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ABSTRACT

U.S. Monetary Shocks and Global Stock Prices*

This paper studies how U.S. monetary policy affects global stock prices. We find that global stock prices respond strongly to changes in U.S. interest rate policy, with stock prices increasing (decreasing) following unexpected monetary loosening (tightening). This impact is more pronounced for sectors that depend on external financing, and for countries that are more integrated with the global financial market. These findings suggest that financial frictions play an important role in the transmission of monetary policy, and that U.S. monetary policy influences global capital allocation.

JEL Classification: E44, F36, G14 and G32
Keywords: asset allocation, asset prices, financial constraints, monetary policy, monetary transmission

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Introduction

The recent financial crisis has reinvigorated a long-standing debate on the link between monetary policy and asset prices. Some have argued that lax U.S. monetary policy fuelled an asset price boom by keeping real interest rates artificially low (e.g., Taylor, 2007), while others do not regard monetary policy as a key contributory factor to the crisis (e.g., Bernanke, 2010).[1] By affecting asset prices, monetary policy could influence real decisions. Understanding the link between monetary policy and asset prices is therefore critical to understanding the transmission mechanism of monetary policy.

In theory, monetary policy may influence stock prices by changing future cash flows or by altering the rate at which those cash flows are discounted. Monetary policy shocks, then, can be transmitted to the real economy through their impact on stock prices via alternative mechanisms, including wealth effects on consumption and changes in the cost of capital (see Mishkin, 1996).

Existing empirical work commonly finds a negative link, at least in the short run, between monetary policy shocks and returns in the stock market, one of the main financial markets.[2] However, the magnitude of this effect and the precise channel through which monetary policy affects stock prices remains by and large an open question (Boudoukh et al., 1994).

Some studies have employed structural vector autoregressive (VAR) models to disentangle whether the impact on stock prices operates mostly through changes in expected cash

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[1] A related debate is about whether or not monetary policy should respond to changes in assets prices beyond their impact on inflation (e.g., Bernanke and Gertler, 2001, and Mishkin, 2009).

[2] Related work on the link between inflation and stock prices also tends to find a negative link, at least in the short run (e.g., Fama and Schwert, 1977, and Fama, 1981), and positive stock market responses to disinflation announcements (Henry, 2002).

flows, real interest rates, or risk premiums. For example, Bernanke and Kuttner (2005) analyze how aggregate equity prices react to changes in monetary policy and the economic sources of that reaction using a structural VAR model. They find that an unanticipated 25-basis-point cut in the Federal funds rate target is associated with about a 1% price increase in broad stock indexes, and that most of this effect operates through a change in risk premium.[3] However, these methods reveal little about the transmission channels of monetary policy.

In this paper, we take a different approach guided by theory about the role of financial frictions, allowing us to shed light on a specific channel through which monetary policy shocks affect stock prices, namely, by affecting the cost of external finance. Theory has offered complementary explanations for why financial frictions may influence the link between monetary policy and stock prices (see Bernanke and Blinder, 1992, and Bernanke and Gertler, 1995, for overviews). According to one set of theories, commonly labeled the balance sheet channel, changes in interest rates induced by monetary policy change the value of collateral, which affects firm's net wealth and the premium they pay for external finance. According to another set of theories, known as the lending channel, monetary policy affects banks' credit supply curve, which in turn affects the cost and quantity of borrowing for firms.[4] Despite their differences, both theories rely on financial frictions to explain how monetary policy can alter the

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[3] Using a VAR model that incorporates risk aversion and uncertainty, Bekaert et al. (2010) provide empirical evidence of a link between monetary policy and risk aversion in financial markets. They find that lax monetary policy decreases risk aversion with a lag of about five months, with the effect lasting for about two years.

[4] A large empirical literature has tried to assess the importance of the balance sheet and lending channels of monetary policy using cross-sectional variation across banks (e.g., Kashyap et al., 1993; Kashyap and Stein, 2000; and Jimenez et al., 2009) and their subsidiaries (e.g., Peek and Rosengren, 2000; Campello, 2002; Ashcraft and Campello, 2007; and Cetorelli and Goldberg, 2009). The difference between our paper and this literature is that we focus on asset prices rather than the quantity or quality of credit.

cost of external finance, and make the cross-sectional prediction that the stock price reaction to monetary policy shocks should vary across firms depending on their financial dependence.

In this paper, we test this prediction using data on 20,121 firms in 44 countries by examining whether U.S. monetary policy shocks disproportionately affect the stock returns of firms that are most dependent on external finance. The advantage of our asymmetric, cross-sectional identification strategy is that it allows for the control of unobserved time-invariant effects that simultaneously affect monetary policy as well as a firm's stock price, thereby alleviating concerns about endogeneity and simultaneity bias.[5] Using stock prices as outcome variable of interest compared to more traditional variables like investment or output has the additional advantage that stock prices are available at high frequency, allowing us to perform an event study type of analysis of short term responses to policy announcements, thereby reducing concerns that results are confounded by other factors.

Our identification strategy requires exogenous measures of monetary policy shocks and financial dependence. Following Bernanke and Kuttner (2005), we measure U.S. monetary policy shocks using the one-day change in the price of the one-month federal funds futures contract on the day that the FOMC meeting announces a policy rate change. The advantage of this measure is that it abstracts from monetary policy actions that were already anticipated by the market. We extend their analysis to examine how U.S. monetary policy affects stock prices in countries outside of the United States, dropping U.S. firms from the analysis. Doing so further strengthens our case of treating our measure of U.S. monetary policy shocks as exogenous, since U.S. monetary policy is unlikely to be affected in a systematic way by idiosyncratic shocks in

[5] A similar cross-sectional approach has been taken by Kashyap and Stein (1994) to examine the asymmetric impact of monetary policy on the lending behavior of different types of banks.

other countries.[6] By taking an international perspective on the transmission channel of U.S. monetary policy, this paper sheds light on the role of U.S. monetary policy in influencing global asset prices and asset allocation.

We measure an industry's financial dependence also using U.S. data, following the influential work by Rajan and Zingales (1998), to gauge the intrinsic demand for external finance in the absence of financial constraints. This approach relies on the assumption that large U.S. listed firms face minimal financial constraints given the depth of U.S. financial markets and that the ranking of financial dependence across sectors in the U.S. is preserved in other countries.[7]

We find strong evidence of a negative response of stock prices to U.S. monetary shocks, with U.S. monetary policy loosening (tightening) being associated with an increase (decrease) in stock prices in other countries, consistent with earlier work based on U.S. stock prices (e.g., Thorbecke, 1997, and Bernanke and Kuttner, 2005). Moreover, this impact is particularly pronounced for firms with a relatively high intrinsic dependence on external finance. For example, an unexpected policy rate decrease of 5 basis points (equal to its interquartile range) is associated with a stock price response that is 6 basis points greater for firms whose financial dependence is at the 75th percentile (the Construction machinery industry) relative to firms whose financial dependence is at the 25th percentile (the Beverages industry). This is a

[6] Cetorelli and Goldberg (2009) also study how U.S. monetary policy shocks are transmitted abroad. Rather than analyzing their impact on stock prices of non-financial firms, they study how U.S. monetary policy affects lending activity abroad by foreign subsidiaries of U.S. banks. They find that the globalization of banking has weakened the lending channel of monetary policy domestically but has made lending abroad more sensitive to U.S. monetary policy shocks.

[7] Following Rajan and Zingales (1998), who use this approach to study the impact of financial development on economic growth, this approach has been applied, among others, to study the role of business cycles (Braun and Larrain, 2005), demand for working capital (Raddatz, 2006), and financial crises (Kroszner et al., 2007) in influencing the link between finance and growth.

significant effect compared to the average stock market return around FOMC dates of 19 basis points.

To further distinguish financial from other explanations, we consider asymmetries over the business cycle. Financial constraints are likely to be binding for more firms during recessions. We therefore expect our effect to be stronger during economic downturns. We indeed find that the effect is stronger during U.S. recession periods.

Finally, we examine if the impact of U.S. monetary shocks on stock prices varies across countries, based on country features that capture differences in access to financial markets, such as financial integration and development. We find that the impact of monetary shocks on stock prices is more pronounced in countries that are more financially integrated with the rest of the world, where we measure financial integration following Lane and Milesi-Ferretti (2007) as a country's foreign assets and liabilities over GDP.

Taken together, these results suggest that financial frictions play an important role in the transmission of monetary policy, and that U.S. monetary policy influences global asset allocation.

Empirical research on the link between monetary policy shocks and stock prices has generally not considered the role of financial constraints. Bernanke and Kuttner (2005) and Boudoukh et al. (1994) analyze the differential impact of monetary policy shocks on stock prices across broad classes of industries but do not explicitly consider the role of financial constraints, while Kashyap et al. (1994) do consider financial constraints to show that firm inventory investment by liquidity constrained firms is significantly adversely affected during periods of tight monetary policy but they do not analyze its impact on stock prices. Similarly, Gertler and Gilchrist (1994) show that the investment of small firms, their proxy for the importance of financial frictions, responds more strongly to monetary policy than that of large firms. Finally, research on stock prices and financial constraints has generally not considered the role of monetary policy (e.g., Baker et al., 2003). An exception is Lamont et al. (2001) who find little role for monetary policy but they use traditional measures of monetary policy that do not disentangle monetary shocks from market expectations.

The paper proceeds as follows. Section 2 presents our empirical strategy, construction of key variables, and sources of data. Section 3 discusses the main empirical results and a slew of robustness checks and extensions. Section 4 offers concluding remarks.

2. Methodology and Data

2.1 Methodology

Our basic empirical strategy is to use event study analysis to test whether an exogenous monetary shock in the U.S. has an impact on the stock return of firms in other countries, and whether this effect is more pronounced for firms that are more financially dependent. We use the approach in Bernanke and Kuttner (2005) to identify unexpected policy rate changes, and build on their work by extending the analysis to other countries and by considering asymmetric responses across firms depending on their degree of financial dependence. This allows us to deal more effectively with concerns about endogeneity and simultaneity, and discern more precisely one of the channels through which monetary policy affects stock prices.

Our analysis starts by confirming the common finding in the literature that stock returns are negatively associated with innovations in monetary policy. We do this by showing that stock prices respond negatively to unanticipated changes in the U.S. Federal funds rate following meetings of the US Federal Open Market Committee (FOMC). To be precise, we estimate the following equation:

$$\text{Stock Return}_{i,j,k,t} = \beta \text{ Monetary Shock}_t + \gamma \text{ Control}_{i,t} + \varepsilon_{i,j,k,t} \qquad (1)$$

where i stands for company, j for country, k for sector, and t for time. Note that this is a panel regression. We start by assuming the same β for all sectors and countries in order to estimate an average effect, but will subsequently allow for variations across sectors, countries, and time. We include firm specific fixed effects to control for unobserved firm specific factors, and cluster standard errors at the FOMC date level, to adjust standard errors for cross-sectional correlation over time.

Asset pricing models offer guidance for the inclusion of control variables. In the base specification, we include the three Fama and French (1992) factors: firm size (log assets), the ratio of the market value to book value, and the beta coefficient (i.e., the correlation between the firm's stock return and the market return) times the stock market return. These control variables are lagged by one-year, except the stock market return which we include contemporaneously, to alleviate concerns about endogeneity. We follow Whited and Wu (2006) and incorporate these three factors by entering the relevant firm characteristics directly into our regressions rather than by first estimating a factor model. For our purposes, these two alternative ways of incorporating the three factors are equivalent. Entering firm characteristics directly in our regressions is easier to implement, though the interpretation of the coefficients on these factors is less straightforward.

To investigate how an industry's financial dependence affects the impact of the U.S. monetary policy shock, we now consider the interaction between the monetary policy shock and an industry's dependence on external finance. In other words,

$$\beta_k = \beta_1 + \beta_2 \, Financial\ Dependence_k \tag{2}$$

where *Financial Dependence*$_k$ measures the external financing needs for capital expenditure for firms in a given industry following Rajan and Zingales (1998). The slope coefficient, β_2, then captures the extent to which the effect of the monetary policy shock depends on an industry's dependence on external financing. We include firm and time specific fixed effects to control for unobserved firm and time specific factors, and cluster standard errors at the time level, to adjust standard errors for cross-sectional correlation at different dates.

To further distinguish financial from other explanations, we consider asymmetries over the business cycle. Financial constraints are likely to be binding for more firms during recessions. We therefore expect out effect to be stronger during economic downturns. We test this prediction by including an interaction between the Monetary Shock * Financial Dependence variable and a Recession variable that denotes whether or not the FOMC meeting date occurs during a recession.

In other words, we extend equation (2) as follows:

$$\beta_{kt} = \beta_1 + \beta_2 \, Financial\ Dependence_k + \beta_3 \, Financial\ Dependence_k * Recession_t \tag{3}$$

where *Financial Dependence*$_k$ measures the external financing needs for capital expenditure for firms in a given industry following Rajan and Zingales (1998) and *Recession*$_t$ indicates FOMC meeting dates that fall during recession periods. The slope coefficient β_2 then captures the extent to which the effect of the monetary policy shock depends on an industry's dependence on external financing during non-recession periods, and the slope coefficient β_3 then captures the extent to which this effect differs during recession periods. We expect negative signs for both coefficients. Note that the inclusion of the Recession variable makes the coefficient on the monetary shock interaction variable time dependent.

Finally, we examine if the impact of U.S. monetary shocks on stock prices varies across countries by including additional interaction terms between country characteristics (such as financial integration and financial development) and the monetary shock variable. In other words, we extend equation (2) as follows:

$$\beta_{\mathrm{kjt}} = \beta_1 + \beta_2 \, \textit{Financial Dependence}_{\mathrm{k}} + \beta_4 \, \textit{Country Trait}_{\mathrm{jt}} \tag{4}$$

where the slope coefficient β_4 then captures the extent to which the effect of the monetary policy shock depends on a particular country trait.

2.2. Data and Variable Definitions

Stock prices

To construct our dependent variable, we collect data on stock prices of 20,121 firms in 44 countries over the period 1990 to 2008. Appendix Table 1 shows the complete list of countries.

Stock price data are retrieved from Datastream, and are adjusted for dividends and capital actions such as stock splits and reverse splits. We consider two-day stock price responses to monetary policy shocks following FOMC meetings. Specifically, we compute the stock return as the log difference in the closing price of the stock over the period t-1 and t+1, where t is the day of the FOMC meeting. The reason for using a two-day window rather than a one-day window of stock returns is due to time zone differences between stock markets in the U.S. and other countries. To reduce the impact of extreme values, we drop two-day stock returns with a value of above 50% or below -50%, which covers 0.1% of the sample. As a robustness check, we also winsorize the sample at its top and bottom 1% level, and the key results carry through. Our sample includes of a total of 140 FOMC meetings, for a total of 925,306 firm-date observations.

Monetary Policy Shock

Our measure of monetary shocks at U.S. FOMC meetings follows the approach in Kuttner (2001) and Bernanke and Kuttner (2005).[8] They propose to use the change in the price of federal funds futures contracts relative to the day prior to the policy action as a measure of unexpected policy rate changes.[9] For a FOMC meeting on day *d* of month *m*, the monetary shock is the change in the rate implied by the current-month futures contract. However, because the contract's settlement price is based on the monthly average federal funds rate, the change in the

[8] Alternative measures of monetary policy include those developed by Bernanke and Mihov (1998) and Romer and Romer (2004), among others. The measure of monetary policy by Bernanke and Mihov is computed using VAR models on monthly data and is therefore not applicable to our event study setting for which daily data are needed. The Romer and Romer measure has the right frequency but uses information from the Fed's greenbooks that include Fed staff economic forecasts that are not made publicly available to the market until five years after the FOMC meeting and may therefore not be fully incorporated in stock prices.

[9] This approach assumes that risk premia that could be embedded in prices on federal funds futures do not change systematically within a one day period (Piazzesi and Swanson, 2008).

implied futures rate then should be scaled up by a factor related to the number of days in the month affected by the change, or:

$$Shock_d = \frac{D}{D-d}\left(f_d - f_{d-1} \right)$$

where *Shock* is the unexpected target rate change, f_d is the current-month futures rate at day *d*, and *D* is the number of days in the month. The expected rate change then is the actual change minus the shock.

We extend the data coverage of monetary shocks from year 2002 to year 2008. Moreover, while Bernanke and Kuttner (2005) exclude FOMC dates when there is no policy rate change, we include these dates as well as control groups. Appendix Table 2 lists the exact dates of FOMC meetings, the actual changes of federal funds rate, and the unexpected component of the change.

We drop U.S. firms from the sample, since we use U.S. monetary shocks as our source of exogenous variation in monetary policy. This lends additional credibility to using our measure of monetary shocks as an exogenous variable of monetary policy given that U.S. monetary policy is unlikely to respond in a systematic way to idiosyncratic economic factors in other countries, though it may respond to economic factors in the U.S.

Financial dependence index

As measure of an industry's intrinsic dependence on external finance, we use the financial dependence measure proposed by Rajan and Zingales (1998). They compute an industry's dependence on external finance as:

$$\text{Financial dependence} = \frac{\text{Capital expenditures - Cash flow}}{\text{Capital expenditures}},$$

where cash flow = cash flow from operations + decreases in inventories + decreases in receivables + increases in payables. The index is computed using data on publicly listed U.S. firms, which are judged to be least likely to suffer from financing constraints relative to generally smaller, non-listed U.S. firms and firms in other countries. Conceptually, the Rajan and Zingales index aims to identify sectors that are naturally more dependent on external financing for their business operation. While the original Rajan and Zingales (1998) paper covers only 40 (mainly SIC 2-digit) sectors, we recompute their measure using data for the period 1990-2006 to expand the coverage to around 150 SIC 3-digit sectors. We drop firms active in the utilities industry (SIC 4), wholesale and retail industry (SIC 5), financial industry (SIC 6), and public administration (SIC 9) because these firms are subject to strict regulation or because their financing needs are not comparable with those of other industries.

To calculate the demand for external financing of U.S. firms, we take the following steps. We first sort every firm in the Compustat USA files based on their 3-digit SIC sectoral classification and then calculate the ratio of dependence on external finance for each firm by aggregating cash flows and expenditures as in Rajan and Zingales over the period 1990-2006. We then calculate the financial dependence index as the sector-level median value of these firm ratios for each SIC 3-digit sector that contains at least 5 firm observations.

Recession dates

We use NBER recession dates, available on a quarterly frequency, to construct a dummy variable Recession that indicates whether or not the data on which an FOMC meeting takes place falls during a recession quarter.

Control variables

The three Fama and French (1992) factors that we include as control variables are computed using data from Worldscope and Datastream. We compute firm size as the log of total assets, and the market-to-book ratio as the ratio of the market value of equity to the book value of equity. The firm-level beta coefficient (that we interact with the stock market return) is calculated as the correlation between the firm's weekly stock return and the weekly country-level return on the local stock market index. We use the domestic beta rather than a beta based on a world factor model because Griffin (2002) finds that domestic factor models perform better in explaining time-series variations in returns and have lower pricing errors than the world factor model.

2.3 Descriptive statistics

Table 1 reports summary statistics of the key dependent and explanatory variables. The actual change in the federal funds rate announced following FOMC meetings ranges from a rate cut of 100 bps to a rate increase of 75 bps. Unexpected rate shocks vary from -43 bps to +24 bps, indicating that rate surprises on average were on the downside.

Financial dependence ranges from a low of -2.4 for the Manifold Business Forms industry (an industry that has been in decline globally for over a decade and hence seen correspondingly low investment) to a high of 1.4 for the Photographic Equipment and Supplies industry (an industry that has gone digital and hence seen large capital investment). Financial openness, measured as a country's foreign assets and liabilities over GDP, ranges from a low of 0.3 percent for the Republic of Korea in year 1991 to a high of 23.9 percent for Hong Kong in 2007.

3. Empirical Results

3.1 Basic Specification

The baseline results are presented in Table 2. There we include firm fixed effects throughout all regression specifications, and cluster standard errors at the level of FOMC meeting dates. In Column 1, we first examine the impact of actual federal funds rate changes on stock returns, to allow comparison with existing results in the literature. We obtain a negative coefficient on the actual federal funds rate variable but this coefficient is not significantly different from zero.

In Column 2, we further decompose the change of the federal funds rate into its expected and unexpected components, following the method proposed by Bernanke and Kuttner (2005). We find that the unexpected component has a significantly negative coefficient, suggesting that unexpected monetary tightening reduces stock prices. Based on the estimated coefficient of 0.04, a 25-base point increase of U.S. rate would reduce global stock prices by about 1%. This is not a trivial number. Moreover, the economic impact is of similar magnitude to that reported in Bernanke and Kuttner (2005) for broad U.S. stock market indexes. Also, based on the coefficient of 0.04, a one-standard deviation increase in the monetary shock would reduce stock prices by 0.4%, which would explain 8% of the standard deviation of stock returns. The expected rate change component enters with a positive coefficient, but it is less statistically significant and its economic impact is only about 10% of the impact for the unexpected rate shock. These findings for the unexpected and expected rate components are consistent with earlier findings by Bernanke and Kuttner (2005) for U.S. firms.

In Column 3, we exclude expected rate shocks and focus on the unexpected rate shocks only. The unexpected rate shock variable has a coefficient that is similar to that in Column 2. This indicates that unexpected and expected rate shocks are orthogonal to each other, and the exclusion of the expected rate shock variable, which should be incorporated in stock prices, does not alter the results we find for the unexpected rate shock variable.

In Column 4, we examine the asymmetric impact of monetary shocks on stock prices based on sector-level dependence on external finance for capital expenditure, using the Rajan and Zingales (1998) measure of financial dependence. We do this by including the interaction term of financial dependence and the unexpected shock variable. We do not include the financial dependence variable by itself in the regression specification, as it is fully absorbed by the firm dummies that we include. We find that the impact of interest rate shocks is statistically significantly higher for sectors that depend more on external finance. Based on the estimated coefficients in Column 4, an unexpected policy rate decrease of 5 basis points (equal to its interquartile range) is associated with a stock price response that is 6 basis points greater for firms whose financial dependence is at the 75th percentile (the Construction machinery industry) relative to firms whose financial dependence is at the 25th percentile (the Beverages industry). This is a significant effect compared to the average stock market return around FOMC dates of 19 basis points.

In Column 5, we include two firm-level controls from the Fama and French (1992) three-factor model: firm size and market to book ratio. Inclusion of these two factors increases somewhat the coefficient on our main variable of interest, the interaction between Shock and Financial dependence, though the statistical significance is almost the same.

In Column 6, we further control for the beta factor, the third factor in the Fama and French (1992) three factor model, by including the interaction between the firm's beta and the local stock market return. The beta is lagged by one-year and computed as the correlation of weekly individual stock returns and local market return within a year. The local stock market return is computed over the same period as the dependent variable (firm's stock return). Adding the beta factor reduces the magnitude of the coefficient for the interaction between the Shock and the Financial dependence variable from 0.018 to 0.012, though it is still significantly different from zero at the 1% level. As beta may capture some elements of Financial dependence, it is not surprising that the coefficient on the Shock*Financial dependence variable is somewhat reduced.

In the last column, we further include dummies for FOMC dates to control for other contemporaneous time effects. Including these time dummies drops the Shock variable. The interaction of our variable of interest, Shock*Financial dependence, still has a significant coefficient of -0.011, comparable to the results without FOMC date effects.

3.2 Robustness Checks of Our Main Results

Clustering of standard errors

We have clustered the standard errors so far at the level of intervention dates. In Table 3, we show that the results are consistent across different specifications of clustering. The empirical model is the same as the last column of our baseline table except that we change the level of clustering of the standard errors. In Column 1, we cluster standard errors at the level of countries. In Column 2, we cluster standard errors at the level of 3-digit SIC industries. In Column 3, we cluster standard errors at the level of the interaction of country and year. In Column 4, we cluster standard errors using two-way clustering by date and industry. All regression specifications include firm and date fixed effects. Across these specifications, we continue to find that our variable of interest, Shock*Financial dependence, is consistently significant at the level of 1%.

FOMC meetings without rate change

Our results thus far are based on a sample that includes observations from FOMC meetings on which no change in the Federal Funds rate took place.[10] We want to make sure that the inclusion of dates on which no rate change took place does not confound our results. We therefore drop cases where there is no change in the Federal Funds rate at the FOMC meetings in a robustness check. The results are presented in Table 4. Again, the results are quite similar to the baseline case.

Manufacturing sector only

In the original paper by Rajan and Zingales (1998), financial dependence was computed for manufacturing industries only due to data limitations. In addition, the index of financial dependence they develop is less applicable to industries without significant capital expenditures. We already excluded the utility sector, trade sector, financial sector, and government sector from the sample to accommodate this. Next, we rerun our main regression specification on the subset of manufacturing of firms in our sample. The results are presented in Table 5. We find similar results for the impact of U.S. monetary shocks for manufacturing firms. Our main variable of interest, Shock*Financial Dependence, remains statistically significant at conventional levels.

[10] Note that Bernanke and Kuttner (2005) dropped such cases from their analysis. This robustness check therefore also enhances comparison of their results with ours.

3.3 Reverse Causality and Simultaneity Bias

Our results reported thus far would be biased if monetary policy were to respond contemporaneously to the stock market. However, Bernanke and Kuttner (2005) do not find any evidence for such a systematic reaction. Moreover, if the FOMC did respond to large changes in equity prices (for example by cutting rates in response to large drops in equity prices) such reverse causality would tend to reduce the size of the estimated response to the monetary shock and would therefore bias our results toward finding no effect.

Moreover, results would be biased if monetary policy and stock prices were jointly determined and responded jointly to new information, for example, about the state of the economy. For instance, bad news about the health of the economy could lead to both negative stock price reactions and a loosening of monetary policy. The resulting tendency for rate cuts to be associated with stock market declines would lead to a downward bias in the size of the estimated response to the monetary shock. Such simultaneity bias would therefore bias our results toward finding no effect.

This mitigates concerns that our significant results on our variable of interest are driven by reverse causality and/or simultaneity bias.

3.4 Growth Opportunity and Business Cycle

To further address concerns about simultaneity bias and omitted variables, we now test for the importance of other channels and the presence of asymmetric effects of our main result during the business cycle.

In Column 1 of Table 6, we control for the potential effect of channels other than financial constraints. Prominent examples include the demand channel. For example, when there is a negative monetary policy shock, sectors with better growth opportunities may suffer more. We therefore consider the possibility that differences in growth opportunities may influence the result. In Column 1, we control for this alternative channel using an industry's lagged sales growth based on U.S. data as proxy for growth opportunities, following Fisman and Love (2007). Specifically, we include this measure of global growth opportunities and its interaction with Financial dependence into our regression model. This interaction enters with a negative coefficient, suggesting that monetary shocks may also affect stock prices through the demand channel. Importantly, though, our main results on the Shock*Financial dependence interaction variable are not altered.

To further distinguish financial from other explanations, we consider asymmetries over the business cycle. Financial constraints are likely to be binding for more firms during recessions. For example, Braun and Larrain (2005) show that financially dependent firms perform worse during recessions. We therefore expect out effect to be stronger during economic downturns. We test this prediction by including an interaction between the Shock * Financial Dependence variable and a Recession variable that denotes whether or not the FOMC meeting date occurs during a recession.

The results are presented in Columns 2 and 3. The recession dummy variable is based on the NBER recession dates: July 1990 to March 1991; March 2001 to November 2001; and December 2007 till 2008, the end of our sample period). We use U.S. recessions as proxy for global recessions. We indeed find that the disproportionate effect of U.S. monetary shocks on stock returns of financially dependent firms is significantly larger during economic recessions, suggesting that the financing channel of monetary policy is significantly more important during economic recessions.

3.5 Cross-Country Variations and Spillovers

In Table 7, we examine whether and how the impact of U.S. monetary shocks varies across countries. Throughout the specifications, we include country fixed effects and FOMC meeting fixed effects. We first examine the role of financial openness by adding a measure of financial openness as well as its interaction with monetary shocks. Financial openness implies that domestic financial markets are more financially integrated with the world, thereby enhancing access to external finance for local firms. We measure financial openness by the country's foreign assets and liabilities over GDP, following Lane and Milesi-Ferretti (2007). We find that the interaction term of shock and financial openness is significantly negative at the 5% level, which suggests that the spillover of U.S. shocks is more important for countries that are more financially integrated. Reassuringly, the coefficient of our main variable of interest, Financial dependence*Shock, is little changed. The additional result on the importance of financial openness lends additional support to our thesis that financial frictions play an important role in the transmission of monetary policy.

In Column 2, we examine the impact of financial development by adding a proxy for domestic financial development and its interaction with the monetary policy shock. A large literature starting with King and Levine (1993), has shown that financial development boosts economic growth by relaxing financial constraints. Following this literature, we measure domestic financial development by domestic credit to private sector over GDP. The interaction term of domestic financial development and the shock variable does not turn out to be significant.

In Column 3, we include trade openness and its interaction with shock, where trade openness is measured by imports plus exports over GDP. Again, we do not find the interaction of shock and trade openness to be significant.

In Column 4, we combine the financial openness and trade channels. We continue to find significant results for the financial openness channel. In fact, the interaction between Shock and Financial Openness is now significant at 1%. Importantly, our main result on the interaction between Shock and Financial dependence also remains statistically significant at 1%.

In Column 5, we control for the impact of economic development of the country, as proxied by log per capita GDP. We include log per capita GDP and its interaction with the U.S. monetary shock variable. Neither of these additional variables enters significantly. More importantly, the interaction of Shock*Financial dependence still keeps its magnitude and significance.

In Column 6, we examine potential asymmetric impact across countries based on the degree of interest rate synchronization. We expect that our effect is more pronounced in countries whose monetary policy is more closely aligned with U.S. monetary policy in general. As measure of synchronization of monetary policy, we use the correlation of monthly money market rates between the U.S. and the individual countries over the period from 1990 to 2008 (for Euro countries we substitute the country's market rate with the Euro money market rate after the country joins the Euro). Then we define a country as having a high-synchronization of monetary policy if its correlation coefficient is above 0.5 (Appendix Table 3 lists the estimated correlation coefficient). Not surprisingly, we find that the asymmetric impact of monetary shocks on the return of financially dependent firms is more significant in countries with a high synchronization of monetary policy with the United States.

Overall, we find a strong and robust asymmetric relationship between the stock responses of financially dependent firms and monetary policy shocks.

4. Conclusions

This paper studies global stock price responses to U.S. monetary policy shocks using a dataset of 20,121 firms across 44 countries over the period 1990-2008. We find that stock prices tend to increase (decrease) following unexpected monetary loosening (tightening). This impact is more pronounced for sectors that depend on external financing, especially during economic recessions, and for countries that are more integrated with the global financial market.

The advantage of our asymmetric, cross-sectional identification strategy of estimating differential effects of monetary shocks across firms that differ in external financial dependence is that it allows for the control of unobserved time-invariant effects that simultaneously affect monetary policy as well as a firm's stock price, thereby alleviating concerns about endogeneity and simultaneity bias. In extensions of our main analysis we further consider asymmetries over the business cycle by estimating differential effects during economic downturns to further distinguish financial from other explanations.

The economic effects of our results are significant. For example, an unexpected policy rate decrease of 5 basis points (equal to its interquartile range) is associated with a stock price response that is 6 basis points greater for firms whose financial dependence is at the 75th percentile (the Construction machinery industry) relative to firms whose financial dependence is at the 25th percentile (the Beverages industry). This is a significant effect compared to the average stock market return around FOMC dates of 19 basis points.

The evidence in this paper contribute to the debate about the link between monetary policy and asset prices by showing that prices in stock markets, one of the key financial markets, respond strongly to monetary shocks. These findings suggest that financial frictions play an important role in the transmission of monetary policy, and that U.S. monetary policy influences global capital allocation.

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Table 1. Summary Statistics

This table reports summary statistics for the main variables in our analysis. Stock return is the log difference in the closing price over the period t-1 and t+1, where t is the FOMC meeting date. The actual change is the actual change in federal funds rate announced at FOMC meetings. The shock is the change in the federal funds rate implied by the current-month futures contract from Bernanke and Kuttner (2005). The expected change is the change between the actual change and the shock in federal funds rate. Financial dependence is an industry's intrinsic dependence on external finance for investment based on Rajan and Zingales (1998). Firm size is the log of book assets in U.S. dollar. Market beta is the correlation between weekly firm stock price and the weekly country-level local market index within a year. Financial openness is a country's foreign assets and liabilities over GDP. Trade openness is a country's imports plus exports over GDP. We use data from 20,121 firms across 44 countries over the period 1990-2008, for a total of 925, 306 firm-year observations.

Key Variables	Obs	Mean	Median	St Dev.	P25	P75	Min	Max
Stock return (in %)	925306	0.19	0	5.38	-1.79	2.00	-50	50
Actual change (in bp)	140	-4.82	0	26.29	-25	0	-100	75
Expected change (in bp)	140	-1.31	0	22.19	-8.5	4.5	-92	61
Shock (in bp)	140	-3.51	0	10.63	-5	0	-43	24
Financial dependence	150	-0.06	0.04	0.7	-0.37	0.33	-2.4	1.4
Shock*Financial dependence	19375	0.09	0	6.86	-0.85	0.74	-48.6	61.7
Firm size	924690	12.00	11.98	1.93	10.81	13.19	-1.16	19.8
Market/Book	899602	2.40	1.49	3.00	0.85	2.65	0.2	20.3
Beta*Market Return	897219	0.41	0.11	1.88	-0.27	0.89	-26.1	41.9
Financial Openness	564	2.38	1.41	2.53	0.96	2.96	0.3	23.9
Trade Openness	564	0.02	0.01	0.07	-0.02	0.05	-0.2	0.3

Table 2. The Effect of Monetary Policy Shocks on Stock Returns

Dependent variable is stock return measured as the log difference in the closing price over the period t-1 and t+1, where t is the FOMC meeting date. The actual change of federal funds rate (FFR) is the change announced at FOMC meetings. The unexpected change of FFR (shock) is the change in the FFR implied by the current-month futures contract from Bernanke and Kuttner (2005). Financial dependence is industry's intrinsic dependence on external finance for investment based on Rajan and Zingales (1998). Firm size is the log of book assets in U.S. dollar. Market beta is the correlation between weekly firm stock price and the weekly country-level local market index within a year. Standard errors are clustered at the level of intervention dates. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

	Actual change	Components	Shock	Financial dependence	Firm Controls	Beta	Date Effects
Actual change	-0.0029						
	[0.0040]						
Expected change		0.0052*					
		[0.0028]					
Shock		-0.043**	-0.041**	-0.038**	-0.038**	-0.013**	
		[0.017]	[0.017]	[0.016]	[0.016]	[0.0056]	
Shock*				-0.017***	-0.018***	-0.012***	-0.011***
Financial dependence				[0.0049]	[0.0048]	[0.0032]	[0.0030]
Firm size					0.067	-0.045	-0.032
					[0.11]	[0.060]	[0.040]
Market/Book ratio					0.045***	0.032***	0.029***
					[0.015]	[0.011]	[0.0098]
Beta*Market Return						0.64***	0.56***
						[0.025]	[0.025]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date fixed effects	No	No	No	No	No	No	Yes
Observations	925306	925306	925306	925306	899041	871415	871415
R-squared	0.025	0.031	0.031	0.031	0.033	0.081	0.092

Table 3. Clustering of Standard Errors

Dependent variable is stock return measured as the log difference in the closing price over the period t-1 and t+1, where t is the FOMC meeting date. The unexpected change of FFR (shock) is the change in the FFR implied by the current-month futures contract from Bernanke and Kuttner (2005). Financial dependence is industry's intrinsic dependence on external finance for investment based on Rajan and Zingales (1998). Firm size is the log of book assets in U.S. dollar. Market beta is the correlation between weekly firm stock price and the weekly country-level local market index within a year. Standard errors are clustered as specified in the title of the columns. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

	Country level	Sector level	Country-year level	Country and sector level
Shock*Financial dependence	-0.011***	-0.011***	-0.011***	-0.011***
	[0.0035]	[0.0023]	[0.0029]	[0.0009]
Firm size	-0.032	-0.032	-0.032	-0.032
	[0.027]	[0.025]	[0.032]	[0.041]
Market/Book ratio	0.029***	0.029***	0.029***	0.029***
	[0.0061]	[0.0038]	[0.0088]	[0.0093]
Beta*Market Return	0.56***	0.56***	0.56***	0.56***
	[0.028]	[0.022]	[0.020]	[0.031]
Firm fixed effects	Yes	Yes	Yes	Yes
Date fixed effects	Yes	Yes	Yes	Yes
Observations	871415	871415	871415	871415
R-squared	0.092	0.092	0.092	0.092

Table 4. Excluding FOMC Dates Without Change in Federal Funds Rate

Dependent variable is stock return measured as the log difference in the closing price over the period t-1 and t+1, where t is the FOMC meeting date. The actual change of federal funds rate (FFR) is the change announced at FOMC meetings. The unexpected change of FFR (shock) is the change in the FFR implied by the current-month futures contract from Bernanke and Kuttner (2005). Financial dependence is industry's intrinsic dependence on external finance for investment based on Rajan and Zingales (1998). Firm size is the log of book assets in U.S. dollar. Market beta is the correlation between weekly firm stock price and the weekly country-level local market index within a year. Standard errors are clustered at the level of intervention dates. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

	Actual change	Components	Shock	Financial dependence	Firm controls	Date effects
Actual change	-0.0015					
	[0.0037]					
Expected change		0.0057**				
		[0.0026]				
Shock		-0.038**	-0.037**	-0.034**	-0.011*	
		[0.017]	[0.017]	[0.016]	[0.0063]	
Shock*				-0.017***	-0.012***	-0.012***
Financial dependence				[0.0049]	[0.0034]	[0.0031]
Firm size					0.024	0.016
					[0.085]	[0.059]
Market/Book ratio					0.047***	0.042***
					[0.014]	[0.012]
Beta*Market Return					0.60***	0.54***
					[0.029]	[0.029]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Date fixed effects	No	No	No	No	No	Yes
Observations	473713	473713	473713	473713	446432	446432
R-squared	0.047	0.056	0.055	0.055	0.105	0.115

Table 5. The Impact of Monetary Policy Shocks on Manufacturing Sectors

Dependent variable is stock return measured as the log difference in the closing price over the period t-1 and t+1, where t is the FOMC meeting date. The unexpected change of FFR (shock) is the change in the FFR implied by the current-month futures contract from Bernanke and Kuttner (2005). Financial dependence is industry's intrinsic dependence on external finance for investment based on Rajan and Zingales (1998). Firm size is the log of book assets in U.S. dollar. Market beta is the correlation between weekly firm stock price and the weekly country-level local market index within a year. Standard errors are clustered at the level of intervention dates. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

	1	2	3	4	5
Shock	-0.036**	-0.036**	-0.036**	-0.0098**	
	[0.015]	[0.015]	[0.016]	[0.0047]	
Shock*Financial dependence		-0.012***	-0.012***	-0.0061**	-0.0060**
		[0.0043]	[0.0043]	[0.0028]	[0.0029]
Firm size			0.044	-0.079	-0.055
			[0.13]	[0.064]	[0.038]
Market/Book ratio			0.03	0.018	0.019
			[0.020]	[0.016]	[0.014]
Beta*Market Return				0.66***	0.60***
				[0.025]	[0.026]
Date fixed effects	No	No	No	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	606315	606315	592030	577823	577823
R-squared	0.027	0.027	0.028	0.09	0.104

Table 6. Growth Prospects and Business Cycles

Dependent variable is stock return measured as the log difference in the closing price over the period t-1 and t+1, where t is the FOMC meeting date. The unexpected change of FFR (shock) is the change in the FFR implied by the current-month futures contract from Bernanke and Kuttner (2005). Financial dependence is industry's intrinsic dependence on external finance for investment based on Rajan and Zingales (1998). Firm size is the log of book assets in U.S. dollar. Market beta is the correlation between weekly firm stock price and the weekly country-level local market index within a year. The global growth opportunity is the lagged sector growth rate of the U.S. firms, similar to Fisman and Love (2007). The recession dummy is based on the NBER recession dates. Standard errors are clustered at the level of intervention dates. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

	Growth opportunity	Recession	Recession* shock
Shock*Financial dependence	-0.011***	-0.012***	-0.0054*
	[0.0029]	[0.0033]	[0.0028]
Firm size	-0.033	-0.03	-0.03
	[0.040]	[0.039]	[0.039]
Market/Book ratio	0.029***	0.029***	0.029***
	[0.0098]	[0.0098]	[0.0098]
Beta*Market Return	0.56***	0.56***	0.56***
	[0.025]	[0.025]	[0.025]
Growth Opportunity	0.038		
	[0.11]		
Shock*Growth Opportunity	-0.031		
	[0.021]		
Recession*Financial dependence		-0.12	-0.18**
		[0.077]	[0.081]
Recession*Shock*Financial dependence			-0.014***
			[0.0046]
Firm fixed effects	Yes	Yes	Yes
Date fixed effects	Yes	Yes	Yes
Observations	869238	871415	871415
R-squared	0.092	0.092	0.092

Table 7. Spillover Channels

Dependent variable is stock return measured as the log difference in the closing price over the period t-1 and t+1, where t is the FOMC meeting date. The unexpected change of FFR (shock) is the change in the FFR implied by the current-month futures contract from Bernanke and Kuttner (2005). Financial dependence is industry's intrinsic dependence on external finance for investment based on Rajan and Zingales (1998). Financial openness is a country's foreign assets and liabilities over GDP. Financial development is a country's domestic private credit over GDP. Trade openness is a country's imports plus exports over GDP. Per capita income is GDP per capita in constant U.S. dollar term. We measure synchronization by the correlation of monthly money market rates between the U.S. and the individual countries over the period from 1990 to 2008, and call a country as High Synchronization if the correlation is above 0.5. Firm fixed effects and date fixed effects are included. Standard errors are clustered at the level of intervention dates. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

	Financial Openness	Financial Development	Trade Openness	Fin-trade Openness	GDP per capita	Policy Rate Correlations
Shock*Financial dependence	-0.011***	-0.011***	-0.011***	-0.011***	-0.010***	-0.0033
	[0.0030]	[0.0031]	[0.0030]	[0.0029]	[0.0031]	[0.0032]
Firm size	-0.027	-0.033	-0.039	-0.035	-0.034	-0.031
	[0.040]	[0.044]	[0.040]	[0.040]	[0.039]	[0.039]
Market/Book ratio	0.029***	0.032***	0.029***	0.030***	0.029***	0.030***
	[0.0098]	[0.0080]	[0.0098]	[0.0098]	[0.0098]	[0.0098]
Beta*Market Return	0.56***	0.55***	0.56***	0.56***	0.56***	0.56***
	[0.025]	[0.026]	[0.025]	[0.025]	[0.027]	[0.025]
Financial Openness	-0.057*			-0.051		
	[0.032]			[0.032]		
Shock*Financial Openness	-0.0018**			-0.0021***		
	[0.00073]			[0.00065]		
Financial Development		0.013				
		[0.13]				
Shock*Financial Development		-0.0016				
		[0.0083]				
Trade openness			-2.15	-1.91		
			[1.37]	[1.37]		
Shock*Trade openness			0.039	0.067		
			[0.070]	[0.071]		
Per capita income					0.022	
					[0.32]	
Shock*Per capita income					-0.0045	
					[0.0062]	
High Synchronization*Shock						-0.018***
						[0.0070]
High Synchronization*Shock						-0.011***
*Financial dependence						[0.0041]
Observations	871415	825335	871415	871415	871415	862522
R-squared	0.093	0.094	0.092	0.093	0.092	0.093

Appendix Table 1. List of Countries

This table lists the total number of firms in each of the 44 countries in our sample over the period 1990 to 2008.

Country	Number of firms
Argentina	51
Australia	1,701
Austria	108
Belgium	116
Brazil	236
Canada	1,662
Chile	79
China	1,387
Colombia	25
Czech Republic	43
Denmark	135
Egypt	39
Finland	117
France	844
Germany	732
Greece	223
Hong Kong	611
Hungary	23
India	890
Indonesia	227
Ireland	71
Israel	142
Italy	249
Japan	3,061
Korea (South)	973
Malaysia	781
Mexico	83
Netherlands	197
New Zealand	94
Norway	230
Pakistan	88
Peru	59
Philippines	110
Poland	205
Portugal	78
Russian Federation	60
Singapore	474
South Africa	415
Spain	117
Sweden	416
Switzerland	186
Thailand	391
Turkey	176
United Kingdom	2,216
Total	20,121

Appendix Table 2: List of FOMC Meetings, Actual Change in Federal Funds Rate, and Monetary Shock, in bp

Date	Actual	Shock	Date	Actual	Shock	Date	Actual	Shock	Date	Actual	Shock
13-Jul-90	-25	-14	26-Mar-96	0	-3	22-Aug-00	0	-2	10-Nov-04	25	0
29-Oct-90	-25	-31	21-May-96	0	0	3-Oct-00	0	0	14-Dec-04	25	0
14-Nov-90	-25	4	3-Jul-96	0	-5	15-Nov-00	0	0	2-Feb-05	25	0
7-Dec-90	-25	-27	20-Aug-96	0	-4	19-Dec-00	0	5	22-Mar-05	25	0
18-Dec-90	-25	-21	24-Sep-96	0	-13	3-Jan-01	-50	-38	3-May-05	25	0
8-Jan-91	-25	-18	13-Nov-96	0	0	31-Jan-01	-50	0	30-Jun-05	25	0
1-Feb-91	-50	-25	17-Dec-96	0	1	20-Mar-01	-50	6	9-Aug-05	25	0
8-Mar-91	-25	-16	5-Feb-97	0	-3	18-Apr-01	-50	-43	20-Sep-05	25	1
30-Apr-91	-25	-17	25-Mar-97	25	3	15-May-01	-50	-8	1-Nov-05	25	24
6-Aug-91	-25	-15	20-May-97	0	-11	27-Jun-01	-25	8	13-Dec-05	25	0
13-Sep-91	-25	-5	2-Jul-97	0	-2	21-Aug-01	-25	2	31-Jan-06	25	0
31-Oct-91	-25	-5	19-Aug-97	0	-1	2-Oct-01	-50	-7	28-Mar-06	25	0
6-Nov-91	-25	-12	30-Sep-97	0	0	6-Nov-01	-50	-10	10-May-06	25	-1
6-Dec-91	-25	-9	12-Nov-97	0	-4	11-Dec-01	-25	0	29-Jun-06	25	-2
20-Dec-91	-50	-28	16-Dec-97	0	-1	30-Jan-02	0	2	8-Aug-06	0	-4
9-Apr-92	-25	-24	4-Feb-98	0	0	19-Mar-02	0	-3	20-Sep-06	0	0
2-Jul-92	-50	-36	31-Mar-98	0	0	7-May-02	0	0	25-Oct-06	0	0
4-Sep-92	-25	-22	19-May-98	0	-3	26-Jun-02	0	-2	12-Dec-06	0	0
4-Feb-94	25	12	1-Jul-98	0	-1	13-Aug-02	0	3	31-Jan-07	0	0
22-Mar-94	25	-3	18-Aug-98	0	1	24-Sep-02	0	2	21-Mar-07	0	0
18-Apr-94	25	10	29-Sep-98	-25	0	6-Nov-02	-50	-19	9-May-07	0	0
17-May-94	50	13	15-Oct-98	-25	-26	10-Dec-02	0	0	28-Jun-07	0	0
6-Jul-94	0	-5	17-Nov-98	-25	-6	29-Jan-03	0	1	7-Aug-07	0	3
16-Aug-94	50	14	22-Dec-98	0	-2	18-Mar-03	0	5	18-Sep-07	-50	-15
27-Sep-94	0	-8	3-Feb-99	0	0	6-May-03	0	4	31-Oct-07	-25	-2
15-Nov-94	75	14	30-Mar-99	0	0	25-Jun-03	-25	15	11-Dec-07	-25	1
20-Dec-94	0	0	18-May-99	0	-4	12-Aug-03	0	0	30-Jan-08	-50	-10
1-Feb-95	50	5	30-Jun-99	25	-4	16-Sep-03	0	0	18-Mar-08	-75	17
28-Mar-95	0	10	24-Aug-99	25	2	28-Oct-03	0	0	30-Apr-08	-25	-5
23-May-95	0	0	5-Oct-99	0	-4	9-Dec-03	0	0	25-Jun-08	0	-3
6-Jul-95	-25	-1	16-Nov-99	25	9	28-Jan-04	0	0	5-Aug-08	0	-1
22-Aug-95	0	0	21-Dec-99	0	2	16-Mar-04	0	0	16-Sep-08	0	6
26-Sep-95	0	0	2-Feb-00	25	-5	4-May-04	0	-1	29-Oct-08	-50	-43
15-Nov-95	0	6	21-Mar-00	25	-3	30-Jun-04	25	-1	16-Dec-08	-100	-12
19-Dec-95	-25	-10	16-May-00	50	5	10-Aug-04	25	2			
31-Jan-96	-25	-7	28-Jun-00	0	-2	21-Sep-04	25	2			

Appendix Table 3. Correlation between U.S. and Local Money Market Rates

This table reports the correlation of monthly money market rates between the U.S. and the individual countries over the period 1990 to 2008 using data on money market rates from the International Financial Statistics database of the International Monetary Fund.

Country	Correlation
Argentina	0.18
Australia	0.65
Austria	0.44
Belgium	0.42
Brazil	0.18
Canada	0.77
Chile	0.60
China	0.50
Hong Kong SAR	0.87
Colombia	0.57
Czech Republic	0.51
Denmark	0.39
Euro Area countries	0.62
Finland	0.46
France	0.44
Germany	0.42
Greece	0.61
India	0.25
Indonesia	0.30
Ireland	0.34
Italy	0.51
Japan	0.42
Korea, Republic of	0.54
Malaysia	0.44
Mexico	0.63
Netherlands	0.43
New Zealand	0.70
Norway	0.34
Pakistan	0.21
Peru	0.60
Philippines	0.48
Poland	0.50
Portugal	0.39
Russian Federation	0.26
Singapore	0.78
South Africa	0.54
Spain	0.50
Sweden	0.21
Switzerland	0.50
Thailand	0.57
Turkey	0.28
United Kingdom	0.68