# Global financial transmission of monetary policy shocks

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This version: February 2007

**Abstract**

The paper analyses the transmission of US monetary policy shocks to global equity markets and the macroeconomic determinants of the underlying transmission process. We show that there is a substantial cross-country and cross-sector heterogeneity in reactions across 50 equity markets worldwide, with returns falling on average around 3.8% in response to a 100 basis point tightening of US monetary policy, but ranging from a zero response in some to a reaction of 10% or more in other markets. As to the determinants of the strength of transmission to individual countries, we test the relevance of their macroeconomic policies and the role of real and financial integration. We find that in particular the degree of global integration of countries – and not a country's bilateral integration with the United States – is a key determinant for the transmission process.

JEL No.: F36; F30; G15.
Keywords: global financial markets; monetary policy; transmission; financial integration; United States; advanced economies; emerging market economies.

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## 1. Introduction

The interdependence of economies has been a topic of research for a number of decades. Beyond studies of business cycle co-movement (e.g., Baxter and Stockman 1989 or Gerlach 1988; more recently, Forni et al. 2000; Camacho et al. 2006), analyses of the international transmission of identified structural shocks have improved our understanding of the channels by which developments in one economy spread to other countries (e.g. Ahmed et al. 1993; Canova and Marrinan 1998). At the same time, our knowledge on the interdependence of financial markets has also progressed substantially. In this area, studies have generally focused on the co-movement of asset returns in reduced form models, disentangling cross-country factors, global factors, sectoral factors and country-specific effects.[1] The nature of this integration and the transmission channels through which shocks dissipate are, however, still not well understood. What are the factors that cause such a co-movement? Are they global in nature or can they be traced to specific developments in individual countries and sectors?

In this paper, we attempt to combine the two approaches by analyzing the transmission of monetary policy shocks to a large number of equity markets, and by studying its macroeconomic determinants. Specifically, we look at the transmission of US monetary policy shocks to 50 equity markets worldwide, covering not only advanced economies but all of the major emerging market economies, over the period 1994-2004. This approach allows us to make use of a precisely identified structural shock (Kuttner 2001; Gürkaynak, Sack and Swanson 2005), that is well known to exert substantial effects not only on financial markets,[2] but also on the US and international macro economies (among many others, see Christiano et al. 1999).

This approach allows us to address two related issues. First, we identify the overall *strength* of the transmission of US monetary policy shocks to equity markets and find that global equity markets fall by around 3.8% in response to a 100 basis point (bp) tightening of US monetary policy. Equally importantly, we show that there is a substantial degree of heterogeneity in the reaction across the 50 countries and the 10 industry sectors we analyze in this paper. Some markets fall by more than 10% due to a 100 bp tightening, thus reacting even more strongly than the US equity market itself, while other countries' stock markets do not react at all to US monetary policy shocks.

[1] Seminal studies on international co-movements of asset prices and on quantifying financial market integration are King and Wadhwani (1990), Hamao et al. (1990), Lin et al. (1994), Bekaert and Harvey (1995), and more recently by Campbell et al. (2001), Griffin and Stulz (2001) and Wongswan (2006).

[2] Thorbecke (1997) and Patelis (1997) are important earlier studies using VAR frameworks for identification, while more recent studies on this topic are Bernanke and Kuttner (2005), Bomfim (2001), Rigobon and Sack (2004), Faust et al. (2005) and Ehrmann and Fratzscher (2004).

Moreover, we detect a substantial degree of sector heterogeneity, ranging from a 7.4% response of the information technology sector to 1.6% for the utilities sector.

As to the second issue, we study the *determinants* of the strength of transmission by explaining the differential effects across countries and over time through macroeconomic policies and the degree of real and financial integration of countries. Countries with open and well developed equity markets and financial sectors react significantly more to US monetary policy shocks than closed ones, as do countries with more volatile exchange rates. However, we find no evidence that countries with de jure fixed or with floating exchange rate regimes react differently to US monetary policy shocks.

For the analysis of the role of real (i.e., trade) and financial integration in the transmission of US monetary policy shocks to global markets, we employ a novel database that contains holdings of capital stocks vis-à-vis the United States as well as the rest of the world for all elements of the capital account – FDI, portfolio equity investment, portfolio debt investment and loans. We find that stock markets in countries that hold a large amount of foreign financial assets (relative to domestic GDP) and also that owe a large amount of domestic financial assets to foreigners react two to three times more strongly to monetary policy shocks than less financially integrated countries. We show that this holds quite independently of which type of capital is concerned – countries that are more financially integrated either with regard to FDI, portfolio equity investment, portfolio debt investment or with regard to loans all face an equity market response that is at least twice as strong as that of less financially integrated countries.

A further finding of the paper is that it is in particular the degree of *global* integration, i.e. integration of individual countries vis-à-vis all other countries, rather than the degree of *bilateral* integration with the United States that determines the magnitude of transmission. This underlines the complexity of the channels of the global financial transmission process. It also has important implications for portfolio diversification and risk-sharing through global capital markets.

To the best of our knowledge, there are so far no studies that systematically analyze the transmission of structural shocks, such as US monetary policy shocks, to global financial markets and link the underlying transmission process to macroeconomic determinants. Nevertheless, the paper is related to a few studies that analyze similar issues in different contexts. The present paper is closest in its objective to the important work by Forbes and Chinn (2004). Using a factor model, they distinguish between cross-country factors, global factors, sectoral factors and country-specific

factors. They study cross-country comovements of asset prices, and find both trade and financial linkages to be important, mainly since the mid 1990s. Furthermore, they show that there are regional spillovers from the largest economy in a given region to nearby countries.

Related analyses at the macroeconomic level have tested to what extent US monetary policy shocks affect economies other than the US. However, typically only a small number of countries has been looked at in such studies. Kim (2001), using a VAR framework with low-frequency data, finds that US monetary expansions have a positive effect on G6 output, and identifies changes in world interest rates as the most important channel of transmission. This conclusion is shared by Canova (2005), who also employs a VAR framework to study the effect of US monetary policy on Latin American countries. He furthermore finds that the strength of countries' response to US monetary policy depends on exchange rate regimes, even though differences with the de jure classification appear relatively small. Finally, Miniane and Rogers (2003) assess whether capital controls manage to insulate countries from US monetary shocks, by estimating their effect on the exchange rate and foreign interest rates of 26 countries, also in the context of a VAR analysis. The study does not find evidence for the notion that countries with capital controls might exhibit systematically smaller responses, however, whereas there is an effect of the exchange rate regime and the degree of dollarization.

The paper is structured as follows. We proceed by describing the data in detail in section 2. Section 3 then discusses the empirical methodology employed and presents the estimates for the strength of the financial transmission process, at a global level and distinguishing also across countries and across sectors. Section 4 contains the analysis of the macroeconomic determinants of the strength of transmission, together with several robustness tests of the empirical results. Section 5 summarizes the findings and concludes by drawing some implications for future work.

## 2. Data

We proceed by first outlining the data for the financial market returns, for the monetary policy shocks as well as for the macroeconomic variables of the transmission channels. In the subsequent section, we will then turn to the empirical methodology and modeling of the financial transmission process.

## 2.1 Financial market data

The main focus of the paper is on the transmission of US monetary policy shocks to foreign equity markets. A first important choice is therefore what type of equity indices to chose. We decided to take Datastream price indices in national currencies for several reasons. First, they offer a maximum amount of comparability across countries. Second, they are based on a broad sample of stocks, including many small firms in the indices. Third, the indices are available for 50 countries, covering all major advanced economies and major emerging market economies. Fourth, each national index is furthermore available disaggregated into sector indices. Finally, the choice of currency implies that we are able to calculate national equity returns pure of exchange rate effects. Annex 1 lists the country and sector coverage of the Datastream indices, showing that series are mostly available for the full time sample covered.

An important issue is the sector composition of the different equity markets. As discussed above, a potentially relevant determinant for differences in the transmission of shocks to equity markets may be the different sector composition of the overall market indices. For instance, the equity market of a particular country may react more to foreign shocks due to the concentration of firms of a particular sector in that index, rather than due to the other factors of interest here. We use two ways to control for such sector effects in the empirical analysis below. First, we model the transmission on each sector index in each country allowing for sector-specific fixed effects and transmission effects. Second, for the analysis of the determinants of a country's response to US monetary policy shocks, we construct aggregate indices which are calculated as the unweighted average of the sector returns in each country.

Finally, the analysis and empirical modeling is based on daily financial market data, using closing quotes of the respective equity markets. We choose this frequency due to the fact that several equity markets, i.e. those in Asia but also in Europe, are closed when US monetary policy decisions are announced. Hence, tomorrow's equity returns for these countries are included to test the effect of a US monetary policy shock today.

## 2.2 Monetary policy shocks

The second issue is how to measure US monetary policy shocks. To obtain an as clean and exogenous as possible proxy for such shocks, we use the change of the Fed funds future rates in the 30-minute window surrounding FOMC decisions. The data stems

from Gürkaynak, Sack, and Swanson (2005) and builds on the important work by Kuttner (2001).[3]

FOMC meetings usually take place 8 times per year, about every six weeks. Starting in February 1994, the Federal Reserve announces its decisions on the day of the FOMC meetings, whereas before, markets needed to infer decisions from the open market operations. Accordingly, we start our sample period in February 1994, as from this date monetary policy surprises on the day of the FOMC meetings can be accurately measured. Most FOMC announcements since February 1994 have taken place at 14.15 EST, such that markets in Asia and in Europe were closed and affected only on the subsequent business day. Over the whole period February 1994 – December 2004, we have a total of 93 FOMC meetings. These include also unscheduled FOMC meetings, except for the one on 17 September 2001 following the 11 September attacks.[4] Figure 1 plots the US monetary policy surprises over the included 93 FOMC meetings.

Figure 1

As we model the daily returns of stock markets on all days in our sample, i.e. also for non-FOMC meeting days, our measure of monetary policy shocks is set to zero for these days.

### 2.3 Integration and macroeconomic determinants

As discussed in the introduction, an important part of the analysis is to understand the determinants of the strength of transmission. For that purpose, we use various measures. One key element we analyze is the degree of financial openness of countries. We use the openness of the capital account, which is a dummy that takes the value zero if a country's capital account is closed and one if it is open. The source of this data is the IMF's Annual Report on Exchange Arrangement and Exchange Restrictions (AREAER). For the openness of the domestic equity markets as well as for the openness of the domestic financial sector we take the indicators developed by Kaminsky and Schmukler (2003) and complemented by Bussiere and Fratzscher (2004). All of these openness variables are dummies, being zero if a country's market is closed and one if it is open.

[3] See Gürkaynak (2005) for a detailed explanation of the methodology for calculating policy expectations based on Fed funds futures of different maturities.

[4] Excluding the other four unscheduled meetings from the sample reduces the overall effect of US monetary policy shocks somewhat. However, such an exclusion does not change the results shown below, in particular the cross sectional heterogeneity and the analysis of the channels of determinants in any significant way.

As to exchange rates, we use both de facto measures of exchange rate flexibility from Reinhart and Rogoff (2004) as well as a de jure classification from the IMF's AREAER. We also use the actual exchange rate volatility, which is measured as the standard deviation of a country's daily exchange rate changes against the US dollar over the previous 12-months. Other volatility proxies based on shorter or somewhat longer periods show very similar results to the ones presented below.

Finally, for the degree of real and financial integration, we look at both the current account and the financial account of countries. Trade data are flows of exports and imports and stem from the IMF's Direction of Trade Statistics. Financial account data are all stocks of assets and/or liabilities for FDI (source: UNCTAD), portfolio investment equity and debt (source: IMF CPIS), and other investment, which are mostly loans (source: BIS ILB). A key strength of this dataset is that it contains a geographic decomposition of trade and financial linkages, so that both real and financial integration can be measured vis-à-vis the rest of the world and, alternatively, vis-à-vis the United States alone.

Most of the integration and macroeconomic variables vary over time and across countries, though there are some exceptions and some variables are not available for the full sample of countries. Annex 2 provides a more detailed summary of the sources and characteristics of all the variables. Table 1 provides some summary statistics of the variables, including the US monetary policy shock.

Table 1

## 3. The strength of financial transmission

Our empirical modeling strategy consists of two parts. In the first part, which is presented in this section, we measure the overall transmission of US monetary policy shocks to US and foreign equity markets. We also decompose this transmission process by taking into account the cross-country heterogeneity and the cross-sector heterogeneity as well as possible time variations of the transmission process. In the second part, we then turn to an analysis of the macroeconomic determinants in Section 4.

### 3.1 Benchmark results

Our first objective is to measure the overall transmission of US monetary policy shocks to foreign equity markets. As the most simple benchmark specification, we model daily equity returns in country *i*, $r_{it}$, as follows:

$$r_{it} = \alpha_i + \beta S_t + \sum_n \delta_n Z_{i,t} + \varepsilon_{it} \quad (1)$$

Daily equity returns are thus a function of monetary policy shocks in the United States, $S_t$, as well as a vector $Z_t$ of controls such as past returns, day-of-the-week effects, and US equity returns corrected for the effect of US monetary policy shocks.[5] $\beta$ is our main parameter of interest, which measures the strength of the transmission of the shock to foreign equity markets. As discussed above, one would expect that the coefficient has a negative sign, as a positive monetary policy shock, i.e. higher interest rates than expected, induces negative equity returns.

As to the specific estimator, we use for all models in this paper, except when indicated otherwise, an OLS estimator with panel-corrected standard errors (PCSE), which corrects for heteroskedasticity and for the correlation of residuals across stock market indices. This estimator takes residuals to be contemporaneously correlated across panels. It estimates the covariance of the OLS coefficients as $\hat{V} = (X'X)^{-1} X' \Omega X (X'X)^{-1}$ where $\Omega$ is the covariance matrix of the residuals $\Omega = \Sigma_{mxm} \otimes I_{T_i x T_i}$. $I$ is an identity matrix and $\Sigma$ the $m$ by $m$ panel-by-panel covariance matrix of the residuals, formulated as $\hat{\Sigma}_{ij} = (\varepsilon_i' \varepsilon_j)/T_{ij}$, where $\varepsilon_i$ and $\varepsilon_j$ are the residuals for panels $i$ and $j$ from equation (1) and $T_{ij}$ is the number of residuals between the panels that can be matched by time period. This correction is important as neglecting such heteroskedasticity and cross-correlation leads to a substantial underestimation of the variance-covariance matrix and thus to an overestimation of the significance of the parameters.

Table 2

Table 2, row (1), shows the results for US equity returns alone using the weighted equity returns $r_{US,t}$, whereas row (2) gives the analogous results when using the unweighted equity returns, $r^u_{US,t}$, as explained above in section 2. We find that US stock markets respond significantly to a US monetary policy shocks. Overall, an

[5] The estimated coefficients for these controls are not shown for brevity reasons; however, it should be noted that the estimates of β are not sensitive to the specific inclusion of these controls.

tightening of US monetary policy by 100 bp lowers the weighted US equity index by 7.9% and the unweighted index by 6.5%. These effects are in line with those of the literature, which are estimated at 5.3% by Bernanke and Kuttner (2005), at 5.5% by Ehrmann and Fratzscher (2004) and at 6.2% by Rigobon and Sack (2004).

As the main focus of the present paper, rows (3) and (4) show the corresponding results for the international transmission. The results show that a 100 bp tightening in US monetary policy leads to a drop of the foreign weighted returns by 4.5% and of the unweighted returns by 3.8%. As such, the magnitude of the international stock markets response is more than half of the domestic one within the US.

A first robustness test is to check whether the strength of the transmission relates to specific characteristics of the interest rate decision, such as whether or not the FOMC changed interest rates, whether there was a directional change in US monetary policy at a particular meeting, whether the surprise was small or large etc. We conduct this test by estimating

$$r_{it} = \alpha_i + \beta_1 S_t D_t + \beta_2 S_t (1 - D_t) + \sum_n \delta_n Z_{i,t} + \varepsilon_{it} \qquad (2)$$

with $D_t$ =1 e.g. if there was no change in monetary policy at a particular FOMC meeting and $D_t$=0 otherwise, and analogously for other asymmetries. Table 3 shows the estimates for various specifications of such heterogeneity. Overall, the results indicate that although there are some differences in the strength of the transmission, none of these differences is statistically significant, neither with weighted nor with unweighted return indices, as indicated by the p-values in the last column of the tables. We take this as evidence that in our further analysis below, we do not need to take such differences into account.

Table 3

### 3.2 Cross-country and cross-sector heterogeneity

Table 2 shows the *average* transmission across all countries and all sectors. To understand the degree of heterogeneity of the transmission process, we therefore now proceed to analyze the differences in the transmission across countries as well as across sectors. For this purpose, we allow for country-specific as well as sector-specific intercepts and interactions with the US monetary policy shock. We therefore

estimate the benchmark model by including return indices for each country *and* each sector, $r_{ikt}$ (excluding the national market aggregates used in the preceding section):

$$r_{ikt} = \alpha_i + \alpha_k + \sum_i [\beta_i \; S_t \; D_i] + \sum_k [\beta_k \; S_t \; D_k] + \sum_n \delta_n \; Z_{i,t} + \varepsilon_{ikt} \qquad (3)$$

Table 4 indicates that the cross-country variation in the financial transmission from the United States is substantial. Some of the more closed emerging markets – such as China, India, Peru, Sri Lanka and Malaysia – do not react significantly or only very weakly to US monetary policy shocks. By contrast, other emerging markets – for instance Hong Kong, Indonesia, Korea and Turkey – react very strongly to US shocks, with some equity returns falling by 10% or more to a 100 bp tightening in US monetary policy.

There are also substantial differences in the transmission of US shocks to advanced economies.[6] Some markets, such as those in Canada and Australia, react relatively strongly, while others, such as Japan's, are far less responsive. Interestingly, the largest effects of US monetary policy shocks among advanced economies are recorded for Finland and Sweden. These are two economies where the high-tech sector is particularly important. Although model (3) controls for differences in the sector composition of countries' equity indices, this finding may suggest that there are important sector spillovers within countries, i.e. all sectors react more strongly to US shocks in countries where the high tech sector is particularly important.

Tables 4 and 5

Table 5 gives the sector effects $\beta_k$ and indeed underlines their importance. The table confirms that the information/high-tech sector responds by far the strongest, with equity returns in this sector declining on average by 7.4% in response to a 100 bp tightening in US monetary policy. Also the financial sector, non-cyclical services and the industrial sector respond relatively more strongly. By contrast, utilities and non-cyclical consumer goods react the least to US monetary policy shocks.

In summary, there is a substantial transmission of US monetary policy shocks to global equity markets. This transmission moreover exhibits a large degree of heterogeneity, both across countries and across sectors. This heterogeneity ranges from countries or sectors that are basically unaffected by US monetary policy shocks to those that react by 10% or more to a 100 bp change in US monetary policy.

[6] Luxembourg is excluded from subsequent model estimations in part due to its special characteristic as financial centre, and in part due to a lack of some macroeconomic and integration data used below.

## 4. Determinants of financial transmission

We now turn to the question of what explains why some countries' equity markets overall respond more strongly to such shocks. We focus in this section on the role of macroeconomic policies – in particular the degree of openness and exchange rate policies – and the extent of real and financial integration of countries, and provide some extensions and robustness checks of the empirical results.

### 4.1 The role of macroeconomic policies

As to macroeconomic policies, one would expect that countries that are financially open are much more affected by US monetary policy and other shocks. More openness implies that capital can move more freely. A US monetary policy shock may induce a rebalancing of asset portfolios not only in the United States, but more generally in global markets overall, and in particular in those that are more open financially. We analyze various dimensions of financial openness: the openness of the capital account, the domestic equity market and the domestic financial sector, as well as the overall market capitalization of the domestic stock market relative to GDP as a proxy for the depth and liquidity of the market. Moreover, exchange rate policies may matter and we therefore also analyze the role of the exchange rate regime.

As discussed above, we expect that countries that are highly integrated with the United States, both in terms of finance and in terms of the real economy, should be more responsive to US monetary policy shocks for several reasons. On the one hand, there should be a closer linkage at the macroeconomic level; on the other hand, individual stocks are more likely to be affected beyond the macroeconomic linkages, through effects on their financing costs and their growth outlook. Finally, for investors, a rebalancing of portfolios should affect these countries more strongly.

As described in section 2, we use several proxies for real and financial integration. First, we look at the role of trade, both as the sum of bilateral inflows and outflows between a particular country *i* and the United States or the whole world as well as separated into inflows and outflows to or from country *i*. Second, we test whether stocks of FDI, portfolio equity, portfolio debt or other investment/loans play a role for the transmission process. Finally, we also test for the role of business cycle correlation, using the correlation of annual GDP growth rates in 1980-2003 between country *i* and the United States.

In the empirical model, we use a discrete definition of determinant $X_{it}$:

$$r_{it}^{u} = \alpha_i + (\beta_1 S_t) X_{it}^{low} + (\beta_2 S_t) X_{it}^{mid} + (\beta_3 S_t) X_{it}^{high} + \eta_1 X_{it}^{low} + \eta_2 X_{it}^{mid} + \eta_3 X_{it}^{high} + \sum_n \delta_n Z_{i,t} + \varepsilon_{it}^{u} \quad (4)$$

with $X^{low}$=1 if the determinant X of country *i* at time *t* lies in the lowest third of the distribution across all countries over the sample period, and zero otherwise, and analogously for $X^{mid}$ and $X^{high}$. This specification has the advantage that it nests a linear model, and that the magnitude of the parameters can be easily interpreted and compared. Note that most determinants are varying both across time and across countries, though some of the determinants only vary across countries, such as financial integration based on portfolio investment.

Table 6

Table 6 shows the estimates for openness, exchange rate regimes and business cycle correlation. There is indeed a strong relationship between the openness of countries and the strength of the transmission of US monetary policy shocks. In particular, US monetary policy affects equity markets only in countries that have an open equity market and an open domestic financial sector; whereas closed markets exhibit no statistically significant response (panel A, Table 6).

As to exchange rates, it appears that it is not the de jure exchange rate regime that matters but the de facto regime.[7] Panel B shows that stock markets in countries with more volatile exchange rates, both in effective terms or against the US dollar, react about twice as strongly as those with the least volatile ones – 5.5/5.6% as compared to 2.7% in response to a 100 bp change.[8] By contrast, there is no significant difference in the transmission among countries that de jure have declared to have a fixed or a floating exchange rate regime.

These two results on openness and on exchange rates may go some way in understanding the cross-country differences in the transmission of US monetary policy shocks discussed in section 3.2. For instance, the findings may explain to a significant extent why relatively closed emerging markets – such as China, India, Peru, Sri Lanka and Malaysia – do not react significantly or only very weakly to US monetary policy shocks, and why markets such as that of Hong Kong, which has a very open financial sector, show a relatively large response.

[7] This finding is consistent with Shambaugh (2004), which focuses specifically on comparing the responsiveness of monetary policy to foreign shocks under different de facto exchange rate regimes.
[8] The results using real exchange rates are very similar to those with nominal exchange rates shown in the table.

Next we turn to business cycle correlation and other macroeconomic variables as shown in panel C of Table 6. There appears indeed a significant relationship between the degree of business cycle correlation with the United States and the extent to which a country's stock market is affected by US monetary policy shocks; equity markets in countries with a low level of GDP correlation with the US react by 2.6%, which is significantly less than the 4.8% in countries with a high correlation. Little systematic role is however found for the degree of indebtedness of a country. There is also no systematic relationship between the transmission of the shocks and geographic distance – often used as a proxy for information asymmetries and transaction costs in the gravity literature. A broad set of other macroeconomic variables, such as the correlation of domestic inflation rates with those in the US, were tested and were not found to be significantly related to the transmission process. They are not shown in the tables for reasons of brevity.

### 4.2 The role of trade and financial integration

As the last step, we turn to the role of real and financial integration as a determinant for the transmission process of US monetary policy shocks. Table 7 shows the estimates when using integration proxies that measure the sum of inflows and outflows or the sum of assets and liabilities of residents in country *i*, vis-à-vis the whole world in panel A, and vis-à-vis the United States in panel B. Table 8 conducts the same analysis separately for inflows and outflows or assets and liabilities vis-à-vis the United States.

Tables 7-8

The key finding of Table 7 is that the financial transmission process to equity markets is strongly related to the degree of integration of countries vis-à-vis the whole world (panel A), but basically unrelated to the integration with the United States alone (panel B). In panel A for the integration with the world, countries that have a high degree of trade and that have a large size of financial assets and liabilities with the rest of the world react two to three times more strongly to US monetary policy shocks than countries with a low degree of such integration. This holds almost equally for all four types of capital (FDI, portfolio equity, portfolio debt and other investment). Note that it is hard to disentangle which type of capital plays relatively more important role for the transmission process as there is a high degree of correlation across these different proxies of financial integration.

By contrast, the relationship between the degree of integration of countries with the United States and the strength of the transmission of US monetary policy shocks to these countries is much weaker (panel B, Table 7). The case of other investment loans is the only one where a high degree of financial integration coincides with a stronger reaction to monetary policy shocks than a low degree.

To understand better the weak evidence regarding integration with the United States, we analyze the issue in more depth by distinguishing between inflows and outflows for trade, and between asset and liabilities for capital stocks in Table 8. But also this split reveals no systematic relationship between a country's integration with the United States and the strength of the financial transmission of US monetary policy to its equity markets.

An important caveat is that the different proxies for real and financial integration and macroeconomic variables are in some cases significantly correlated with one another; for instance, countries that are very open to trade are generally also open to financial investment from abroad. Hence, one should not give too much weight in interpreting the role of individual variables. Nevertheless, the fact that the results do not change much with regard to the statistical significance of e.g. individual financial integration variables, underlines the robustness of the results.

In summary, there is a strong relationship between, on the one hand, macroeconomic policies with regard to financial openness and exchange rates as well as the degree of real and financial integration, and, on the other hand, the financial transmission of US monetary policy to foreign equity markets. Financially open countries and also those with more volatile and flexible exchange rate react substantially more to US monetary policy. A key finding of this section is that the degree of integration with the rest of the world is strongly linked to the effect of US monetary policy on foreign equity markets, with stock returns in highly integrated countries reacting two to three times more strongly. However, it appears to be the integration with the world as a whole, and not the specific integration with the United States, that determines the strength of the financial transmission process.

## 5. Conclusions

How are shocks transmitted through international financial markets? And through which channels does the transmission process take place? This paper has focused on US monetary policy shocks, which are well known to exert substantial effects not only on financial markets, but also on the US and international macro economies, to

analyze the financial transmission across equity markets for a broad set of 50 equity markets, including those in all major advanced economies and emerging market economies.

We find that a 100 bp tightening of US monetary policy reduces equity returns on average by 3.8%. We show that there is a substantial degree of heterogeneity in the effect of US monetary policy on country-specific and sector-specific equity returns. For the cross-country heterogeneity, a few equity markets change hardly at all while others react substantially to US monetary policy shocks – in some cases by 10% or more in response to a 100 bp change. For the cross-sector heterogeneity, the effects of the transmission vary from a reaction of 1.6% for utilities to 7.4% for the information technology sector.

Having identified the strength of transmission, the paper has then analyzed its determinants. We find particularly strong transmission for countries that have open and relatively liquid financial markets. Moreover, there is substantial evidence that the transmission process is related to the degree of real and financial integration: equity markets in countries that are relatively open to trade and in particular those that hold a large magnitude of cross-border financial assets react two to three times more strongly to US monetary policy shocks than those of less integrated countries. A striking finding is that it is the degree of integration with the entire rest of the world that appears to matter for the financial transmission process, and not the bilateral integration of countries with the United States.

Overall, taking the evidence of the paper together, the findings suggest that US monetary policy and macroeconomic shocks are to a considerable extent indeed global rather than idiosyncratic shocks, as they affect most if not all markets simultaneously. This implies that diversification and insurance against such shocks is limited, a finding with important implications for portfolio diversification and risk-sharing in global capital markets. Understanding the implications for global capital flows and portfolio choices are important areas for future research.

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## Annex 1: Country and sector coverage, Datastream stock price indices

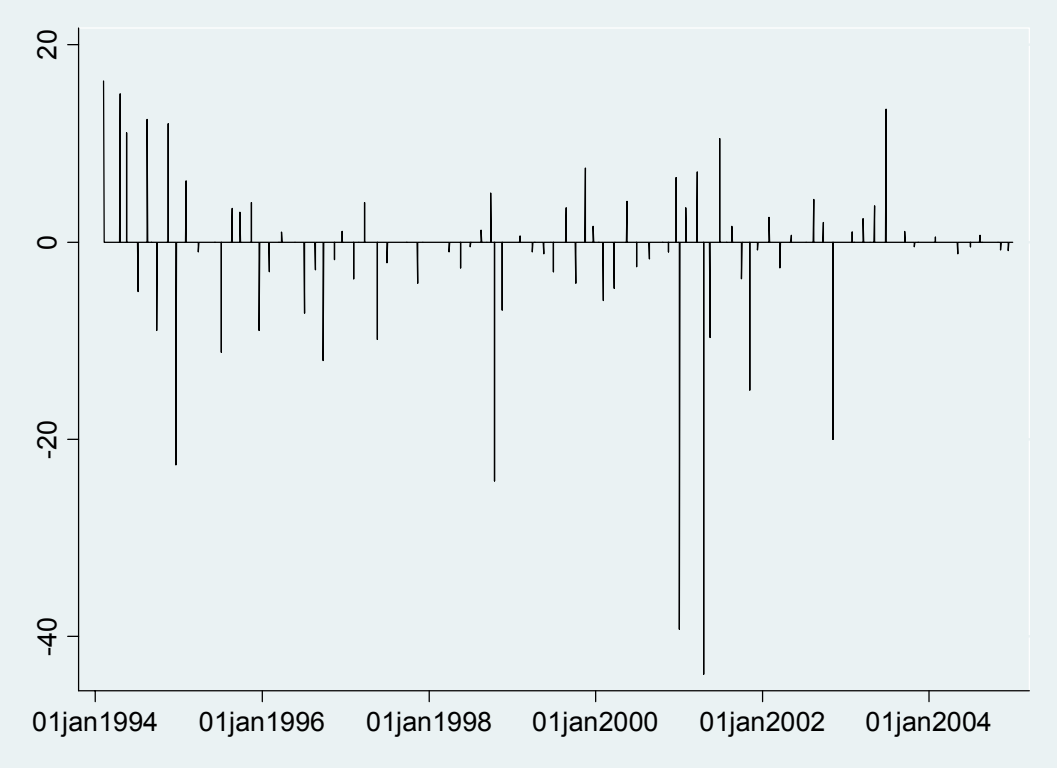
| | Resources | Basic Industries | General Industrials | Cyclical Consumer Goods | Non-Cyclical Consumer Goods | Cyclical Services | Non-Cyclical Services | Utilities | Information Technology | Financials |
|---|---|---|---|---|---|---|---|---|---|---|
| **Argentina** | √ | √ | √ | √ | √ | √ | √ | 23/06/94 | x | √ |
| **Australia** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Austria** | √ | √ | √ | x | √ | √ | √ | √ | x | √ |
| **Belgium** | x | √ | √ | 18/10/96 | √ | √ | √ | √ | √ | √ |
| **Brazil** | 04/07/94 | 04/07/94 | 04/07/94 | 11/12/96 | 04/07/94 | 04/02/02 | 04/07/94 | 04/07/94 | x | 04/07/94 |
| **Canada** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Chile** | √ | √ | √ | x | √ | √ | √ | √ | x | √ |
| **China** | 12/05/98 | √ | 02/02/94 | √ | 01/11/94 | √ | √ | √ | 26/06/97 | √ |
| **Columbia** | √ | √ | 06/01/98 | √ | √ | √ | √ | √ | 23/08/94 | √ |
| **Cyprus** | 28/11/95 | √ | 05/05/97 | √ | √ | √ | √ | √ | 05/05/99 | √ |
| **Czech Republic** | √ | √ | √ | √ | √ | 14/03/95 | 14/03/95 | √ | √ | √ |
| **Denmark** | x | √ | √ | √ | √ | √ | √ | √ | 29/03/99 | √ |
| **Finland** | 18/04/05 | √ | √ | 06/06/95 | √ | √ | √ | 07/12/94 | √ | √ |
| **France** | √ | √ | √ | √ | √ | √ | √ | 18/07/00 | √ | √ |
| **Germany** | x | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Greece** | 16/12/94 | √ | √ | √ | √ | √ | 30/04/96 | √ | √ | √ |
| **Hong Kong** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Hungary** | 28/11/95 | √ | 05/05/97 | √ | √ | √ | √ | √ | 05/05/99 | √ |
| **India** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Indonesia** | 12/10/94 | √ | √ | √ | √ | √ | 19/10/94 | √ | x | √ |
| **Ireland** | x | √ | √ | √ | √ | √ | 18/03/04 | √ | 02/05/97 | √ |
| **Israel** | √ | √ | √ | 01/01/98 | √ | x | √ | x | √ | √ |
| **Italy** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Japan** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Korea** | √ | √ | √ | √ | √ | √ | √ | √ | 18/08/95 | √ |
| **Luxembourg** | √ | √ | √ | x | √ | √ | 30/01/97 | √ | x | √ |
| **Malaysia** | √ | √ | √ | √ | √ | √ | √ | √ | 30/07/98 | √ |
| **Mexico** | √ | √ | √ | √ | √ | √ | √ | x | x | √ |
| **Netherlands** | √ | √ | √ | √ | √ | √ | √ | x | √ | √ |
| **New Zealand** | √ | √ | 31/03/94 | √ | √ | √ | √ | √ | x | √ |
| **Norway** | √ | √ | √ | 05/07/94 | √ | √ | √ | √ | √ | √ |
| **Pakistan** | √ | √ | √ | √ | √ | √ | 16/11/94 | √ | x | √ |
| **Peru** | √ | √ | √ | √ | √ | √ | √ | 22/07/96 | x | √ |
| **Philippines** | √ | √ | √ | x | √ | √ | √ | √ | x | √ |
| **Poland** | 30/01/96 | √ | √ | 11/07/96 | √ | 27/10/95 | 18/11/98 | √ | 10/02/98 | √ |
| **Portugal** | √ | √ | √ | √ | √ | √ | √ | 17/06/97 | 01/07/99 | √ |
| **Romania** | 09/02/98 | 05/12/96 | 05/12/96 | 04/06/97 | 01/04/97 | 23/04/97 | x | x | x | 15/10/97 |
| **Russia** | 20/06/94 | 20/06/94 | x | 20/06/94 | 02/11/94 | 10/09/96 | 20/06/94 | 20/06/94 | 14/07/00 | 20/06/94 |
| **Singapore** | √ | √ | √ | √ | √ | √ | √ | x | √ | x |
| **South Africa** | √ | √ | √ | √ | √ | √ | √ | x | x | x |
| **Spain** | √ | √ | √ | √ | √ | √ | √ | √ | 16/11/99 | √ |
| **Sri Lanka** | 19/11/96 | √ | √ | √ | √ | √ | √ | x | x | √ |
| **Sweden** | 06/09/01 | √ | √ | √ | √ | √ | 27/05/94 | x | √ | √ |
| **Switzerland** | x | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Taiwan** | x | √ | √ | √ | √ | 03/07/89 | 19/09/00 | x | √ | √ |
| **Thailand** | √ | √ | √ | x | √ | √ | √ | 16/01/95 | √ | √ |
| **Turkey** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **United Kingdom** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **United States** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Venezuela** | 05/01/99 | √ | √ | x | √ | 15/03/00 | 22/11/96 | √ | x | √ |

Note: The table shows the data availability for sector equity price indices. √ indicates availability for the full sample period, ***x*** means that no data is available, and a date indicates the starting date of a particular index series.

## Annex 2: Variable definitions and sources

| Variable definition: | Source: |
|---|---|
| **US monetary policy shocks** – change of the Fed funds futures rates in the 30 minutes around FOMC policy announcements on FOMC meeting days | Gürkaynak, Sack, and Swanson (2005) |
| **Equity market returns –** Log changes in Datastream price indices for 10 sectors and 50 countries | Datastream |
| **Exchange rates, money market rates and bond yields –** Log changes in daily spot exchange rates against the US dollar, 3-month (mostly) money market rates and 10-year bonds | Bloomberg, Datastream and national sources |
| **Trade –** the sum of imports and exports of goods and services between country *i* and the United States or the rest of the world (ROW), as a ratio of GDPs of country *i* and the US or ROW | IFS, IMF |
| **FDI stocks –** sum of FDI asset and liability holdings between country *i* and the United States or the rest of the world, as a ratio of GDPs of country *i* and the US or ROW | UNCTAD |
| **Portfolio equity and portfolio debt stocks –** sum of asset and liability holdings, averaged over 2001-2003, between country *i* and the United States or the rest of the world, as a ratio of GDPs of country *i* and the US or ROW | Coordinated Portfolio Investment Survey (CPIS), IMF |
| **Cross-border loans –** sum of asset and liability holdings of claims of banks between country *i* and the United States or the rest of the world, as a ratio of GDPs of country *i* and the US or ROW | International Locational Banking Statistics (ILB), BIS |
| **Capital account openness –** dummy equal to one if a country had fully liberalized its capital account and zero otherwise | Annual Report of Exchange Arrangements and Exchange Restrictions (AREAER), IMF |
| **Equity market openness –** dummy equal to one if a country had fully liberalized its equity market and zero otherwise | Kaminsky and Schmukler (2003), Bussiere and Fratzscher (2004) |
| **Domestic financial sector openness –** dummy equal to one if a country had fully liberalized its domestic financial system and zero otherwise | Kaminsky and Schmukler (2003), Bussiere and Fratzscher (2004) |
| **Stock market capitalization** – stock market capitalization relative to domestic GDP | Datastream and IFS |
| **Volatility of exchange rate –** standard deviation of daily exchange rate changes (either in effective terms or vis-à-vis the US dollar) over the previous 12 months | IFS, IMF and JP Morgan |
| **Exchange rate regime –** dummy equal to zero if a country's exchange rate is fixed (classification 1 or 2 of Reinhart-Rogoff) and one if it is more flexible (classification 3 or 4) | Reinhart and Rogoff (2004) |
| **GDP correlation –** bilateral correlation of annual real GDP growth rates between a particular country and the United States over the period 1980-2003 | IFS, IMF and OECD |
| **Net indebtedness –** sum of liabilities of FDI, portfolio investment and other investment as a ratio to GDP | UNCTAD, CPIS and BIS |
| **Geographic distance** – log bilateral great circle distance in miles between economic centers of source country and host country | Andy Rose's website |

**Figure 1: US monetary policy shocks, February 1994-December 2004**




Note: The figure shows the US monetary policy shocks (in basis points), based on the reaction of Fed funds futures rates, in the 30 minutes around FOMC policy announcements on FOMC meeting days.

## Table 1: Summary statistics

| | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| **US MONETARY POLICY SHOCK** | -1.388 | 9.035 | -43.8 | 16.3 |
| **OPENNESS, EXCHANGE RATES AND MACROECONOMIC VARIABLES** | | | | |
| A. OPENNESS | | | | |
| Capital account | 0.643 | 0.479 | 0 | 1 |
| Equity market | 0.894 | 0.308 | 0 | 1 |
| Domestic financial sector | 0.878 | 0.327 | 0 | 1 |
| Stock market capitalisation | 0.677 | 4.951 | 0.132 | 113.5 |
| B. EXCHANGE RATE | | | | |
| Volatility of effective exchange rate | 0.027 | 0.030 | 0 | 1.086 |
| Volatility vis-à-vis US dollar | 0.028 | 0.035 | 0 | 1.894 |
| Regime - de jure | 0.689 | 0.463 | 0 | 1 |
| C. OTHER | | | | |
| GDP correlation with US | 0.365 | 0.311 | -0.131 | 0.889 |
| Net indebtedness | -0.009 | 0.114 | -0.361 | 0.474 |
| Geographic distance | 8.585 | 0.420 | 6.981 | 9.154 |
| **REAL AND FINANCIAL INTEGRATION** | | | | |
| A. WITH THE WORLD - ASSETS & LIABILITIES, IN- & OUTFLOWS | | | | |
| Total trade | 0.137 | 0.115 | 0.027 | 0.960 |
| Total capital | 0.210 | 0.338 | 0.084 | 2.577 |
| FDI | 0.078 | 0.134 | 0.036 | 1.189 |
| Portfolio equity | 0.065 | 0.091 | 0.024 | 0.053 |
| Portfolio debt | 0.012 | 0.016 | 0.008 | 0.064 |
| Other investment/loans | 0.114 | 0.223 | 0.000 | 1.737 |
| B. WITH THE UNITED STATES - ASSETS & LIABILITIES, IN- & OUTFLOWS | | | | |
| Total trade | 0.003 | 0.007 | 0.008 | 0.045 |
| Total capital | 0.018 | 0.020 | 0.010 | 0.098 |
| FDI | 0.044 | 0.048 | 0.004 | 0.051 |
| Portfolio equity | 0.008 | 0.015 | 0.001 | 0.066 |
| Portfolio debt | 0.019 | 0.018 | 0.004 | 0.066 |
| Other investment/loans | 0.026 | 0.058 | 0.001 | 0.034 |

Note: The table shows summary statistics for the monetary policy shock, in basis points; the openness, exchange rate and macroeconomic variables, as defined in the text and in Annex 2; and the financial integration variables, in percent of GDP of country *i*.

## Table 2: Transmission of US monetary policy shocks – benchmark model

| | Benchmark effects | Parameter estimates β | | *std error* |
|---|---|---|---|---|
| (1) | United States, weighted index | -0.079 | *** | *0.017* |
| (2) | United States, unweighted index | -0.065 | *** | *0.013* |
| (3) | International transmission, weighted indices | -0.045 | *** | *0.007* |
| (4) | International transmission, unweighted indices | -0.038 | *** | *0.006* |

Note: The table shows the response of equity returns to US monetary policy shocks estimated as

$$r_{it} = \alpha_i + \beta S_t + \sum_n \delta_n Z_{i,t} + \varepsilon_{it} \quad (1)$$

for only US equity markets in rows (1) and (2), and in a panel setting of the equity return market indices of 50 countries to US, using country-fixed effects, in rows (3) and (4). Rows (1) and (3) show results with a weighted index, based on relative market capitalization of the stocks in the index, rows (2) and (4) with unweighted indices, i.e. unweighted averages of 10 sector return indices. Sample: Daily data, February 1994 - December 2004 (including 93 FOMC meetings). ***, ** and * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 3: Transmission of US monetary policy shocks: type of US monetary policy shock

| Monetary policy shock | Parameter estimates $\beta_1$ | *std error* | $\beta_2$ | *std error* | Difference p-value |
|---|---|---|---|---|---|
| ***Weighted indices*** | | | | | |
| (1) Monetary policy: no change vs. change | -0.038 *** | *0.008* | -0.047 *** | *0.003* | 0.305 |
| (2) Directional change: no vs. yes | -0.044 *** | *0.003* | -0.052 *** | *0.006* | 0.255 |
| (3) Monetary policy shock: negative vs. positive | -0.047 *** | *0.003* | -0.040 *** | *0.007* | 0.382 |
| (4) Monetary policy shock: small vs. large | -0.046 *** | *0.003* | -0.042 *** | *0.007* | 0.558 |
| (5) Volatility: small vs. large | -0.047 *** | *0.008* | -0.044 *** | *0.013* | 0.855 |
| ***Unweighted indices*** | | | | | |
| (6) Monetary policy: no change vs. change | -0.033 ** | *0.016* | -0.039 *** | *0.007* | 0.713 |
| (7) Directional change: no vs. yes | -0.039 *** | *0.007* | -0.037 *** | *0.013* | 0.902 |
| (8) Monetary policy shock: negative vs. positive | -0.039 *** | *0.007* | -0.034 ** | *0.015* | 0.491 |
| (9) Monetary policy shock: small vs. large | -0.039 *** | *0.007* | -0.036 ** | *0.015* | 0.882 |
| (10) Volatility: small vs. large | -0.039 *** | *0.007* | -0.039 *** | *0.012* | 0.998 |

Note: The model estimates the effect of US monetary policy shocks on 50 country indices, depending on the type of the monetary policy shock. The model specification is as follows

$$r_{it} = \alpha_i + \beta_1 S_t D_t + \beta_2 S_t (1 - D_t) + \sum_n \delta_n Z_{i,t} + \varepsilon_{it} \quad (2)$$

with $D_t$ =1 e.g. if there was no change in monetary policy at a particular FOMC meeting and $D_t$=0 otherwise, and analogously for other asymmetries. Small and large monetary policy shocks are defined by the average surprise over the full sample. Equivalently, for the volatility case, small and large are defined relative to the average volatility over the full sample. "Difference" shows the significance level of tests for the null hypothesis that two respective coefficients are equal. The upper part shows results using weighted, the lower with unweighted indices. ***, ** and * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 4: Country effects of transmission of US monetary policy shocks

| | Parameter estimates | | Diff. to mean |
|---|---|---|---|
| **Country:** | $\beta_i$ | *p-value* | $\beta_i - \beta$ |
| Argentina | -0.039 *** | *0.000* | 0.002 |
| Australia | -0.060 *** | *0.000* | -0.019 *** |
| Austria | -0.047 *** | *0.000* | -0.006 |
| Belgium | -0.035 *** | *0.000* | 0.007 |
| Brazil | -0.041 *** | *0.000* | 0.000 |
| Canada | -0.059 *** | *0.004* | -0.019 |
| Chile | -0.012 ** | *0.039* | 0.029 *** |
| China | 0.014 | *0.130* | 0.056 *** |
| Colombia | 0.015 | *0.422* | 0.057 *** |
| Cyprus | -0.048 *** | *0.000* | -0.007 |
| Czech Republic | -0.043 *** | *0.000* | -0.002 |
| Denmark | -0.042 *** | *0.000* | -0.001 |
| Finland | -0.073 *** | *0.000* | -0.033 *** |
| France | -0.040 *** | *0.001* | 0.001 |
| Germany | -0.037 *** | *0.000* | 0.004 |
| Greece | -0.046 *** | *0.000* | -0.005 |
| Hong Kong | -0.075 *** | *0.000* | -0.035 ** |
| Hungary | -0.042 *** | *0.000* | -0.001 |
| India | -0.011 | *0.290* | 0.031 *** |
| Indonesia | -0.159 *** | *0.009* | -0.119 * |
| Ireland | -0.036 *** | *0.002* | 0.005 |
| Israel | -0.036 *** | *0.000* | 0.005 |
| Italy | -0.050 *** | *0.000* | -0.010 |
| Japan | -0.011 ** | *0.035* | 0.030 *** |
| Korea | -0.101 *** | *0.000* | -0.061 *** |
| Luxemburg | -0.053 *** | *0.000* | -0.012 |
| Malaysia | -0.029 *** | *0.000* | 0.013 * |
| Mexico | -0.011 | *0.373* | 0.031 ** |
| Netherlands | -0.050 *** | *0.000* | -0.009 |
| New Zealand | -0.041 *** | *0.000* | 0.001 |
| Norway | -0.057 *** | *0.000* | -0.016 ** |
| Pakistan | 0.031 | *0.149* | 0.074 *** |
| Peru | -0.001 | *0.897* | 0.041 *** |
| Philippines | -0.037 ** | *0.015* | 0.004 |
| Poland | -0.030 *** | *0.001* | 0.012 |
| Portugal | -0.030 *** | *0.001* | 0.011 |
| Romania | -0.002 | *0.781* | 0.039 *** |
| Russia | -0.043 ** | *0.018* | -0.002 |
| Singapore | -0.051 *** | *0.001* | -0.010 |
| South Africa | -0.044 *** | *0.000* | -0.003 |
| Spain | -0.059 *** | *0.000* | -0.018 ** |
| Sri Lanka | -0.001 | *0.932* | 0.041 *** |
| Sweden | -0.086 *** | *0.000* | -0.046 *** |
| Switzerland | -0.039 *** | *0.000* | 0.003 |
| Taiwan | -0.036 *** | *0.000* | 0.005 |
| Thailand | -0.059 *** | *0.000* | -0.018 |
| Turkey | -0.117 *** | *0.000* | -0.078 *** |
| United Kingdom | -0.041 *** | *0.000* | 0.000 |
| Venezuela | 0.027 ** | *0.046* | 0.069 *** |

Note: The model estimates the effect of US monetary policy shocks on 10 sector return indices across 50 countries, controlling for country- and sector-fixed effects using:

$$r_{ikt} = \alpha_i + \alpha_k + \sum_i [\beta_i \; S_t \; D_i] + \sum_k [\beta_k \; S_t \; D_k] + \sum_n \delta_n \; Z_{i,t} + \varepsilon_{ikt} \qquad (3)$$

The table shows the country-specific effects $\beta_i$. "Diff. to mean" shows the significance level of tests for the null hypothesis that the country-coefficients are equal to their global average.***, ** and * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 5: Sector effects of transmission of US monetary policy shocks

| Sector: | Parameter estimates $\beta_k$ | *p-value* | Diff. to mean $\beta_k - \beta$ |
|---|---|---|---|
| Financial | -0.044 *** | *0.000* | -0.003 |
| Information technology | -0.074 *** | *0.000* | -0.036 *** |
| Utilities | -0.016 ** | *0.011* | 0.028 *** |
| Non-cyclical services | -0.051 *** | *0.000* | -0.012 * |
| Cyclical services | -0.040 *** | *0.000* | 0.001 |
| Cyclical consumer goods | -0.040 *** | *0.000* | 0.001 |
| Industrial | -0.045 *** | *0.000* | -0.005 |
| Basic industries | -0.034 *** | *0.000* | 0.008 |
| Resources | -0.047 *** | *0.000* | -0.006 |
| Non-cyclical consumer goods | -0.026 *** | *0.001* | 0.017 *** |

Note: The model estimates the effect of US monetary policy shocks on 10 sector return indices across 50 countries, controlling for country- and sector-fixed effects using:

$$r_{ikt} = \alpha_i + \alpha_k + \sum_i [\beta_i \; S_t \; D_i] + \sum_k [\beta_k \; S_t \; D_k] + \sum_n \delta_n \; Z_{i,t} + \varepsilon_{ikt} \qquad (3)$$

The table shows the sector-specific effects $\beta_k$. "Diff. to mean" shows the significance level of tests for the null hypothesis that the sector-coefficients are equal to their global average. ***, ** and * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 6: The role of openness, the exchange rate and other macroeconomic variables

| | | parameter estimates | | difference | |
|---|---|---|---|---|---|
| | | $\beta_X$ | *std error* | (2) | (3) |
| **A. OPENNESS** | | | | | |
| **Capital account** | (1) closed | -0.031 *** | *0.008* | 0.200 | |
| | (2) open | -0.041 *** | *0.007* | | |
| **Equity market** | (1) closed | -0.001 | *0.012* | **0.001** | |
| | (2) open | -0.041 *** | *0.007* | | |
| **Domestic financial** | (1) closed | -0.010 | *0.012* | **0.012** | |
| **sector** | (2) open | -0.040 *** | *0.006* | | |
| **Stock market** | (1) low | -0.022 *** | *0.008* | **0.003** | **0.006** |
| **capitalisation** | (2) medium | -0.046 *** | *0.008* | | 0.764 |
| | (3) high | -0.044 *** | *0.007* | | |
| **B. EXCHANGE RATE** | | | | | |
| **Volatility of effective** | (1) low | -0.027 *** | *0.007* | 0.284 | **0.001** |
| **exchange rate** | (2) medium | -0.036 *** | *0.008* | | **0.020** |
| | (3) high | -0.056 *** | *0.008* | | |
| **Volatility vis-à-vis** | (1) low | -0.027 *** | *0.007* | 0.261 | **0.001** |
| **US dollar** | (2) medium | -0.036 *** | *0.008* | | **0.019** |
| | (3) high | -0.055 *** | *0.008* | | |
| **Regime - de jure** | (1) fix | -0.031 *** | *0.007* | 0.333 | |
| | (2) float | -0.038 *** | *0.007* | | |
| **C. OTHER** | | | | | |
| **GDP correlation** | (1) low | -0.026 *** | *0.008* | 0.193 | **0.012** |
| **with US** | (2) medium | -0.036 *** | *0.007* | | **0.098** |
| | (3) high | -0.048 *** | *0.008* | | |
| **Net indebtedness** | (1) low | -0.041 *** | *0.010* | 0.114 | 0.640 |
| | (2) medium | -0.052 *** | *0.010* | | **0.099** |
| | (3) high | -0.036 *** | *0.006* | | |
| **Geographic distance** | (1) low | -0.037 *** | *0.007* | 0.389 | 0.679 |
| | (2) medium | -0.032 *** | *0.008* | | 0.307 |
| | (3) high | -0.040 *** | *0.007* | | |

Note: The model estimates the effect of US monetary policy shocks on 50 unweighted country indices, testing for time heterogeneity *and* cross-sectional heterogeneity, as follows

$$r_{it}^{u} = \alpha_i + (\beta_1 S_t) X_{it}^{low} + (\beta_2 S_t) X_{it}^{mid} + (\beta_3 S_t) X_{it}^{high} + \eta_1 X_{it}^{low} + \eta_2 X_{it}^{mid} + \eta_3 X_{it}^{high} + \sum_n \delta_n Z_{i,t} + \varepsilon_{it}^{u} \quad (4)$$

where $X^n$ are 0-1 dummies for $X^{low}$=1 if the respective variable $X_{i,t}$ in country *i* at time *t* is in the lowest third compared to other countries respective value and over time; and analogously for $X^{mid}$ and $X^{high}$. For the openness and exchange rate regime variables there are only two respective categories. Note that not all X are varying over time, but some are purely cross-sectional $X_i$, as discussed in the text. "Difference" shows the significance level of tests for the null hypothesis that two respective coefficients are equal. ***, ** and * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 7: The role of real and financial integration

| | | parameter estimates | | difference | |
|---|---|---|---|---|---|
| | | $\beta_X$ | *std error* | (2) | (3) |
| **A. WITH THE WORLD - ASSETS & LIABILITIES, IN- & OUTFLOWS** | | | | | |
| **Total trade flows** | (1) low | -0.024 *** | *0.008* | **0.084** | **0.018** |
| | (2) medium | -0.037 *** | *0.007* | | 0.191 |
| | (3) high | -0.047 *** | *0.008* | | |
| **Total capital stocks** | (1) low | -0.018 ** | *0.008* | **0.000** | **0.010** |
| | (2) medium | -0.048 *** | *0.008* | | 0.518 |
| | (3) high | -0.043 *** | *0.008* | | |
| **FDI** | (1) low | -0.019 ** | *0.008* | **0.001** | **0.003** |
| | (2) medium | -0.045 *** | *0.008* | | 0.976 |
| | (3) high | -0.045 *** | *0.007* | | |
| **Portfolio equity** | (1) low | -0.024 *** | *0.007* | **0.002** | **0.015** |
| | (2) medium | -0.047 *** | *0.007* | | 0.490 |
| | (3) high | -0.043 *** | *0.007* | | |
| **Portfolio debt** | (1) low | -0.019 *** | *0.007* | **0.000** | **0.013** |
| | (2) medium | -0.051 *** | *0.008* | | 0.242 |
| | (3) high | -0.042 *** | *0.008* | | |
| **Other investment loans** | (1) low | -0.015 | *0.009* | **0.004** | **0.007** |
| | (2) medium | -0.048 *** | *0.008* | | 0.841 |
| | (3) high | -0.046 *** | *0.008* | | |
| **B. WITH THE UNITED STATES - ASSETS & LIABILITIES, IN- & OUTFLOWS** | | | | | |
| **Total trade flows** | (1) low | -0.031 *** | *0.007* | **0.008** | 0.611 |
| | (2) medium | -0.050 *** | *0.008* | | **0.015** |
| | (3) high | -0.035 *** | *0.007* | | |
| **Total capital stocks** | (1) low | -0.047 *** | *0.009* | 0.588 | 0.130 |
| | (2) medium | -0.051 *** | *0.009* | | **0.018** |
| | (3) high | -0.035 *** | *0.006* | | |
| **FDI** | (1) low | -0.043 *** | *0.008* | 0.652 | 0.281 |
| | (2) medium | -0.039 *** | *0.008* | | 0.467 |
| | (3) high | -0.035 *** | *0.006* | | |
| **Portfolio equity** | (1) low | -0.035 *** | *0.008* | 0.319 | 0.745 |
| | (2) medium | -0.042 *** | *0.008* | | 0.107 |
| | (3) high | -0.033 *** | *0.006* | | |
| **Portfolio debt** | (1) low | -0.042 *** | *0.009* | 0.204 | 0.312 |
| | (2) medium | -0.049 *** | *0.009* | | **0.060** |
| | (3) high | -0.034 *** | *0.006* | | |
| **Other investment loans** | (1) low | -0.025 *** | *0.008* | **0.002** | **0.034** |
| | (2) medium | -0.049 *** | *0.008* | | 0.243 |
| | (3) high | -0.040 *** | *0.007* | | |

Note: The model estimates the effect of US monetary policy shocks on 50 unweighted country indices, testing for time heterogeneity *and* cross-sectional heterogeneity, as follows

$$r_{it}^{u} = \alpha_i + (\beta_1 S_t) X_{it}^{low} + (\beta_2 S_t) X_{it}^{mid} + (\beta_3 S_t) X_{it}^{high} + \eta_1 X_{it}^{low} + \eta_2 X_{it}^{mid} + \eta_3 X_{it}^{high} + \sum_n \delta_n Z_{i,t} + \varepsilon_{it}^{u} \quad (4)$$

where $X^n$ are 0-1 dummies for $X^{low}$=1 if the respective variable $X_{i,t}$ in country *i* at time *t* is in the lowest third compared to other countries respective value and over time; and analogously for $X^{mid}$ and $X^{high}$. Note that not all X are time-varying, but are cross-sectional $X_i$, as discussed in the text. "Difference" shows the significance level of tests for the null hypothesis that two respective coefficients are equal. ***, ** and * indicate statistical significance at the 99%, 95% and 90% levels, respectively.

## Table 8: The role of real and financial integration with the US, separated into inflows and outflows or assets and liabilities

| | | parameter estimates | | difference | |
|---|---|---|---|---|---|
| | | $\beta_X$ | *std error* | (2) | (3) |
| **A. FROM THE UNITED STATES** | | | | | |
| **Trade** | (1) low | -0.036 *** | *0.009* | 0.610 | 0.530 |
| | (2) medium | -0.033 *** | *0.007* | | 0.198 |
| | (3) high | -0.042 *** | *0.007* | | |
| **Total capital** | (1) low | -0.038 *** | *0.011* | 0.274 | 0.849 |
| | (2) medium | -0.048 *** | *0.009* | | 0.120 |
| | (3) high | -0.036 *** | *0.006* | | |
| **FDI** | (1) low | -0.025 *** | *0.009* | **0.056** | 0.115 |
| | (2) medium | -0.044 *** | *0.008* | | 0.455 |
| | (3) high | -0.039 *** | *0.006* | | |
| **Portfolio equity** | (1) low | -0.033 *** | *0.007* | 0.416 | 0.191 |
| | (2) medium | -0.039 *** | *0.007* | | 0.558 |
| | (3) high | -0.042 *** | *0.007* | | |
| **Portfolio debt** | (1) low | -0.037 *** | *0.009* | 0.193 | 0.909 |
| | (2) medium | -0.046 *** | *0.010* | | 0.222 |
| | (3) high | -0.036 *** | *0.006* | | |
| **Other investment loans** | (1) low | -0.030 *** | *0.010* | 0.550 | 0.265 |
| | (2) medium | -0.036 *** | *0.008* | | 0.468 |
| | (3) high | -0.042 *** | *0.007* | | |
| **B. TO THE UNITED STATES** | | | | | |
| **Trade** | (1) low | -0.040 *** | *0.009* | 0.700 | 0.750 |
| | (2) medium | -0.037 *** | *0.007* | | 0.961 |
| | (3) high | -0.037 *** | *0.007* | | |
| **Total capital** | (1) low | -0.051 *** | *0.010* | **0.087** | **0.031** |
| | (2) medium | -0.037 *** | *0.008* | | 0.663 |
| | (3) high | -0.034 *** | *0.006* | | |
| **FDI** | (1) low | -0.027 *** | *0.008* | **0.003** | 0.240 |
| | (2) medium | -0.051 *** | *0.008* | | **0.013** |
| | (3) high | -0.036 *** | *0.006* | | |
| **Portfolio equity** | (1) low | -0.044 *** | *0.009* | 0.367 | 0.184 |
| | (2) medium | -0.037 *** | *0.008* | | 0.672 |
| | (3) high | -0.034 *** | *0.005* | | |
| **Portfolio debt** | (1) low | -0.053 *** | *0.009* | 0.315 | **0.000** |
| | (2) medium | -0.045 *** | *0.008* | | **0.007** |
| | (3) high | -0.027 *** | *0.006* | | |
| **Other investment loans** | (1) low | -0.032 *** | *0.008* | 0.120 | 0.546 |
| | (2) medium | -0.044 *** | *0.007* | | 0.244 |
| | (3) high | -0.037 *** | *0.006* | | |

Note: The model estimates the effect of US monetary policy shocks on 50 unweighted country indices, testing for time heterogeneity *and* cross-sectional heterogeneity, as follows

$$r_{it}^{u} = \alpha_i + (\beta_1 S_t) X_{it}^{low} + (\beta_2 S_t) X_{it}^{mid} + (\beta_3 S_t) X_{it}^{high} + \eta_1 X_{it}^{low} + \eta_2 X_{it}^{mid} + \eta_3 X_{it}^{high} + \sum_n \delta_n Z_{i,t} + \varepsilon_{it}^{u} \quad (4)$$

where $X^n$ are 0-1 dummies for $X^{low}$=1 if the respective variable $X_{i,t}$ in country *i* at time *t* is in the lowest third compared to other countries respective value and over time; and analogously for $X^{mid}$ and $X^{high}$. Note that not all X are time-varying, but are cross-sectional $X_i$, as discussed in the text. "Difference" shows the significance level of tests for the null hypothesis that two respective coefficients are equal. ***, ** and * indicate statistical significance at the 99%, 95% and 90% levels, respectively.