. The cross-country variation in the equity market response is also strongly related to the percentage of each country's equity market capitalization owned by U.S. investors, supporting the role of financial linkages. In addition, this finding is consistent with theoretical models that emphasize the role of investors' asset holdings in transmitting shocks across markets (e.g., Kyle and Xiong, 2001). To our knowledge, this is the first paper that uses *actual* asset holdings to document this effect.[7]

The implications of our findings are as follows. First, our results imply that countries should consider their vulnerability to financial shocks when choosing their exchange rate regime. Our results suggest that a country's exchange rate regime in part determines how U.S. monetary policy shocks, and by extension changes in U.S. interest rates, are distributed across domestic equity, bond, and foreign exchange markets. This may be important information for countries choosing an exchange rate regime. Second, our results imply that countries may be able to insulate themselves from the effects of foreign monetary shocks by limiting international financial linkages (e.g., Malaysia's capital controls and limits on foreign ownership in equity markets). Of course, such limits may have undesirable effects on other aspects of the economy. Third, we show that it is inappropriate to judge differences in the foreign effects of U.S. monetary policy by *only* examining the cross-country variation in the response of one asset class. Two countries may be similarly affected by U.S. monetary policy with the effect on one country transmitted mainly through the equity and bond markets, while the effect on the other country is transmitted through the foreign exchange market.

The remainder of the paper is organized as follows. Section 2 describes the data sources. Section 3 reports benchmark results and asset class results by country. Section 4 examines factors that influence cross-country variation in the response to FOMC announcement surprises. Section 5 concludes and discusses implications of our findings.

2. Data description

The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. The latter was part of a joint response by the Federal Reserve, several other central banks, and financial markets to the September 11, 2001 terrorist attacks. The sample includes 94 FOMC announcements (90 scheduled meeting decisions and 4 intermeeting decisions). Basic statistics for proxies for real and financial integration and other important macroeconomic factors are shown in Table 1, and the corresponding correlations are shown in Table 2.

2.1. Measure of monetary policy surprises

Gürkaynak et al. (2005) provide evidence that monetary policy surprises contain more than just a surprise to the announced target rate. They show that two factors are needed to capture monetary

[6] This finding is related to research that looks at the role of a country's exchange rate regime in insulating domestic interest rates from foreign monetary policy. This research compares the influence of changes in U.S. interest rates on domestic interest rates in countries with different degrees of exchange rate flexibility. However, these studies are usually carried out with low frequency (e.g., monthly, quarterly, or annual) data, making it hard to separate out the influence of common shocks (e.g., increases in oil prices) from the influence of U.S. monetary policy shocks. Frankel et al. (2004), Shambaugh (2004), and Miniane and Rogers (2007) find that the more flexible a country's exchange rate regime, the less the short-run response of domestic interest rates to changes in U.S. interest rates.

[7] Boyer et al. (2006) provide empirical evidence suggesting that international investors were a source of spillover effects during the 1997 Asian financial crisis. They find that the returns of emerging market stocks that foreigners are eligible to purchase are more correlated with the crisis country's stock index returns. They use the extent to which a stock is available to foreign investors as a proxy for actual foreign ownership. We also use this variable and call it Foreign Eligibility (See Section 2).

Table 1
Basic statistics.

	Mean	Standard deviation	Minimum	Maximum	Number of observations
Panel A: Monetary policy announcements					
Policy action (basis points)	0.266	23.620	−50.000	75.000	94
Target surprise (basis points)	−1.370	8.990	−43.800	16.300	94
Path surprise I (basis points)	−1.320	8.410	−28.500	24.500	94
Path surprise II (basis points)	0.000	7.140	−20.980	24.890	94
Panel B: Asset returns					
Equity index (%)	0.251	1.597	−13.612	19.035	4415
Exchange rate (%)	0.012	0.709	−14.642	13.746	4415
Short-term interest rate (basis points)	−0.427	10.085	−64.000	215.600	1443
Long-term interest rate (basis points)	−0.328	6.375	−32.000	36.500	1743
Panel C: Real economic linkages					
Trade with U.S. (% of GDP)	9.563	11.804	0.835	58.122	4272
Exports to U.S. (% of GDP)	5.719	7.267	0.295	33.682	4272
Panel D: Financial linkages					
U.S. Equity participation (% of equity market capitalization)	9.716	6.687	0.128	72.452	3912
Foreign eligibility (% of equity market capitalization)	73.303	30.088	0.000	100.000	2135
Bank lending from U.S. (% of GDP)	4.045	3.576	0.009	18.420	3638
Panel E: Other macro variables					
Exchange rate regime (3 = fixed, 2 = intermediate, 1 = floating)	1.363	0.677	1.000	3.000	4256
Equity market capitalization (% of GDP)	67.060	66.338	0.038	528.490	4304

This table shows basic statistics for proxies for monetary policy announcements, real and financial integration, and other important macroeconomic factors. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement.

policy surprises. The *target surprise* is defined as the difference between the announced target fed funds rate and expectations derived from fed funds futures contracts (Kuttner, 2001). The target surprise can be computed from the change in the current-month fed funds futures contract rate in a 30-min window around the FOMC announcement (10 min before to 20 min after). Because fed funds futures contracts have a payout that is based on the *average* effective fed funds rate that prevails over the calendar month specified in the contract, the change in the fed funds futures rate needs to be adjusted by a factor that is a function of the number of days in the month affected by the change in the target fed funds rate. For an FOMC announcement on day d of a month with D days, the fed funds futures rate 10 min before the announcement ($ff_{\tau\text{-}10}$) is a weighted average of the fed funds rate that has prevailed so far in the month (r_0) and the rate that is expected to prevail for the remainder of the month (r_1) plus a risk premium ($rp_{\tau\text{-}10}$):

$$ff_{\tau-10} = \frac{d}{D} r_0 + \frac{D-d}{D} E_{\tau-10}(r_1) + rp_{\tau-10},$$

where τ is the FOMC announcement time. By evaluating the above equation at time $\tau + 20$, differencing, and assuming a constant risk premium,[8] we see that the target surprise is

[8] Beechey (2007) and Piazzesi and Swanson (2008) find that monetary policy surprises affect the risk premium of interest rate instruments. In addition, Piazzesi and Swanson (2008) find that the time variations in the risk premium are primarily at lower, business-cycle frequencies. They note that computing monetary policy surprises based on one-day changes of the federal funds futures contract should be robust to the time variation in the risk premium since the low frequency time variation is effectively differenced out.

Table 2
Correlation matrix.

	Policy action	Target surprise	Path surprise I	Path surprise II	Equity return	Exchange rate return	Changes in short-term interest rate	Changes in long-term interest rate
Panel A: Correlations between proxies for monetary policy announcements and asset returns								
Policy action	**1.000**	**0.500**	**0.402**	**0.166**	−0.024	**0.070**	**0.184**	**0.136**
Target surprise	**0.500**	**1.000**	**0.529**	0.008	**−0.205**	0.019	**0.197**	**0.167**
Path surprise I	**0.402**	**0.529**	**1.000**	**0.853**	**−0.143**	**0.151**	**0.225**	**0.379**
Path surprise II	**0.166**	0.008	**0.853**	**1.000**	**−0.042**	**0.166**	**0.144**	**0.345**
Equity return	−0.024	**−0.205**	**−0.143**	**−0.042**	**1.000**	**−0.097**	**−0.090**	−0.042
Exchange rate return	**0.070**	0.019	**0.151**	**0.166**	**−0.097**	**1.000**	**0.058**	**0.209**
Changes in short-term interest rate	**0.184**	**0.197**	**0.225**	**0.144**	**−0.090**	**0.058**	**1.000**	**0.144**
Changes in long-term interest rate	**0.136**	**0.167**	**0.379**	**0.345**	−0.042	**0.209**	**0.144**	**1.000**

	Trade with U.S.	Exports to U.S.	U.S. equity participation	Foreign eligibility	Bank lending from U.S.	Exchange rate regime	Equity market capitalization
Panel B: Correlations between proxies for real and financial linkages							
Trade with U.S.	**1.000**	**0.985**	**0.198**	0.027	**0.602**	**0.301**	**0.376**
Exports to U.S.	**0.985**	**1.000**	**0.168**	−0.010	**0.581**	**0.352**	**0.403**
U.S. equity participation	**0.198**	**0.168**	**1.000**	**0.380**	**0.068**	**−0.143**	**0.039**
Foreign eligibility	0.027	−0.010	**0.380**	**1.000**	**0.185**	**−0.148**	**0.121**
Bank lending from U.S.	**0.602**	**0.581**	**0.068**	**0.185**	**1.000**	**0.337**	**0.540**
Exchange rate regime	**0.301**	**0.352**	**−0.143**	**−0.148**	**0.337**	**1.000**	**0.182**
Equity market capitalization	**0.376**	**0.403**	**0.039**	**0.121**	**0.540**	**0.182**	**1.000**

This table shows the correlation matrix for proxies for monetary policy announcements, asset returns, proxies for real economic and financial linkages, and other macroeconomic variables. Correlation coefficients significant at the 5% level are in bold, and correlation coefficients significant at the 10% level are underlined.

$$TS_t = \frac{D}{D-d}(ff_{\tau+20} - ff_{\tau-10}),$$

where TS_t is the target surprise on day t.[9]

The *path surprise* is intended to capture news about the revision in the future path of policy. We use two measures of the path surprise. *Path Surprise I* is the change in one-year-ahead eurodollar interest rate futures in a 30-min window around the announcement. However, a change in near-term (one-year) interest rates may be due to a surprise change in the target rate. To remove the effect of the target rate surprise from the change in the near-term interest rate, we define *Path Surprise II* as the component of the change in one-year-ahead eurodollar interest rate futures in a 30-min window around the announcement that is *uncorrelated* with the target surprise. *Path Surprise II* reflects news that market participants have learned from the FOMC's statement about the expected future path of policy over and above what they have learned about the level of the target rate. To derive Path Surprise II, we run a regression of Path Surprise I on a constant and the target surprise (TS). The innovation from this regression is Path Surprise II:

$$Path\ \ Surprise\ \ I_t = \omega_0 + \omega_1 * TS_t + PS_t^{II}, \tag{1}$$

where PS_t^{II} is the error term and is Path Surprise II.[10] Because the results using Path Surprise I and II are quite similar, we use Path Surprise I in our panel regression analysis.

Panel A of Table 1 shows basic statistics for the measures of monetary policy surprises and actions. The standard deviation of the policy action is higher than those of the target and path surprises, reflecting the fact that policy changes occur in 25-basis-point increments and are usually not large

[9] For FOMC meetings that occur in the last seven days of the month, the target surprise is computed as the unadjusted change in the next-month fed funds futures contract. This is to avoid using a very large adjustment factor in the computation of the target surprise which could magnify changes in bid-ask spreads or other factors. Results are qualitatively similar when we compute the target surprise using a 1-h window around the announcement (15 min before to 45 min after).

[10] For the 94 FOMC meetings in our sample, the estimated equation is *Path Surprise* $I_t = -0.64 + 0.49*TS_t$, and the adjusted R-squared is 0.27.

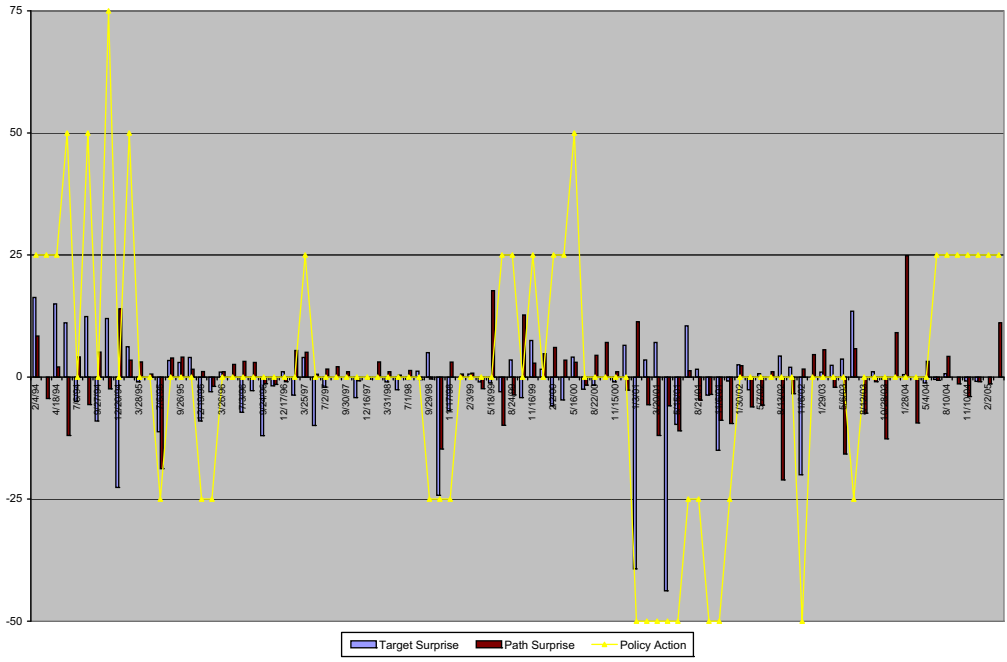

Fig. 1. FOMC policy actions and surprises. This figure shows FOMC policy actions, target surprises, and path surprises (Path Surprise II). The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement.

surprises. The mean of Path Surprise II equals zero by construction. Fig. 1 plots the policy action and target and path surprises (Path Surprise II). The two largest target surprises were intermeeting moves in early 2001 that caught market participants by surprise, as indicated by the fact that the target surprises are almost identical to the actual policy actions. The largest path surprise occurred with the January 28, 2004 FOMC announcement. As market participants expected, the FOMC did not change the target fed funds rate (the target surprise was essentially zero). The FOMC, however, dropped the previously used "considerable period" phrase from the accompanying statement, and this led market participants to revise up their expectations of the path of future policy rates; yields across two- to ten-year Treasury notes rose 15–20 basis points, and the S&P 500 index declined about 1 percent in a 1-h window around the announcement. This example illustrates the importance of the path surprise in capturing the full extent of monetary policy surprises. It is interesting to note that in our sample period, the average target surprise becomes smaller over time. The corresponding increase in the relative importance of the path surprise is consistent with reports that market participants are paying closer attention to the FOMC's accompanying statements in gauging the path of future monetary policy.

2.2. Asset prices data

Daily financial market data for equity market indexes, short- and long-term interest rates, and exchange rates are from Bloomberg.[11] Because of data availability, we have interest rate data for only 20 countries. We use three-month money market interest rates to proxy for short-term interest rates and yields on ten-year government bonds to proxy for long-term interest rates. We exclude asset price observations that occurred on the same day as major country-specific economic news. For example, we exclude the July 2, 1997 FOMC meeting from the Thai data, since it coincided with the Bank of

[11] Interest rate data for Finland and Spain are from Thompson Datastream.

Thailand's decision to float its currency.[12] In addition, we make appropriate adjustments to the event window that covers each FOMC announcement. For example, between June 2000 and October 2003 the Frankfurt Stock Exchange remained open until 7 p.m. local time, allowing us to measure the response of the German stock market index on the same day as the FOMC announcement. In most cases, however, markets outside the Western Hemisphere close before the FOMC announces its decision. Thus we generally measure the return of foreign asset prices in all countries, except those in North and South America, from the closing on the day of the FOMC announcement through the next day's close. In our sample, a few FOMC announcements occur before 1 p.m. eastern time. In this case some European equity markets were open at the time of the announcement. Likewise, some late FOMC announcements occurred after the close of some equity markets in Latin America. To account for these special cases, we carefully constructed data on the closing time of each equity market in our sample, adjusting for daylight savings time conventions as needed. We used similar care in constructing the windows over which we measure exchange rate and interest rate changes for each country. Appendix Table 1 provides the dates that our data begins for each asset for each country.

Because we use daily data to examine the impact of FOMC announcements, there may be other important news unrelated to FOMC announcements that occurs in the event window and influences our estimated responses. A partial solution is to use high-frequency intraday data on foreign stock indexes trading in New York as Exchange Traded Funds (ETFs). However, these ETFs are not actively traded within the day and do not track the underlying national stock indexes well (Engle and Sarkar, 2002). They are therefore unsuitable for a very short-run analysis.[13] In addition, these ETFs do not cover many of the countries included in this study. To evaluate the robustness of our results, we re-estimate our regressions over the same sample period as that in Wongswan (2009). In general, our estimates based on daily data are very close to those based on high-frequency data in Wongswan (2009). Not surprisingly, our adjusted R-squared is lower in all cases.

2.3. Proxies for real integration

We use two proxies to measure each country's degree of real economic integration with the United States and the rest of the world. First, as is common in the literature, we use the ratio of each country's international trade (exports plus imports) with the United States to its GDP (Trade with U.S.). Second, to capture the influence of the U.S. economy through its demand for foreign goods and services, we use the ratio of each country's exports to the United States to its GDP (Exports to U.S.). The empirical results are qualitatively similar when we use each country's trade with the rest of the world in place of each country's trade with the United States. Annual trade data are from the IMF's *Direction of Trade Statistics*, and annual GDP data are from the World Bank's *World Development Indicators* database.[14]

2.4. Proxies for financial integration

There is a large literature that attempts to measure a country's degree of financial integration, especially that of emerging markets. However, there is no consensus on the most appropriate measure.

[12] We exclude eight observations from our sample. 1) Mexico, 20 December 1994: The Tequila crisis began; the Mexican peso depreciated 13.7 percent against the dollar. 2) Mexico, 1 February 1995: A U.S. loan package to Mexico was announced; the Mexican peso strengthened 6.7 percent against the dollar. 3) Brazil, 12 November 1997: Fall out from the Asian crisis lead the Brazilian stock market to fall 10.8 percent. 4) Thailand, 2 July 1997: The day after the Bank of Thailand abandoned the baht's peg. The Thai stock market rose 8.3 percent, and in a retracing of the previous days move, the baht appreciated 3.7 percent against the dollar. 5) Korea, 16 December 1997: The Korean government sold 2 banks and issued 10 billion dollars of sovereign bonds. The won depreciated 3.9 percent against the dollar. 6) Indonesia, 19 May 1998: President Suharto announced that he would step down; unrest continued. The Rupiah appreciated 8 percent against the dollar. 7) China, 30 June 1999: There were rumors that Premier Zhu Ronji would resign; the stock market fell 7.9 percent. 8) Russia, 17 August 1998: Russia announced a de facto devaluation by widening the trading band of the ruble. Russia also declared its intention to restructure all official domestic currency debt obligations due at the end of 1999 and imposed a 90-day moratorium on the repayment of private external debt.

[13] Using high-frequency data on 12 foreign ETFs, Bauer and Vega (2008) find significant evidence that private information about U.S. monetary policy plays a role in explaining the cross section of international equity returns at daily and weekly frequencies.

[14] Trade and GDP data for Taiwan are from the CEIC Asia database.

In this paper, we use three proxies to capture each country's financial integration with U.S. and global financial markets.[15]

First, we use the percentage of domestic equity market capitalization owned by U.S. investors (U.S. Equity Participation). Data on U.S. investors' holdings of foreign equities are from Thomas et al. (2006). The data are available at a monthly frequency for the full sample period. Equity market capitalizations used to normalize foreign holdings are from Standard & Poor's *Global Stock Markets Factbook*.

Second, the percentage of a country's equity market capitalization that foreigners can legally hold is used to measure the extent to which foreigners are eligible to own domestic equities (Foreign Eligibility) (e.g., Bekaert, 1995; Henry, 2000a, 2000b; Edison and Warnock, 2003). This percentage is computed as the ratio of Standard and Poor's/International Finance Corporation (IFC)'s market capitalizations for an Investable Index (IFCI) and a Global Index (IFCG). This ratio only measures the degree of financial integration for equity markets, and it is only available for emerging markets. While U.S. Equity Participation captures the *actual* holdings of domestic equities by foreign investors, this measure captures the extent to which foreigners are *eligible* to hold domestic equities.

Third, we use the ratio of each country's total stock of bank lending from the United States to each country's GDP (Bank Lending from U.S.). The empirical results based on bank lending from the rest of the world are qualitatively similar. The data are from the Bank for International Settlements (BIS)'s total claims of U.S. banks (Table 9B). The data are available on a quarterly basis for the full sample period. This statistic captures financial linkages through the banking sector (Van Rijckeghem and Weder, 2001; Chinn and Forbes, 2004).

2.5. Proxies for other factors

There may be other factors that influence how foreign financial markets respond to FOMC announcements. We examine two additional factors that may be related to real linkages, financial linkages, or both.

First, the exchange rate regime may influence how a country adjusts to changes in global interest rates (in this case, because of U.S. monetary policy surprises). The conventional wisdom is that countries with a more flexible exchange rate regime can insulate their local interest rates more from changes in global interest rates (e.g., Frankel et al., 2004; Shambaugh, 2004). However, there is no consensus on the "correct" exchange rate classification for each country. In this paper, we use Levy-Yeyati and Sturzenegger (2005)'s exchange rate regime classification for two reasons. First, their methodology is a *de facto* classification based on actual data on exchange rates and international reserves. This has an advantage over the *de jure* classification from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* because actual exchange rate regimes often differ from officially announced regimes (Reinhart and Rogoff, 2004; Shambaugh, 2004; Levy-Yeyati and Sturzenegger, 2005). Second, Levy-Yeyati and Sturzenegger (2005)'s classification is available for all our countries except Taiwan and is available for almost our entire sample period. In contrast, Reinhart and Rogoff's classification ends in 2001. Levy-Yeyati and Sturzenegger (2005) proxy for the exchange rate regime with a dummy variable. The dummy variable equals one for a fully floating regime, two for a limited-flexibility or a managed float regime, and three for a fixed or currency board regime.[16] As a robustness check for our results, we use both Shambaugh's and Reinhart and Rogoff's classifications for the available sample period.[17] In addition, we use the estimated response of the exchange rate to FOMC announcements to proxy for exchange rate flexibility.

Second, the development of the financial sector in a country may influence how that country responds to U.S. monetary policy announcements. We use the size of the equity market in each country relative to the country's GDP to proxy for financial sector development.

[15] We do not use official liberalization dates (e.g., regulation changes, the introduction of depositary receipts and country funds, or structural breaks in equity capital flows) to proxy for financial integration because most emerging markets liberalized their markets in the late 1980s or the early 1990s, before our sample begins (Bekaert and Harvey, 2000; Henry, 2000a, 2000b).

[16] We modify Levy-Yeyati and Sturzenegger (2005)'s exchange rate classification to reflect the exchange rate regime with the dollar as the base currency. For example, a country with an effective fixed exchange rate with the euro would be classified in Levy-Yeyati and Sturzenegger (2005) as a fixed exchange rate regime but will be classified as floating in our modified Levy-Yeyati and Sturzenegger's classification.

[17] We obtain Shambaugh's exchange rate classification through 2004 from his webpage.

3. Do foreign asset prices respond to FOMC announcement surprises?

3.1. Empirical specification

Our empirical methodology follows the standard event study literature. We examine asset price returns over a one-day window around the FOMC announcement. Specifically, we estimate a panel regression for all foreign countries for each asset class using only days on which FOMC announcements took place:

$$R_{i,t} = \alpha + \beta_1 TS_t + \beta_2 PS_t + \varepsilon_{i,t} \quad (2)$$

where $R_{i,t}$ is the return of country i's asset price on day t, TS is the target surprise, PS is the path surprise, and ε is a residual term. We show results for both measures of the path surprise: the change in one-year-ahead eurodollar interest rate futures (Path Surprise I) and the component of the change in one-year-ahead eurodollar interest rate futures that is uncorrelated with the target surprise (Path Surprise II). We estimate Equation (2) by Ordinary Least Square (OLS) and account for heteroskedasticity and contemporaneous correlation across panels in the residuals by using Panel-Corrected Standard Errors (PCSE).

3.2. Baseline Results

Table 3 presents the average response of foreign equity indexes, exchange rates, and short- and long-term interest rates to U.S. monetary policy announcements. Panel A shows average responses for all 49 foreign countries for equities and exchange rates. Foreign equity indexes respond mainly to the target surprise, and this is consistent with results documented for U.S. equity markets (Gürkaynak et al., 2005; Wongswan, 2009). Exchange rates respond mainly to the path surprise. This is consistent with the view that (1) the path surprise is more related to the term-structure of interest rates (shown in panel B and documented in Gürkaynak et al. (2005) for U.S. interest rates) and that (2) exchange rates are more affected by the term-structure of interest rates than they are by short-term interest rates alone. Our empirical results are robust to different measures of the path surprise. On average, a hypothetical 25-basis-point surprise cut in the fed funds rate is associated with about a 1 percent increase in foreign equity indexes and small effects on the exchange rate, and a hypothetical

Table 3
Average responses of global asset prices to FOMC announcements.

	Target surprise		Path surprise		Adj. R-sq	Number of observations
Panel A: All Countries						
Equity (path surprise I)	**−3.228**	(0.830)	**−0.915**	(0.364)	0.043	4415
Equity (path surprise II)	**−3.679**	(0.946)	**−0.915**	(0.364)	0.043	4415
Exchange rate (path surprise I)	**−0.669**	(0.210)	**1.649**	(0.424)	0.027	4415
Exchange rate (path surprise II)	0.145	(0.181)	**1.649**	(0.424)	0.027	4415
Panel B: 20 Countries						
Equity (path surprise I)	**−3.690**	(0.948)	**−0.892**	(0.455)	0.079	1837
Equity (path surprise II)	**−4.130**	(1.062)	**−0.892**	(0.455)	0.079	1837
Exchange rate (path surprise I)	**−1.449**	(0.372)	**2.608**	(0.670)	0.089	1837
Exchange rate (path surprise II)	−0.161	(0.247)	**2.608**	(0.670)	0.089	1837
Short-term interest rate (path surprise I)	**0.116**	(0.030)	**0.191**	(0.049)	0.057	1443
Short-term interest rate (path surprise II)	**0.210**	(0.054)	**0.191**	(0.049)	0.057	1443
Long-term interest rate (path surprise I)	−0.034	(0.024)	**0.305**	(0.079)	0.144	1743
Long-term interest rate (path surprise II)	**0.117**	(0.030)	**0.305**	(0.079)	0.144	1743

This table shows estimates from the panel regression of global asset prices on target and path surprises (Equation (2)) $R_{i,t} = \alpha + \beta_1 TS_t + \beta_2 PS_t + \varepsilon_{i,t}$, where R is the return of country i's asset price on day t, TS is the target surprise, and PS is the path surprise. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Panel-Corrected Standard Errors (PCSE) are in parentheses. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined. Path Surprise I is the change in one-year-ahead eurodollar interest rate futures, and Path Surprise II is the component of the change in one-year-ahead eurodollar interest rate futures that is uncorrelated with the target surprise.

25-basis-point surprise downward revision in the future path of monetary policy (as measured by the one-year-ahead eurodollar interest rate futures contract) is associated with a ¼ percent increase in equity indexes and about a ½ percent decline in the exchange value of the dollar against foreign currencies. These asset price responses are economically significant since they represent asset price movements over a one-day horizon.

Panel B shows average asset price responses for the 20 foreign countries for which we have interest rate data. The results for equities and exchange rates are qualitatively the same as those obtained from a broader set of countries. Short-term interest rates respond to both the target and path surprises, while long-term interest rates respond only to the path surprise. This is not surprising, since we use three-month interest rates to proxy for short-term interest rates, and thus our short-term interest rates have a longer maturity than the fed funds rate (an overnight rate). On average, a hypothetical 25-basis-point surprise cut in the fed funds rate is associated with about 5 and 3 basis point declines in foreign short- and long-term interest rates, respectively, and a hypothetical 25-basis-point surprise downward revision in the future path of monetary policy is associated with 5 and 8 basis point declines in foreign short- and long-term interest rates, respectively. The adjusted R-squared values suggest that U.S. monetary policy surprises have the highest explanatory power for foreign long-term interest rates and the least for foreign short-term interest rates. This may be because short-term interest rates are strongly influenced by the central bank policy rate, and the policy rate is likely to be influenced by several country-specific factors. In contrast, long-term interest rates are more linked to the general global business cycle in which the U.S. economy plays an important role.

Tables 4–6 show individual country responses to FOMC announcements in equity, currency, and interest rate markets, respectively. The format of each table is similar. The first row shows results for the United States as a comparison, columns two and three show estimates on the target and path surprises, and the last column shows the adjusted R-squared. For ease of interpretation, we only show results for Path Surprise II (orthogonal to the target surprise). We estimate each country and asset pair separately with OLS.

The equity market response, shown in Table 4, varies greatly across countries. Most foreign equity indexes respond only to the target surprise. Equity markets in more closed economies (e.g., China, India, Peru, Malaysia, and Venezuela) do not respond significantly or respond only weakly to U.S. monetary policy surprises. Equity markets in Finland, Hong Kong, Korea, Russia, and Turkey respond statistically significantly (at the 95 percent confidence level) more to FOMC announcements than the U.S. stock market does. On average, a hypothetical 25-basis-point surprise cut in the fed funds rate is associated with little or no change in some countries, about a 1 percent increase in Western European stock indexes, almost a 2 percent increase in the S&P 500, and about a 3 percent increase in equity indexes in Finland, Hong Kong, Korea, Russia, and Turkey. The stronger responses of these countries than that of the United States may reflect the fact that during our sample period these countries experienced major financial crises. These crises could have made their stock markets become more sensitive to U.S. monetary policy surprises.[18] In addition, the strong response in Finland and Korea may be related to the high concentration of information technology and telecommunication services sectors in these countries' equity markets. These sectors tend to respond more to FOMC announcement surprises (Ehrmann and Fratzscher, 2004, 2006; Bernanke and Kuttner, 2005). The strong response of Hong Kong's equity market may be due to the fact that Hong Kong has a currency board exchange rate regime in which U.S. monetary policy surprises transmit one-to-one to Hong Kong's policy rate. Also, Hong Kong's economy depends largely on external sectors that are heavily linked to the United States. We find that many countries in the Asia-Pacific region respond to the path surprise in addition to or instead of the target surprise (e.g., Japan). This result suggests that previous studies that only use the target surprise as a measure of U.S. monetary policy surprises may underestimate the influence of U.S. monetary policy on equity markets in the Asia-Pacific region. The importance of FOMC announcements to global equity markets can be examined by looking at the adjusted R-squared. U.S. monetary policy explains the most variation in U.S. and Canadian equity markets, followed by equity markets in Hong Kong and South Africa.

[18] Finland had a major financial crisis from 1991 through 1993 and was recovering in 1994.

Table 4
Responses of equity indexes to FOMC announcements.

	Target surprise		Path surprise II		Adj. R-sq
United States	**−7.384**	(1.898)	−2.321	(1.909)	0.317
Panel A: North and South America					
Canada	**−7.311**	(1.879)	−1.337	(1.519)	0.318
Argentina	**−8.493**	(4.333)	−3.388	(3.235)	0.131
Brazil	−6.709	(4.326)	−3.537	(3.700)	0.080
Chile	−0.393	(0.771)	**−1.841**	(0.935)	0.031
Mexico	**−6.922**	(2.787)	−2.976	(2.400)	0.145
Peru	−2.008	(1.361)	−1.843	(1.622)	0.016
Venezuela	1.289	(4.063)	2.399	(3.475)	−0.010
Panel B: Western Europe					
Austria	**−3.292**	(0.846)	**−4.132**	(1.062)	0.186
Belgium	−0.590	(0.824)	1.127	(1.603)	−0.012
Denmark	−0.576	(1.397)	0.707	(1.578)	−0.021
Finland	**−11.539**	(5.148)	−0.259	(5.440)	0.155
France	**−4.477**	(2.038)	2.043	(2.634)	0.065
Germany	−4.437	(2.475)	−0.464	(2.243)	0.045
Greece	−2.427	(2.471)	−3.512	(2.295)	0.030
Iceland	0.651	(0.893)	0.324	(0.819)	−0.013
Ireland	−1.860	(1.219)	0.192	(1.360)	0.002
Italy	**−4.933**	(1.940)	0.335	(2.510)	0.073
Netherlands	**−3.503**	(1.787)	1.404	(2.152)	0.040
Norway	−2.901	(1.996)	−0.353	(2.110)	0.028
Portugal	−2.725	(1.493)	−0.004	(0.490)	0.024
Spain	**−6.613**	(2.298)	0.033	(2.050)	0.155
Sweden	−4.005	(2.250)	0.713	(1.481)	0.050
Switzerland	−1.047	(1.015)	0.005	(0.166)	−0.011
United Kingdom	**−4.049**	(0.917)	−0.335	(1.480)	0.137
Panel C: East Asia and South Pacific					
Australia	**−2.719**	(1.317)	**−2.611**	(1.051)	0.111
China	2.456	(1.761)	1.989	(4.638)	−0.013
Hong Kong	**−9.857**	(2.996)	**−6.790**	(2.599)	0.269
Indonesia	−3.433	(3.198)	−4.782	(3.452)	0.058
Japan	−2.087	(1.776)	**−5.260**	(2.279)	0.092
Korea	**−8.760**	(2.952)	−3.696	(2.675)	0.181
Malaysia	−1.949	(1.420)	**−2.986**	(1.496)	0.008
New Zealand	**−2.528**	(1.657)	**−3.039**	(1.146)	0.115
Philippines	**−4.976**	(1.729)	**−5.210**	(2.623)	0.134
Singapore	**−5.163**	(2.143)	−3.240	(2.239)	0.127
Taiwan	**−4.331**	(2.098)	−3.503	(1.870)	0.052
Thailand	**−5.539**	(2.750)	**−6.201**	(2.728)	0.095
Panel D: Eastern Europe and Other Emerging Markets					
Czech Republic	**−5.190**	(1.849)	3.769	(1.996)	0.128
Estonia	1.130	(2.209)	2.233	(2.033)	−0.010
Hungary	−3.630	(3.250)	1.350	(2.700)	0.004
India	−1.190	(2.973)	0.270	(1.967)	−0.015
Israel	**−2.877**	(1.171)	−0.338	(1.269)	0.036
Mauritius	−1.020	(1.502)	−0.594	(1.449)	0.000
Pakistan	3.244	(2.868)	**5.703**	(2.818)	0.071
Poland	0.216	(15.638)	3.328	(2.391)	−0.006
Russia	**−12.811**	(3.293)	−2.103	(3.449)	0.155
Slovak Republic	3.297	(8.996)	0.361	(3.688)	−0.105
Slovenia	−0.355	(1.039)	−1.266	(0.944)	−0.012
South Africa	**−7.168**	(1.623)	−2.244	(1.627)	0.285
Turkey	**−11.506**	(5.457)	4.190	(6.375)	0.094

This table shows estimates from the regression of equity index returns on the target surprise and path surprise II: $R_{i,t} = \alpha + \beta_1 TS_t + \beta_2 PS_t + \varepsilon_{i,t}$, where R is the return of country i's equity index on day t, TS is the target surprise, and PS is Path Surprise II. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Standard errors are in parentheses and are computed from a sampling-with-replacement bootstrap with 2000 repetitions. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined.

Table 5
Responses of exchange rates to FOMC announcements.

	Target surprise		Path surprise II		Adj. R-sq
Panel A: North and South America					
Canada	0.269	(0.418)	**2.303**	(0.820)	0.154
Argentina	−0.161	(0.180)	−0.413	(0.823)	−0.014
Brazil	1.025	(1.101)	−0.307	(1.084)	−0.012
Chile	0.771	(0.455)	1.311	(1.239)	0.043
Mexico	**1.148**	(0.457)	−0.371	(0.843)	0.017
Peru	0.129	(0.794)	−0.110	(0.390)	−0.020
Venezuela	0.274	(0.424)	−0.663	(1.182)	−0.015
Panel B: Western Europe					
Austria	−0.430	(2.996)	**2.645**	(1.087)	0.074
Belgium	−0.207	(5.501)	**2.839**	(1.155)	0.081
Denmark	−0.667	(3.071)	**3.708**	(1.350)	0.147
Finland	−0.386	(1.975)	**2.577**	(1.080)	0.061
France	−0.113	(3.342)	**2.903**	(1.034)	0.083
Germany	−0.009	(0.079)	**2.948**	(0.954)	0.085
Greece	−0.616	(1.805)	**2.494**	(1.120)	0.071
Iceland	0.647	(0.581)	0.705	(0.974)	−0.004
Ireland	−0.437	(2.124)	**3.040**	(1.024)	0.095
Italy	−0.575	(2.330)	**3.316**	(1.073)	0.127
Netherlands	−0.023	(0.195)	**2.971**	(1.032)	0.084
Norway	−0.979	(2.081)	**4.211**	(1.561)	0.175
Portugal	−0.631	(1.916)	**2.944**	(1.071)	0.104
Spain	−0.560	(1.850)	**2.656**	(0.985)	0.083
Sweden	0.120	(0.551)	**2.150**	(0.997)	0.033
Switzerland	0.086	(0.463)	**2.344**	(1.164)	0.036
United Kingdom	−0.034	(1.423)	1.152	(0.615)	0.006
Panel C: East Asia and South Pacific					
Australia	−0.111	(0.886)	**2.817**	(0.949)	0.077
China	−0.003	(0.008)	0.004	(0.010)	−0.026
Hong Kong	0.007	(0.013)	0.004	(0.021)	−0.021
Indonesia	0.393	(1.195)	**2.898**	(1.235)	0.007
Japan	**2.359**	(1.081)	**2.252**	(0.802)	0.109
Korea	**1.538**	(0.534)	0.946	(0.877)	0.086
Malaysia	−0.295	(0.179)	0.019	(0.600)	−0.020
New Zealand	−0.414	(1.339)	**2.721**	(0.880)	0.070
Philippines	0.381	(0.285)	**1.433**	(0.464)	0.014
Singapore	0.473	(0.342)	0.283	(0.596)	−0.003
Taiwan	0.329	(0.268)	0.113	(0.992)	−0.005
Thailand	0.631	(0.365)	**1.283**	(0.476)	0.042
Panel D: Eastern Europe and Other Emerging Markets					
Czech Republic	0.665	(0.655)	**3.001**	(1.180)	0.095
Estonia	−0.112	(1.155)	**1.914**	(0.959)	0.031
Hungary	0.464	(0.320)	1.550	(0.888)	0.028
India	0.097	(0.069)	0.116	(0.133)	0.015
Israel	0.323	(0.322)	−0.181	(0.720)	−0.015
Mauritius	1.208	(0.808)	−1.136	(0.625)	0.017
Pakistan	−0.151	(0.340)	0.833	(0.479)	−0.003
Poland	0.466	(0.461)	0.502	(0.869)	−0.014
Russia	4.963	(9.040)	5.309	(3.396)	0.099
Slovak Republic	0.479	(0.365)	1.647	(0.928)	0.026
Slovenia	−0.407	(0.781)	1.584	(1.054)	0.007
South Africa	0.117	(0.469)	−1.359	(1.276)	−0.010
Turkey	0.707	(0.764)	1.633	(1.408)	−0.010

This table shows estimates from the regression of exchange rate returns on the target surprise and path surprise II: $R_{i,t} = \alpha + \beta_1 TS_t + \beta_2 PS_t + \varepsilon_{i,t}$, where R is the return of country i's exchange rate on day t, exchange rate is expressed as foreign currencies per dollar, TS is the target surprise, and PS is Path Surprise II. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Standard errors are in parentheses and are computed from a sampling-with-replacement bootstrap with 2000 repetitions. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined.

Table 6
Responses of interest rates to FOMC announcements.

	Short-term interest rate					Long-term interest rate				
	Target surprise		Path surprise II		Adj. R-sq	Target surprise		Path surprise II		Adj. R-sq
United States	**0.646**	(0.146)	**0.167**	(0.038)	0.619	0.071	(0.138)	**0.686**	(0.155)	0.411
Australia	**0.260**	(0.102)	**0.182**	(0.069)	0.208	0.085	(0.155)	**0.563**	(0.145)	0.147
Austria	**0.198**	(0.069)	**0.384**	(0.099)	0.349	**0.146**	(0.049)	**0.276**	(0.089)	0.183
Belgium	0.042	(0.095)	**0.321**	(0.098)	−0.011	**0.147**	(0.060)	**0.263**	(0.094)	0.157
Canada	**0.490**	(0.126)	**0.229**	(0.070)	0.301	0.066	(0.113)	**0.512**	(0.132)	0.268
Denmark	**0.215**	(0.070)	0.050	(0.067)	0.068	**0.160**	(0.062)	**0.274**	(0.092)	0.156
Finland	**0.164**	(0.063)	**0.090**	(0.043)	0.212	0.087	(0.071)	**0.280**	(0.091)	0.128
France	0.123	(0.069)	**0.157**	(0.040)	0.030	**0.149**	(0.067)	**0.316**	(0.102)	0.018
Germany	**0.150**	(0.049)	**0.091**	(0.023)	0.381	**0.162**	(0.055)	**0.267**	(0.095)	0.164
Hong Kong	**0.961**	(0.247)	**0.367**	(0.131)	0.291	**0.271**	(0.110)	**0.472**	(0.121)	0.257
Ireland	0.118	(0.068)	**0.141**	(0.046)	0.068	0.140	(0.073)	**0.325**	(0.084)	0.185
Italy	−0.025	(0.105)	0.282	(0.161)	−0.011	**0.226**	(0.069)	**0.265**	(0.104)	0.163
Japan	0.036	(0.086)	0.156	(0.133)	0.055	0.032	(0.051)	**0.159**	(0.065)	0.036
Netherlands	**0.157**	(0.051)	**0.094**	(0.024)	0.395	**0.167**	(0.061)	**0.285**	(0.087)	0.184
New Zealand	**0.285**	(0.123)	0.198	(0.136)	0.033	−0.059	(0.145)	**0.412**	(0.143)	0.120
Norway	**0.178**	(0.075)	0.106	(0.126)	0.025	0.065	(0.101)	**0.230**	(0.109)	0.050
Portugal	**0.229**	(0.074)	**0.340**	(0.103)	0.213	0.101	(0.072)	**0.257**	(0.092)	0.129
Spain	**0.102**	(0.051)	0.050	(0.037)	0.054	**0.180**	(0.078)	**0.362**	(0.110)	0.199
Sweden	**0.191**	(0.049)	0.076	(0.059)	0.099	0.174	(0.102)	**0.248**	(0.104)	0.089
Switzerland	**0.174**	(0.045)	**0.097**	(0.037)	0.186	0.046	(0.047)	**0.144**	(0.051)	0.054
United Kingdom	**0.156**	(0.074)	**0.139**	(0.045)	0.176	0.125	(0.099)	**0.261**	(0.101)	0.068

This table shows estimates from the regression of changes in interest rates on the target surprise and path surprise II: $R_{i,t} = \alpha + \beta_1 TS_t + \beta_2 PS_t + \varepsilon_{i,t}$, where R is the change in country i's interest rate on day t, TS is the target surprise, and PS is Path Surprise II. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Standard errors are in parentheses and are computed from a sampling-with-replacement bootstrap with 2000 repetitions. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined.

Table 5 presents individual currency responses to FOMC announcements. Most currencies respond mainly to the path surprise, with the exception of the yen which responds to the target and path surprises similarly. On average, a hypothetical surprise 25-basis-point downward revision in the future path of monetary policy is associated with no change in some exchange rates, a $^2/_3$ percent depreciation of the dollar against most major currencies, and about a 1 percent depreciation of the dollar's exchange value against the Norwegian krone. It is interesting to note that most currencies in developed countries respond significantly to FOMC announcements, while currencies in emerging market countries respond much less. This may reflect the de facto inflexible exchange rate regimes of many emerging markets. The influence of FOMC announcements, as measured by the adjusted R-squared, is lower in the foreign exchange market than in the equity market.

Table 6 shows results of foreign interest rates' responses to FOMC announcements. We find that short-term interest rates respond to both the target and path surprises. On average, a hypothetical 25-basis-point surprise cut in the fed funds rate is associated with no change in the short-term interest rate in Belgium, Italy, and Japan, a 16 basis point decrease in the interest rate in the United States, and almost a 25-basis-point decrease in the interest rate in Hong Kong. It is interesting to note that Hong Kong's short-term interest rate responds more than the U.S. short-term interest rate. We find that this is primarily driven by strong responses in Hong Kong's short-term interest rate to the intermeeting announcements on October 15, 1998 and April 18, 2001.[19,20] We find that all foreign long-term interest rates respond to FOMC announcements, mainly to the path surprise. This may reflect the fact that long-

[19] On both days, the Hong Kong three-month interest rate dropped even more than the surprise reduction in the fed funds rate; these declines were more than double the size of the declines in the U.S. three-month Treasury bill interest rate. Excluding these two announcements, estimated coefficients on the target surprise are about the same for short-term interest rates in Hong Kong and the United States.

[20] We do not find any specific events in Hong Kong that occur around the same time as a FOMC announcement and that would warrant dropping any of the FOMC announcement dates from the Hong Kong estimation.

term interest rates are more linked to the global business cycle in which the United States plays an important role. In addition, we find that the size of the response varies across countries. A surprise 25-basis-point downward revision in the path of future policy is associated with a 4 basis point decline in Japan's and Switzerland's ten-year government bond yield (the smallest response) and a 14 basis point decline in the ten-year yield in Australia (the largest response).

Comparing the influence of U.S. monetary policy across the equity, currency, and interest rate markets, as indicated by the adjusted R-squared, interest rate markets are the most affected by the policy surprises. As expected, the adjusted R-squared implies that U.S. monetary policy explains more variation in U.S. interest rates than it does in foreign interest rates. The general conclusion from each country-asset's response to FOMC announcements is that U.S. monetary policy surprises *do* influence foreign asset prices. In addition, the response varies greatly across countries and assets.

3.3. Asymmetry effects

To examine whether foreign asset prices' responses depend on certain characteristics of the announcement, we explore two possible asymmetries in this subsection: policy action versus policy inaction and scheduled versus unscheduled (intermeeting) announcements. To test for asymmetry effects, we augment the basic regression (Equation (2)) by interacting a dummy variable for each type of asymmetry effect with the target and path surprises.

Panel A of Table 7 reports results for the test of whether markets respond differently to policy actions versus policy inactions. For each asset class, we show results for the two measures of path surprise. The probabilities of the significance level of the test-statistics for the null hypothesis that the responses are the same for policy actions and policy inactions are shown in the last two columns. There is strong evidence of the policy action effect for the path surprise on exchange rates and short- and long-term interest rates, with a path surprise that occurs on a day when there is a change in the target fed funds rate having a larger influence on foreign asset prices than a path surprise on a day with no change in the target rate. We also find evidence of this asymmetry for the target surprise's influence on short- and long-term interest rates.

The test results for a scheduled versus intermeeting effect are shown in panel B. There is strong evidence of this type of asymmetry for the target surprise in equity markets and for the path surprise in both foreign exchange and long-term interest rate markets. In equity and foreign exchange markets, the reaction to FOMC announcements on intermeeting days is larger than that on scheduled days. In contrast, long-term interest rates react more on scheduled days. This could be because intermeeting announcements are viewed as moving forward the expected change in near-term policy—a timing surprise, not a path surprise.

Overall, we provide robust evidence that foreign equity indexes, exchange rates, and interest rates respond to FOMC announcement surprises. The magnitude of the response for each asset class depends on how one accounts for different types of asymmetries.

4. Why do different countries respond differently?

4.1. Preliminary analysis

Results in the previous section naturally raise the question: why does the response of foreign asset prices to FOMC announcement surprises vary across countries? There are many factors that can influence the size of each country's response to FOMC announcements. First, the degree of real economic integration with the United States may determine the importance of the U.S. economy for the country's domestic economy and thus for domestic asset prices. Second, a country that is more integrated into international financial markets may respond more to changes in international asset prices. Finally, a country's exchange rate regime may influence how each domestic asset responds to changes in global interest rates.

To explore factors that determine the cross-country variation in the response, we estimate a panel regression and interact the measure of FOMC announcement surprises with proxies for real and

Table 7
Asymmetry effects.

	TS(Asy1)	TS(Asy2)	PS(Asy1)	PS(Asy2)	Adj. R-sq	Number of observations	Probability of the test of equal estimates in Asy1 and Asy2	
							Target surprise	Path surprise
Panel A: Action vs. No Action, (Asy1 = Action and Asy2 = No Action)								
Equity (path surprise I)	**−1.349**	**−1.628**	−1.140	−0.323	0.045	4415	**0.037**	0.318
	(0.861)	(0.567)	(0.719)	(0.386)				
Equity (path surprise II)	**−3.912**	**−1.768**	−1.178	−0.306	0.045	4415	**0.004**	0.299
	(1.006)	(0.594)	(0.737)	(0.385)				
Exchange rate	**−1.391**	0.673	**2.536**	**1.329**	0.035	4415	**0.003**	**0.001**
(path surprise I)	(0.357)	(0.656)	(0.652)	(0.342)				
Exchange rate	−0.135	**1.315**	**2.550**	**1.334**	0.035	4415	**0.032**	**0.001**
(path surprise II)	(0.177)	(0.652)	(0.656)	(0.343)				
Short-term interest rate	**0.097**	−0.077	**0.264**	**0.095**	0.064	1443	0.077	**0.001**
(path surprise I)	(0.034)	(0.093)	(0.068)	(0.025)				
Short-term interest rate	**0.228**	−0.030	**0.260**	**0.099**	0.064	1443	**0.009**	**0.001**
(path surprise II)	(0.059)	(0.094)	(0.067)	(0.025)				
Long-term interest rate	**−0.129**	**0.186**	**0.416**	**0.278**	0.163	1743	**0.000**	**0.003**
(path surprise I)	(0.033)	(0.048)	(0.107)	(0.071)				
Long-term interest rate	**0.077**	**0.320**	**0.422**	**0.275**	0.164	1743	**0.000**	**0.002**
(path surprise II)	(0.023)	(0.082)	(0.108)	(0.071)				
Panel B: Intermeeting vs. Scheduled, (Asy1 = Intermeeting and Asy2 = Scheduled)								
Equity (path surprise I)	**−3.749**	**−1.280**	−2.868	−0.553	0.055	4415	0.087	0.320
	(1.370)	(0.466)	(2.300)	(0.342)				
Equity (path surprise II)	**−5.197**	**−1.553**	−2.883	−0.552	0.055	4415	**0.000**	0.317
	(1.176)	(0.489)	(2.305)	(0.342)				
Exchange rate	**−3.433**	0.037	**5.755**	**1.336**	0.046	4415	**0.000**	**0.001**
(path surprise I)	(0.777)	(0.276)	(1.303)	(0.303)				
Exchange rate	**−0.530**	**0.696**	**5.755**	**1.338**	0.046	4415	**0.000**	**0.001**
(path surprise II)	(0.236)	(0.234)	(1.303)	(0.303)				
Short-term interest rate	**0.128**	**0.105**	0.181	**0.191**	0.056	1443	0.744	0.930
(path surprise I)	(0.060)	(0.041)	(0.104)	(0.043)				
Short-term interest rate	**0.218**	**0.199**	0.187	**0.190**	0.056	1443	0.718	0.974
(path surprise II)	(0.049)	(0.045)	(0.105)	(0.043)				
Long-term interest rate	**−0.099**	**0.147**	**0.176**	**0.333**	0.199	1743	**0.000**	**0.040**
(path surprise I)	(0.044)	(0.033)	(0.074)	(0.075)				
Long-term interest rate	−0.016	**0.311**	**0.199**	**0.331**	0.198	1743	**0.000**	0.090
(path surprise II)	(0.022)	(0.070)	(0.075)	(0.075)				

This table shows estimates from the panel regression of global asset prices on target and path surprises: $R_{i,t} = \alpha + \beta_1 * TS_t * D(Asy1) + \beta_2 * TS_t * D(Asy2) + \beta_3 * PS_t * D(Asy1) + \beta_4 * PS_t * D(Asy2) + \varepsilon_{i,t}$, where R is the return of country i's asset price on day t, TS is the target surprise, PS is the path surprise, D(Asy1) equals one for the asymmetry effect 1 and zero otherwise, and D(Asy2) equals one for the asymmetry effect 2 and zero otherwise. The probability of the significance level of the test-statistics for the null hypothesis that the responses are the same for Asy1 and Asy2 for both the target and path surprises are shown in the last two columns, respectively. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Panel-Corrected Standard Errors (PCSE) are in parentheses. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined. A probability of the test of the difference between Asy1 and Asy2 that is significant at the 5% level is in bold and a probability that is significant at the 10% level is underlined.

financial integration and exchange rate regime classification. Specifically, we estimate the following regression:

$$R_{i,t} = \alpha + \beta_1 TS_t + \gamma * TS_t * X_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

where $X_{i,t-1}$ is a proxy that is used to explain the cross-country variation in the response. For most of our proxies, we use the value for the year before the year in which the announcement takes place. Our panel regression can account for both cross-country differences and within country time variation. To

Table 8
The role of each proxy for real and financial linkages in explaining the cross-country variation in the response.

	Panel A: Equities				Panel B: Exchange rates				Panel C: Short-term interest rates				Panel D: Long-term interest rates			
	TS	TS*X	Adj. R-sq	N	PS	PS*X	Adj. R-sq	N	PS	PS*X	Adj. R-sq	N	PS	PS*X	Adj. R-sq	N
Benchmark	**−3.685**		0.042	4415	**1.274**		0.023	4415	**0.257**		0.050	1443	**0.286**		0.143	1743
	(0.947)				(0.327)				(0.066)				(0.074)			
Real linkages																
Trade with U.S.	**−3.083**	−0.059	0.043	4352	**1.527**	−0.026	0.024	4352	**0.172**	**0.009**	0.085	1416	**0.261**	0.003	0.143	1711
	(0.792)	(0.032)			(0.393)	(0.014)			(0.044)	(0.002)			(0.067)	(0.002)		
Exports to U.S.	**−3.126**	−0.093	0.043	4352	**1.538**	**−0.045**	0.024	4352	**0.170**	**0.015**	0.087	1416	**0.261**	0.004	0.143	1711
	(0.803)	(0.052)			(0.395)	(0.022)			(0.044)	(0.004)			(0.067)	(0.003)		
Financial linkages																
U.S. equity participation	**−2.931**	**−0.133**	0.053	3899	**1.174**	0.014	0.023	3899	**0.325**	−0.006	0.051	1345	**0.343**	−0.005	0.148	1637
	(0.753)	(0.058)			(0.302)	(0.022)			(0.084)	(0.003)			(0.088)	(0.003)		
Foreign eligibility	−0.861	−0.041	0.038	2132	0.506	0.006	0.009	2132								
	(1.766)	(0.022)			(0.756)	(0.010)										
Bank lending from U.S.	**−2.962**	−0.188	0.043	3592	**1.436**	−0.073	0.018	3592	0.056	**0.044**	0.126	901	**0.214**	**0.016**	0.162	1014
	(0.761)	(0.120)			(0.369)	(0.053)			(0.043)	(0.011)			(0.055)	(0.008)		
Others																
Exchange rate regime	**−1.903**	**−1.279**	0.047	4256	**2.029**	**−0.535**	0.024	4256	−0.087	**0.312**	0.064	1441	**0.174**	**0.104**	0.145	1741
	(0.866)	(0.552)			(0.521)	(0.255)			(0.057)	(0.080)			(0.057)	(0.048)		
Equity market capitalization	**−2.649**	**−0.015**	0.044	4415	**1.477**	−0.003	0.023	4415	**0.119**	**0.001**	0.057	1443	**0.260**	0.000	0.143	1743
	(0.681)	(0.006)			(0.380)	(0.003)			(0.039)	(0.000)			(0.067)	(0.000)		

This table shows estimates of regressions of asset price returns on each proxy for real and financial linkages: $R_{i,t} = \alpha + \beta_1 TS_t (or\ PS_t) + \gamma * TS_t + (or\ PS_t) * X_{i,t-1} + \varepsilon_{i,t}$, where X is a proxy for real and financial linkages. We use the target surprise (TS) to proxy for FOMC announcement surprises for equity markets and use Path Surprise I (PS) to proxy for FOMC announcement surprises for exchange rates and interest rates. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Panel-Corrected Standard Errors (PCSE) are in parentheses. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined.

preserve degrees of freedom for a panel of 49 countries, we only use one measure of U.S. monetary policy surprises for each asset class. We use the target surprise for equity markets and Path Surprise I for foreign exchange and interest rate markets.[21] Equation (3) shows the specification for equity markets. For other markets, we replace the target surprise with Path Surprise I.

Table 8 presents results for the role of each proxy in explaining the cross-country variation in the response. In each panel, the first regression is the benchmark regression of each asset class on a proxy for FOMC announcement surprises. The first set of regressions reports results for the role of real economic integration; the second set of regressions reports results for the role of financial integration; and the last set of regressions reports results for the role of the exchange rate regime and financial development. Results for equity markets are reported in panel A. We find that real and financial linkages with the United States, the exchange rate regime, and financial development are important factors in determining the cross-country variation in the response. This result is similar to that documented in Ehrmann and Fratzscher (2006). All significant coefficients have the expected sign; an equity market in a country that has more real and financial integration, a less flexible exchange rate regime, and a larger equity market relative to GDP responds more to U.S. monetary policy announcements.

Panel B reports results for foreign exchange markets. As we found for equity markets, both real integration with the United States and the exchange rate regime are important for explaining the cross-country variation in the response. Unsurprisingly, in a country that has a less flexible exchange rate regime, the exchange rate responds less. The sign on the estimates of real integration with the United States suggest that the exchange rate of a country that has more real integration with the United States responds *less* to FOMC announcements. One possible explanation is that countries that trade more with the United States choose to limit the flexibility of their currencies in order to facilitate trade. China and Hong Kong are obvious examples. Consistent with this explanation, Table 2 shows that the correlation between the exchange rate regime and trade with the United States is about 0.3 (note that the higher the value of the exchange rate regime dummy variable, the less flexible the exchange rate regime). Of course, a smaller exchange rate response does not imply that the overall impact of U.S. monetary policy surprises is less. As we have seen, the Hong Kong exchange rate does not respond at all (it is fixed), but Hong Kong interest rates respond dramatically – exactly what one would expect for a country with a stable fixed exchange rate and no capital controls.

For short-term interest rates, shown in panel C, real and financial integration with the United States, the exchange rate regime, and financial development are important. The results for long-term interest rates are in Panel D. We find that only real and financial integration with the United States and the exchange rate regime are important. The signs for both short- and long-term interest rates are as expected; a country that has a higher degree of real and financial integration with the United States responds more to FOMC announcements, and a country that has a less flexible exchange rate regime also responds more. This finding on the relationship between the exchange rate regime and the interest rate response is consistent with studies that use different assumptions to identify U.S. monetary policy surprises and that use longer window (monthly and quarterly) data (e.g., Shambaugh, 2004; Frankel et al., 2004).

Overall, our results suggest a role for real and financial integration with the United States, the exchange rate regime, and financial development in explaining the cross-country variation in asset market responses. We explore the importance of each channel in a joint panel regression in the next subsection.

4.2. Multivariate regression results

To distinguish among different channels of transmission, we re-estimate Equation (3) using the significant proxies shown in Table 8 jointly, except in cases where they are highly correlated (e.g., the correlation between Trade with U.S. and Exports to U.S. is 0.99). Panel A in Table 9 reports results for equity markets. The first two regressions show results for different combinations of proxies for real integration with the United States (Trade with U.S. and Exports to U.S.) and a proxy for financial

[21] Results are qualitatively very similar when we use Path Surprise II.

Table 9
Explaining the cross-country variation in the response to FOMC announcements.

Equation	TS/PS	Trade with U.S.	Exports to U.S.	U.S. equity participation	Bank lending from U.S.	Exchange rate regime	Market capitalization	Foreign eligibility	Adj. R-sq	Number of observations
Panel A: Equity markets										
(1)	−0.043	0.013		**−0.173**		**−1.374**	−0.008		0.056	3686
	(1.239)	(0.038)		(0.067)		(0.637)	(0.007)			
(2)	0.008		0.029	**−0.175**		**−1.410**	−0.008		0.056	3686
	(1.240)		(0.063)	(0.066)		(0.645)	(0.007)			
(3)	−0.462			**−0.171**		**−1.409**			0.056	3749
	(1.181)			(0.063)		(0.586)				
Emerging markets										
(4)	4.801			−0.134		**−1.732**		**−0.062**	0.044	2026
	(2.976)			(0.110)		(0.852)		(0.031)		
(5)	4.402					**−1.594**		**−0.074**	0.042	2111
	(2.800)					(0.786)		(0.029)		
Panel B: Exchange rates										
(6)	**2.066**	−0.018				−0.436			0.026	4193
	(0.531)	(0.015)				(0.258)				
(7)	**2.039**		−0.031			−0.411			0.025	4193
	(0.524)		(0.025)			(0.244)				
(8)	**2.029**					**−0.535**			0.024	4256
	(0.522)					(0.255)				
Panel C: Short-term interest rates										
(9)	−0.066	**0.005**				**0.250**			0.096	1414
	(0.057)	(0.002)				(0.064)				
(10)	−0.044		**0.007**			**0.232**			0.095	1414
	(0.060)		(0.003)			(0.060)				
Panel D: Long-term interest rates										
(11)	**0.270**		0.003	−0.005	0.008	0.021			0.148	1603
	(0.087)		(0.003)	(0.003)	(0.012)	(0.088)				

This table shows estimates of regressions of asset price returns on proxies for real and financial linkages: $R_{i,t} = \alpha + \beta_1 TS_t(or\ PS_t) + \gamma * TS_t(or\ PS_t) * X_{i,t-1} + \varepsilon_{i,t}$, where X is a vector of proxies for real and/or financial linkages. We use the target surprise (TS) to proxy for FOMC announcement surprises for equity markets and use Path Surprise I (PS) to proxy for FOMC announcement surprises for exchange rates and interest rates. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Panel-Corrected Standard Errors (PCSE) are in parentheses. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined.

linkages (U.S. Equity Participation). We see that financial integration is more important than real economic integration; when the model is estimated with real and financial integration proxies, the real integration proxies are always insignificant. The final regression is our preferred specification. We find that equity markets in a country with more (less) U.S. participation in the equity market and with a less (more) flexible exchange rate regime responds more (less) to FOMC announcements. For the emerging market economies for which we have Foreign Eligibility data, we find that Foreign Eligibility and the exchange rate regime are important factors in explaining the cross-country variation in the equity market response (row 5). Following Edison and Warnock's (2003) interpretation of Foreign Eligibility as a proxy for the degree of capital controls on each country's equity market, our results suggest that capital controls *do* insulate countries from foreign monetary shocks, as other studies have documented (e.g., Kaplan and Rodrik, 2001). Alternatively, U.S. Equity Participation and Foreign Eligibility can be viewed as a proxy for foreign investors' holdings in each country's equity market. Our results are consistent with a role for portfolio rebalancing in transmitting U.S. monetary policy surprises. For example, U.S. investors need to optimally adjust their foreign portfolios when there is a shock to their domestic portfolios (i.e., shocks from U.S. monetary policy). This channel of shock transmission is consistent with theoretical models of Kyle and Xiong (2001), Kodres and Pritsker (2002), and Yuan (2005).

To evaluate the economic significance of our estimates, we compute the average response and compare it with the response of a hypothetical country that has a certain country-specific characteristic different from the average value. We compute the economic significance of our preferred specification (row 3). On average, a 25-basis-point surprise increase in the fed funds rate is associated with about a 1 percent decline in foreign equity markets

$([(-0.171 \times 9.716) + (-1.409 \times 1.363)]^{*}0.25 = -0.895)$, similar to the benchmark result documented in Table 8. With the same size of the target surprise, an equity market in a hypothetical country that has U.S. Participation one standard deviation above the mean responds ¼ percent more than the average equity market ($-0.171 \times 6.687^{*}0.25 = -0.286$; note that the relationship between the target surprise and equity return is negative). A country with an exchange rate regime one standard deviation less flexible than the mean also responds about ¼ percent more than the average country ($-1.409 \times 0.677^{*}0.25 = -0.238$).

Panel B shows that the only important factor in explaining the cross-currency variation in the exchange rate response is the exchange rate regime, with a country that has a more flexible exchange rate regime (lower value of the dummy variable for exchange rate regime) responding more to the path surprise (Path Surprise I).

Panel C reports results for short-term interest rates. We find that trade linkages with the United States and the exchange rate regime are important in explaining the differences in a country's domestic short-term interest rate's response to FOMC announcements. Interest rates in a country with more real integration with the United States and a less flexible exchange rate regime (high value of dummy for exchange rate regime) respond more to FOMC announcements. The positive relationship between trade linkages and a country's short-term interest rate response perhaps suggests that countries with more real economic linkages with the United States tend to experience business cycles tied to U.S. fluctuations. This could lead local central bank policy to be more correlated with Fed actions.

Finally, we explore the cross-country variation in the response of long-term interest rates in Panel D. When we use all proxies jointly in the panel regression, we cannot identify any dominant factors. This does not mean that we cannot explain any cross-country variation because, as we have shown in Table 8, the cross-country variation in the response is related to Exports to U.S., U.S. Equity Participation, and the exchange rate regime. Another interpretation of this finding is that global long-term interest rates are linked to the global business cycle (in which the U.S. economy plays an important role) and, therefore, do not have that much of a country-specific component. This interpretation is consistent with the fact that the adjusted R-squared for the panel regression of long-term interest rates on target and path surprises is higher than the R-squared for any other asset class (Panel B of Table 3).

Overall, we provide evidence that the exchange rate regime is an important determinant of how a foreign country's financial assets respond to FOMC announcements. In addition, we find evidence that both real (for short-term interest rates) and financial (for equities) linkages with the United States explain some of the cross-country variation in the response.

Table 10
Robustness of the results.

Equation	TS/PS	Trade with U.S.	Exports to U.S.	U.S. equity participation	Exchange rate regime	Shambaugh's exchange rate regime	Reinhart and Rogoff's exchange rate regime	Exchange rate response	Adj. R-sq	Number of observations
Panel A: Equity markets										
(1)	−0.462			**−0.171**	**−1.409**				0.056	3749
	(1.181)			(0.063)	(0.586)					
(2)	**−2.538**			**−0.152**		−1.716			0.054	3806
	(0.729)			(0.060)		(0.919)				
(3)	**−3.231**			**−0.168**			−0.118		0.073	2731
	(1.513)			(0.062)			(0.113)			
(4)	**−2.246**			**−0.119**				0.0628	0.055	3899
	(0.762)			(0.059)				(0.347)		
(5) [20 Countries]	1.754			**−0.189**	**−3.543**				0.094	1724
	(1.571)			(0.072)	(1.045)					
(6) [20 Countries]	−1.790			**−0.189**		**−7.085**			0.094	1726
	0.925			0.072		2.090				
(7) [20 Countries]	0.092			**−0.201**			**−2.436**		0.150	1233
	(1.301)			(0.071)			(0.746)			
(8) [20 Countries]	**−7.352**			**−0.161**				**2.725**	0.094	1726
	(1.890)			(0.071)				(0.700)		
Panel B: Short-term interest rates										
(9)	−0.066	**0.005**			**0.250**				0.096	1414
	(0.057)	(0.002)			(0.057)					
(10)	−0.044		**0.007**		**0.232**				0.095	1414
	(0.060)		(0.003)		(0.060)					
(11)	**0.183**	**0.005**				**0.499**			0.095	1416
	(0.047)	(0.002)				(0.128)				
(12)	**0.188**		**0.007**			**0.046**			0.095	1416
	(0.048)		(0.003)			(0.012)				
(13)	−0.039	**0.008**					**0.305**		0.101	989
	(0.115)	(0.003)					(0.088)			
(14)	0.036		**0.017**				**0.212**		0.104	989
	(0.117)		(0.005)				(0.095)			
(15)	**0.477**	**0.006**						**−0.156**	0.092	1416
	(0.108)	(0.002)						(0.040)		
(16)	**0.446**		**0.103**					**−0.139**	0.093	1416
	(0.115)		(0.023)					(0.042)		

This table shows estimates of regressions of asset price returns on proxies for real and financial linkages: $R_{i,t} = \alpha + \beta_1 TS_t(or\ PS_t) + \gamma * TS_t(or\ PS_t) * X_{i,t-1} + \varepsilon_{i,t}$, where X is a vector of proxies for real and/or financial linkages. We use the target surprise (TS) to proxy for FOMC announcement surprises for equity markets and use Path Surprise I (PS) to proxy for FOMC announcement surprises for exchange rates and interest rates. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. Panel-Corrected Standard Errors (PCSE) are in parentheses. Coefficients significant at the 5% level are in bold, and coefficients significant at the 10% level are underlined.

4.3. Robustness of the results

To evaluate the robustness of our results, we re-estimate our preferred panel regressions for each asset class by using the average value over time for each proxy for real and financial integration, exchange rate regime, and financial market development. All results are qualitatively very similar. We also use three other proxies for the exchange rate regime: Shambaugh's classification of pegged and not pegged ($D = 1$ for pegged and $D = 0$ for not pegged), Reinhart and Rogoff's classification ($D = 2$ for fixed, $D = 1$ for moderately flexible, and $D = 0$ for fully floating),[22] and the average response of each currency to Path Surprise I. Table 10 reports results with these alternative measures of the exchange rate regime. Rows 1, 5, 9 and 10 reproduce our preferred specifications from the previous table.

For equity markets, the estimates on the alternative exchange rate regime classifications have the expected sign (negative signs for the two dummy variables and a positive sign for the average response to Path Surprise I) and are statistically significantly different from zero at the 10 percent level for Shambaugh's classification and the average exchange rate response to Path Surprise I. For comparability with the short-term interest rate results, rows 5 through 8 show coefficient estimates for the twenty countries for which we have interest rate data. We see clearly that a country with a less flexible exchange rate regime (higher value of the dummy variable or lower value of the estimate of the exchange rate's response to FOMC announcements) has a larger equity market response (note the negative relationship between the target surprise and equity return).

The results for short-term interest rates are similar to those documented earlier. A country with a less flexible exchange rate (higher value of the dummy variable or lower value of the estimate of the exchange rate's response to FOMC announcements) has a larger interest rate response. Overall, we provide strong evidence that the exchange rate regime is important in determining how each asset class responds to U.S. monetary policy announcements. In addition, our results on the role of real and financial linkages are robust to different proxies for the exchange rate regime.

5. Conclusion

This paper documents the impact of U.S. monetary policy announcement surprises on global asset prices. We provide direct evidence that U.S. monetary policy affects foreign financial markets and thus foreign economies. We use two proxies for monetary policy surprises: the surprise change to the current target federal funds rate, and the revision to the expected path of future monetary policy. We find that different asset classes respond to different components of monetary policy surprises. Global equity indexes respond mainly to the target surprise, exchange rates and long-term interest rates respond mainly to the path surprise, and short-term interest rates respond to both surprises.

We also find that asset prices' responses to FOMC announcements vary greatly across countries, and that these cross-country variations in the response are related to a country's exchange rate regime. The importance of the exchange rate regime in explaining the variation in the response is consistent with a role for both real and financial linkages, as both may influence a country's choice of exchange rate regime. Equity indexes and interest rates in countries with a less (more) flexible exchange rate regime respond more (less) to U.S. monetary policy surprises. In addition, the cross-country variation in the equity market response is strongly related to the percentage of each country's equity market capitalization owned by U.S. investors. This result suggests that investors' asset holdings may play a role in transmitting shocks (monetary policy surprises) across countries, consistent with the recent literature that focuses on the role of investor behavior in explaining asset price co-movement (e.g., Kodres and Pritsker, 2002; Kyle and Xiong, 2001; Yuan, 2005).

[22] We use the coarse classification version of Reinhart and Rogoff (2004). We define a fixed exchange rate regime ($D = 2$) as an exchange rate regime that was assigned a value of 1 in Reinhart and Rogoff (2004) (e.g., peg, de facto peg, and pre-announced horizontal band that is narrower than or equal to +/− 2 percent), a moderately flexible exchange rate regime ($D = 1$) as an exchange rate regime that was assigned a value of 2 (e.g., pre-announced crawling peg, de facto crawling peg, and pre-announced crawling band that is narrower than or equal to +/− 2 percent), and a fully floating exchange rate regime ($D = 0$) as an exchange rate regime that was assigned values of 3 through 6 (e.g., pre-announced crawling band that is wider than or equal to +/− 2 percent, managed floating, freely floating, and freely falling). The data are available through 2001.

There are several issues that merit further exploration. For example, since our results robustly show that U.S. monetary policy affects global asset prices, future studies may want to consider including proxies for U.S. monetary policy surprises as risk factors in international asset pricing models.

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Appendix

Appendix Table 1:
Data coverage for asset returns.

	Equity index	Exchange rate	3-month interest rate	10-year interest rate
Argentina	X	X		
Australia	X	X	X	X
Austria	X	X	8/24/1999	X
Belgium	X	X	X	X
Brazil	X	X		
Canada	X	X	X	X
Chile	X	X		
China	3/28/1995	3/28/1995		
Czech Republic	4/18/1994	4/18/1994		
Denmark	1/31/1996	1/31/1996	1/31/1996	1/31/1996
Estonia	7/3/1996	7/3/1996		
Finland	X	X	X	1/31/1996
France	X	X	X	X
Germany	X	X	X	X
Greece	X	X		
Hong Kong	X	X	3/28/1995	11/13/1996
Hungary	X	X		
Iceland	X	X		
India	X	X		
Indonesia	X	X		
Ireland	X	X	3/22/1994	X
Israel	X	X		
Italy	X	X	9/27/1994	X
Japan	X	X	3/22/1994	X
Korea	X	X		
Malaysia	X	X		
Mauritius	4/18/1994	4/18/1994		
Mexico	X	X		
Netherlands	X	X	X	X
New Zealand	X	X	X	X
Norway	1/31/1996	1/31/1996	1/31/1996	1/31/1996
Pakistan	X	X		
Peru	X	X		
Philippines	X	X		
Poland	X	X		
Portugal	X	X	3/26/1996	3/25/1997
Russia	9/27/1994	9/27/1994		
Singapore	X	X		
Slovak Republic	X	X		
Slovenia	5/27/1997	5/27/1997		
South Africa	7/6/1995	7/6/1995		
Spain	X	X	X	X

(*continued on next page*)

Appendix Table 1: (*continued*)

	Equity index	Exchange rate	3-month interest rate	10-year interest rate
Sweden	X	X	4/18/1994	X
Switzerland	X	X	4/18/1994	11/15/1994
Taiwan	X	X		
Thailand	X	X		
Turkey	X	X		
United Kingdom	X	X	X	X
United States	X		X	X
Venezuela	X	X		

This table shows data coverage for equity indexes, exchange rates, 3-month interest rates, and 10-year interest rates. The sample period includes all FOMC announcements from February 4, 1994 through March 22, 2005, excluding the September 17, 2001 FOMC announcement. X denotes full coverage, and a date indicates the first date for which we have data.

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