Financial Frictions and the Strength of Monetary Transmission

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Abstract

This paper examines the effect of financial frictions on the strength of the monetary transmission mechanism. Credit channel theory implies that the transmission mechanism of monetary policy should be stronger in countries with high levels of financial frictions, all else equal. The intuition is that in these countries, external finance premiums are more sensitive to firms' financial leverage. By affecting asset prices, therefore, monetary policy has greater impact on external finance premiums and output. We test this theoretical prediction by estimating SVAR models on cross-country data to generate indicators for the strength of monetary transmission. We find a positive relationship between various measures of financial frictions and the strength of monetary transmission, supporting the predictions of credit channel theory.

JEL Classification: E44; F31; F41

Keyword(s): monetary transmission, financial frictions, bankruptcy costs.

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1. Introduction

According to the credit channel theory of the monetary transmission mechanism, frictions in credit markets that generate a wedge between the costs of raising funds externally and internally, the external finance premium, help explain the effect of monetary policy on real variables. For example, the cost of monitoring in credit markets suggests poorly-collateralized borrowers will pay a higher premium for external funds than larger, more-collateralized borrowers. The credit channel of monetary policy is a mechanism through which the impact of monetary policy shocks on the real economy is amplified through its effect on external finance premiums. In particular, by affecting this wedge countercyclically, monetary policy has an additional impact on real variables beyond its standard effect through the cost of capital.

The credit channel mainly operates through two conduits: the balance sheet channel, in which monetary policy affects borrowers' net worth and debt collateral, and the bank lending channel, in which policy impacts the level of intermediated credit (c.f. Bernanke and Gertler, 1995 for a review of the credit channel). These channels have been incorporated into general equilibrium models through costly-state-verification to enhance their empirical relevance (c.f. the financial accelerator model of Bernanke, Gertler and Gilchrist,1999, hereafter BGG). A key result from these models is that the strength of both channels and therefore the broader credit channel increases with the level of financial frictions.[1] In particular, in financial systems where financial frictions such as the cost of monitoring (state verification cost) are more pronounced, monetary policy has a larger impact on external premiums through the credit channel.[2]

[1] More recent studies identify the bank capital and risk taking channels as alternative transmission mechanisms. Under the bank capital channel, the strength of banks' balance sheets (instead of the borrowers') is the main focus. Under the risk taking channel, banks search for higher yield in response to a reduction in risk aversion. For both of these channels, higher financial frictions are argued to prompt higher borrowing premiums for banks. Blum and Hcllwig (1995) and Van Den Heuvel (2002) provide a detailed discussion of the bank capital channel. Borio and Zhu (2008) and Rajan (2005) do the same for the risk taking channel.

[2] The amplification mechanism in the costly-state-verification models can be summarized as follows: shocks that affect borrowers' net worth also affect their borrowing premiums. This in turn decreases investment, output and asset prices further

It is important to note at this point that the literature does not identify the credit channel as a distinct alternative to the other monetary transmission mechanisms, such as the more traditional cost of capital channel (Bernanke and Gertler, 1995). Rather, it is argued to be a mechanism in which frictions in credit markets amplify the effect of monetary policy on real economic activity. In this paper, we test whether higher levels of financial frictions are consistent with stronger monetary transmission (hereafter MTS) and the amplification mechanism defined by the credit channel theory.

In conducting this analysis we use cross-country data. Using cross-country data is preferable to comparing MTS within a specific country at different time periods. The reason is that financial frictions are relatively stable over time, especially compared to monetary policy.[3] In our baseline model, we use bankruptcy recovery rates, the proportion of a firm's value creditors can recover from a defaulting firm, as an indicator of financial frictions. This variable provides a close match to the source of financial frictions in costly-state-verification models. Our paper therefore represents, to the best of our knowledge, a first attempt at testing the relationship between financial frictions and MTS implied by costly-state-verification models.

We begin our empirical investigation by generating proxies for MTS in each country. To do so, we obtain the maximum amplitude of output responses to a monetary policy shock (a 100 basis points interest rate shock). Impulse responses are obtained from a structural vector autoregressive (SVAR) model, and monetary policy shocks are identified using the strategies of Kim (1999) and Hoffman (2007) for G-8 and non-G-8 countries, respectively.[4] For most of the countries, the impulse responses do not show any evidence of the price and liquidity puzzles (the

decreasing net worth and borrowing premiums, and creates an adverse feedback mechanism in credit markets. Since the response of borrowing premiums to the changes in borrowers' net worth is positively related to the costs of bankruptcy (the source of financial frictions), the adverse feedback mechanism is amplified when there are higher levels of financial frictions.

[3] See for example Djankov et al. (2007, 2008) for empirical evidence that support the stability of financial frictions.

[4] See the discussion by Elbourne and de Haan (2006) on the usefulness of estimating structural VARs in comparing the monetary transmission mechanisms across countries.

increase in prices and money aggregates following an increase in interest rates), providing some validation for our approach.

Next, we use our measure of MTS in a pooled regression of up to 56 countries from 1984 through 2008 to test the effect of recovery rates on the MTS variable. Our results reveal a negative and statistically significant relationship between recovery rates and MTS that is robust to alternative specifications. Specifically, the coefficient of the recovery rate variable (in our benchmark model) implies that a one percentage point increase in recovery rates leads to a 0.02 percentage point drop in the output response to a monetary policy shock. A value of 0.02 implies that if Malaysia were to increase its recovery rate to the level of the UK's, it would reduce the response of output from 0.72% to 0.13%. Thus this study provides cross-country evidence on the importance of financial frictions in explaining the transmission mechanism of monetary policy.

As an additional test of the relationship between recovery rates and MTS, we generate an alternative measure of financial frictions and determine whether this measure is related to MTS. As mentioned above, credit channel theory predicts that as the level of financial frictions increases, the external finance premium becomes more sensitive to firm leverage, i.e. leverage sensitivity increases. We can therefore use leverage sensitivity as a proxy for financial frictions. Using financial market data to predict financial frictions is an alternative to survey based measures of financial frictions and is a contribution of this paper. To capture leverage sensitivity in each country, we estimate, using firm level data, the effect of firm leverage on corporate bond spreads. Using the estimated leverage sensitivities, we reinvestigate the relationship between financial frictions and MTS and again find support for the model's predictions.

A key implication of our results is that lowering the level of financial frictions may weaken the ability of central banks to affect economic activity. While MTS in the United States

has been questioned (c.f. Ashcraft, 2006), monetary transmission may be more potent in other countries depending on the characteristics of a country's financial institutions. In countries with greater financial frictions, lenders may be more sensitive to a shift in the health of the borrowers' balance sheets.[5]

Our paper complements a broader literature on the effect of institutions on the effectiveness of monetary policy. Cecchetti (1999), for example, using data from 11 European countries, finds that nations with legal origins more protective of creditor rights have weaker MTS. Mishra et al., (2010) argue that central bank independence (CBI) can augment MTS. The argument has also been made that financial market development reduces MTS (Elbourne and de Haan, 2006). We incorporate this broader literature by including as controls measures of legal origin, CBI, and financial market development. We find that financial frictions have an independent effect on MTS after controlling for these variables.

The rest of the paper is organized as follows: in Section 2 we generate our indicator of MTS. In Section 3 we estimate the effect of the bankruptcy recovery rate, our main indicator of financial frictions, on MTS. Sections 4 and 5 present robustness tests. Section 6 concludes.

2. Approximating MTS

We begin our empirical analysis by approximating MTS in different countries. It is important to note here that our goal in this section is to generate a proxy for MTS that is comparable across countries. This task is difficult, however, since variables that represent the stance of monetary policy or economic output are likely to vary across countries. Nevertheless, we use the same definitions for monetary policy (the money market rate) and output (the monthly production index) for each country to facilitate a cross-country comparison of MTS.

[5] Indeed, a significant number of studies point to a stronger monetary transmission outside of the U.S. (Angelopoulou and Gibson, 2009; Arena et al., 2006; Atta-Mensah and Dib, 2008; Braun and Larrain, 2005; Gambacorta, 2005).

Some previous attempts to quantify MTS have estimated VAR models to measure the responses to an unanticipated tightening of monetary policy and then used forecast error variance decompositions (FEVD) obtained from these models for inference. MTS in these studies (c.f. Christiano et al., 1996; Kim, 1999; Kim and Roubini, 2000) is then measured by the percentage of variations in output explained by monetary policy. Most of these studies analyze one country or a group of similar countries. Alternatively, Ceccheti (1999) uses the maximum response of output and inflation as a measure of monetary policy effectiveness. We choose to follow this latter approach and approximate MTS by the maximum amplitude of output responses to a 100 basis points shock to interest rates. This method is preferable to FEVDs for our cross country analysis since the countries in our sample are at different stages of development and their economies face different degrees of shocks.

SVAR Models

To derive our measure for MTS, we estimate a SVAR model for each country. Each country specification includes the following variables: the industrial production index, ip_t, the consumer price index (CPI), cpi_t, the monetary aggregate (M1), m_t, the short term interest rate (the money market rate), r_t, and the world export price index (measured in local currency), $wxpi_t$. This SVAR model can be represented by the following vector: $Y_t = [ip_t, cpi_t, m_t, r_t, wxpi_t]'$.

These variables are widely used in the open economy literature. The industrial production index and the CPI measure overall economic activity and prices, respectively. We include the monetary aggregate to separate money demand and money supply shocks. The interest rate variable captures the monetary authority's reaction to the other variables in the model. The world export price index is included to account for the monetary responses to external price shocks and to external developments that affect the exchange rate. This variable helps us identify monetary

policy shocks that are not induced by exchange rates. The data are monthly, span the period 1984:1-2008:5, and are obtained from the International Financial Statistics (IFS) database for the 56 countries listed in Appendix A.[6,7,8]

Identification

The identification of monetary policy shocks in SVAR models is difficult, and the literature seems to be far from a consensus on this subject. Moreover, comparing the effects of monetary policy across countries (as we do in this paper) amplifies the level of difficulty.

We follow two strategies to check the robustness of our analysis. First, we choose an identification strategy similar to Kim (1999) for G-8 countries and Hoffmann (2007) for others. The appeal of these strategies has been their ability to find responses to monetary policy shocks that are fairly similar to the predictions of theory. Furthermore, using different identification strategies enhances our ability to capture the effects of monetary policy in economies that are dissimilar. The drawback to this approach, however, is that differences across countries may be generated artificially by the differences in model specification. Therefore, as a robustness test,

[6] The industrial production index was available for a majority of the countries in our data set. When these data were not available, we used other indicators for monthly economic activity. These indicators (by country) are provided in Appendix A. The money market rate and monetary aggregate data for 11 countries (Austria, Chile. Colombia, Cyprus, Czech Republic, Hong Kong, Hungary, Israel, Luxembourg, Nigeria, Russia) were obtained through their central bank websites.

[7] This appendix also provides the IFS definitions of the macroeconomic variables used in our analysis.

[8] We should point out that some countries in our sample have intervened heavily to limit exchange rate fluctuations or followed hard pegs during the sample period (e.g. Hong Kong, European Monetary Union countries). For these countries, interest rate fluctuations are mostly caused by the interest rates fluctuations in the foreign country/countries whose currency/currencies they are pegging to (although we measure interest rate shocks that are orthogonal to the U.S. interest rate shocks for non G-8 countries, not all of these countries have pegged to the U.S dollar only during the sample period). For these economies, we therefore capture how much foreign interest rate movements are transmitted to the domestic real economy. In other words, monetary transmission is induced by international shocks and not domestic shocks. In this paper our focus is the relationship between financial frictions and the output effects of interest rate shocks, regardless of whether they are domestically and/or internationally induced. But we should note that if, for example, financial frictions are positively related to output effects of interest rate shocks, this does not imply stronger monetary policy but rather that foreign interest rate shock transmission to the domestic economy is stronger. In addition, some countries in our sample such as Peru and Uruguay have had highly dollarized economies during the sample period. By measuring the effect of interest rate shocks on output in these economies, we are therefore capturing the effect of monetary policy that is transmitted primarily through exchange rates (expansionary monetary policy causing a depreciation of the currency and increasing exports and output. See also Acosta-Ormaechea and Coble, 2011 for a discussion of monetary transmission in dollarized economies). To the extent that exchange rates impact borrower and lender balance sheets, credit channel theory predicts that financial frictions would amplify the effect of monetary policy shocks.

we use the same strategy (Kim, 1999) for industrialized and developing countries to identify monetary policy shocks. We proceed by discussing our benchmark identification strategy.

G-8 countries

To identify monetary policy shocks, we follow the strategy in Kim (1999). To measure these shocks, we assume that the monetary policy variable does not respond to output and prices contemporaneously mainly due to lags in announcement. We also assume that output and prices are not affected contemporaneously by financial variables due to adjustment costs. The monetary aggregate is included to account for the liquidity puzzle and to minimize the risk that the monetary policy shock is not independent of money demand shocks. Consistent with economic theory, money demand is assumed to depend contemporaneously on real income and the interest rate. The world export price index is affected by shocks to every other variable. Although individual countries are not large enough to affect the world export price index, domestic developments can affect exchange rates and therefore the price of exports in local currency units.

These identifying restrictions on the contemporaneous structural parameters are summarized in the equations below.

$$\begin{bmatrix} e_{ip} \\ e_{cpi} \\ e_{md} \\ e_{ms} \\ e_{wxpi} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ P_{21} & 1 & 0 & 0 & 0 \\ P_{31} & P_{32} & 1 & P_{34} & 0 \\ 0 & 0 & P_{43} & 1 & P_{45} \\ P_{51} & P_{52} & P_{53} & P_{54} & 1 \end{bmatrix} \begin{bmatrix} u_{ip} \\ u_{cpi} \\ u_{m} \\ u_{r} \\ u_{wxpi} \end{bmatrix}$$

where e_{ip}, e_{cpi}, e_{md}, e_{ms}, e_{wxpi} are the structural disturbances and u_{ip}, u_{cpi}, u_{md}, u_{ms}, u_{wxpi} are the reduced form residuals. P_{ij} denote the contemporaneous structural parameters.

Non G-8:

The restrictions used above have done reasonably well in replicating the response of the economy to monetary shocks in G-8 countries. For non G-8 countries, we maintain these restrictions from Kim (1999) for the domestic economy. In addition, following the literature (c.f. Hoffman, 2007), we assume that advance economy output and interest rates are exogenous to the model that describes non G-8 economies. We then estimate the following for non G-8 countries:

$$Y_t = B(L)Y_t + C_0 X_t + C(L)X_t + e_t \tag{1}$$

where Y_t is the endogenous domestic variable vector given by: $Y_t = [ip_t, cpi_t, m_t, r_t, wxpi_t]'$. X_t is the exogenous foreign variable vector given by $X_t = [y^*, r^*]'$, and *B(L)* and *C(L)* are the matrix polynomials in the lag operators. The vector X_t includes the foreign industrial production index and the money market rate. We use the U.S. industrial production index and the federal funds rate for y^* and r^*, respectively.[9]

For a majority of the countries in our sample, Augmented Dickey-Fuller (ADF) tests suggested non-stationarity of the industrial production, consumer price, and world export price indices. However, we do not impose any cointegrating restrictions and instead estimate an unrestricted VAR in levels since this is a convenient setup for measuring the effects of monetary policy in the short run.[10] We do, however, check the robustness of our results by using a vector error correction model (VECM) to take account of the possible cointegration among the endogenous variables in Section 4. A lag length for estimating each VAR is chosen according to the corrected-AIC (Hurvich and Tsai, 1989).

The first row of Table 1 and Appendix A displays summary statistics for MTS. As mentioned above, the identification of monetary policy shocks is far from straightforward. For example, the positive response of inflation to an increase in interest rates (the price puzzle) and

[9] Replacing the U.S. with Germany for countries in the European Union did not change our results significantly.
[10] Alternatively, we measured variables in logs and detrended them using a quadratic time trend and obtained similar results.

the positive response of monetary aggregates to an increase in interest rates (the liquidity puzzle) are the two widely-documented shortcomings of some identification strategies. Although the identification strategy used in Kim (1999) solves these puzzles by including a monetary aggregate to separate money demand and money supply shocks and by including inflation, most of the countries in our sample do not match those in Kim (1999). Nevertheless, we find that the price puzzle is observed in only 4 out of the 56 countries in our sample, and the liquidity puzzle in only 5 countries. To check for the presence of a puzzle, we compute, for each country, the maximum positive response of inflation and the monetary aggregate to a 100 basis point positive shock to the interest rate. If the one-standard-deviation error band around this maximum positive response does not include zero, we identify this result as a puzzle.[11]

We also find that the FEVD (forecast error variance attributable to monetary policy shocks) in our model are within the ranges of values found in the literature with the exception of a few cases, as shown in Table 2. The measures are similar despite the different identification schemes, forecast horizons, frequencies and measures for output and monetary policy stance.

3. Financial frictions and MTS

In this section, we investigate the relationship between MTS and financial frictions. We use the maximum amplitudes of output responses generated in the previous section as proxies for MTS. The key parameter in costly-state-verification models (such as the framework of BGG, 1999) that captures financial frictions is the bankruptcy recovery rate, which measures the percentage of the value of a loan that banks can recover when there is default. The closest match for this parameter is from the World Bank's Doing Business database, which contains the variable, "recovery rate (%)", defined as "how many cents on the dollar claimants recover from

[11] A 24-month forecast horizon was used to compute the maximum positive responses. Appendix B summarizes our findings.

an insolvent firm."[12] In particular, the higher the recovery rate, the lower the level of financial frictions. Of course the recovery rate is only one aspect of financial frictions. We focus on this variable, however, because the close match to the source of financial frictions discussed in BGG (1999) (the monitoring cost coefficient) allows us to more accurately test the predictions of credit channel theory.

Let RR_i and MTS_i denote the recovery rate and MTS for country *i*. The simple correlation between these two variables is -0.44. In this section we determine whether this negative relationship holds after controlling for other factors. We estimate the following model:

$$MTS_i = \alpha_0 + \alpha_1 RR_i + \beta x_i + \varepsilon_i \tag{2}$$

where x_i denotes the vector of country specific control variables. We obtained control variables from the previous literature on the determinants of MTS. First, we include stock market capitalization (% of GDP) to control for financial market development. By doing so, we are able to account for the dampening effect that a developed financial market might have on MTS by providing alternative sources of finance during contractions (Elbourne and de Haan, 2006). An additional reason to include stock market capitalization is that it is also captures small firm presence. In particular, lower values indicate greater small firm presence since small firms tend to depend more on bank finance.[13] Because monetary policy actions change the reserves available to the banking system and, ultimately, the supply of loans, the effect of these actions is

[12] This survey follows the methodology developed by Djankov et al. (2008).

[13] There are, however, a number of potential problems with using stock market capitalization as an indicator of the share of large firms. First, large market capitalization could imply that asymmetric information problems are not severe and that it is not difficult to obtain equity finance, implying more small firms. Second, small firms can list in foreign stock exchanges, further weakening the link between market capitalization and large firm presence. We therefore used other measures of small firm presence as well, namely the percent of firms using banks to finance investment (smaller firms tend to be more reliant on bank finance) and the percent of workers employed by small and medium firms (Ayyagari et al., 2007). The results were very similar.

greater when there are more bank-dependent (i.e. small) firms (Bean et al., 2002; Cecchetti, 1999; Kashyap and Stein, 1997).[14]

Second, we include a measure of CBI since CBI can affect the central bank reaction function and therefore agents' interpretation of what an unanticipated change in monetary policy indicates about future monetary policy. This in turn determines the extent to which changes in short-term interest rates affect long-term rates (Mishra et al., 2010), which amplifies the response of output. We control for CBI using the index in Cukierman et al. (1992), which is based on the turnover rate of central bank governors.[15] Finally, we include legal origin following Cecchetti (1999) as it can impact creditor and shareholder rights. These rights can stimulate the size, health, and concentration of the banking system as well as the development of primary capital markets, all of which can reduce MTS (Cecchetti, 1999). French civil law countries tend to have worse creditor and shareholder rights and enforcement of existing laws compared to English and German legal origin countries. The former, therefore, are predicted to have relatively strong MTS.

We considered a number of additional control variables to address the concern that the recovery rate variable is picking up the effects of other aspects of institutional quality or perhaps even the level of economic development, both of which vary greatly in our large cross-country sample and could conceivably affect MTS. To address this possibility, we first regressed MTS on the log of real GDP per capita and a more general institutional quality variable, GOVQ, that averages measures of law and order, corruption, and bureaucratic quality, obtained from the

[14] In addition, net worth matters more for small firms in terms of the ability to obtain external finance because they tend to be more informationally opaque and credit constrained. Interest rate changes that affect net worth, therefore, have a larger effect on small firms.

[15] Turnover rate is the average number of changes in the central bank governor per year in each decade. For example, if turnover = 0.2, there are 2 changes per decade for an average tenure of 5 years. CBI is also commonly ranked using legal aspects of independence. We present results using central bank governor turnover because data are available for 20 more countries. Cukierman et al. (1992) provide data up through 1989. The turnover index was supplemented with data after 1990 from Crowe and Meade (2007) and Dreher et al. (2008).

International Country Risk Guide (ICRG). The coefficients of both variables were negative and significant, suggesting that perhaps these variables are important determinants of MTS. When we included *RR*, however, the coefficients of both variables became completely insignificant, while the coefficient of *RR* was highly significant. This implies that *RR* has an independent effect on MTS while these other variables do not. We therefore omit these two variables from our base regression, although we do present the results from a regression where all the control variables are included.

The sample includes 56 countries without any control variables and 47 countries in the base regression (the sample size drops since not all 56 countries had data for all the control variables). We use annual data averaged over the years 1984 to 2008 for the right hand side variables to match the sample period used to generate the dependent variable. The exception is *RR* for which data are only available beginning in 2004; we discuss this issue below. Thus there is only one observation per country. We estimate equation (2) using OLS with robust standard errors.[16]

Before presenting the results, it is important to highlight a potential caveat in our analysis. Notice that, due to data availability, we are using a shorter period (2004-2008) to measure financial frictions than we use to estimate our VAR models (1984-2008). However, there is little time series variation in the recovery rate data and so it is possible that the data that are available

[16] Note that using *MTS* without considering its standard deviation may lead to invalid inferences. This problem is more commonly known as the generated regressors problem. We accounted for the measurement error in *MTS* and adjusted the standard errors of the coefficients in equation (2) using the methodology of Gawande (1997). Although this methodology is usually applied to account for generated regressors, it can also account for generated regressands as in our model. Specifically, let y_t, x_t, u_t, ε_t denote the generated dependent variable, a vector of independent variables, the first stage measurement error and the second stage error term, the second stage model can then be represented as $y_t + u_t = \beta x_t + \varepsilon_t$. This representation is different from the usual generated regressors estimation where the measurement error is included in the independent variable vector x_t. Assuming that the measurement error and the second stage error term are not correlated, it is straightforward to derive the coefficient estimates and their variances as $\hat{\beta} = \beta + (x_t'x_t)^{-1}x_t'\varepsilon_t - (x_t'x_t)^{-1}x_t'u_t$ and $Var(\hat{\beta}) = (\hat{\sigma}_u + \hat{\sigma}_\varepsilon)^2(x_t'x_t)^{-1}$. When we accounted for the first stage measurement errors, the results were very similar to those from our baseline model, although developing country observations were given smaller weights due to the large variation in their *MTS*.

may be a good representation of earlier values. While we cannot be sure, Djankov et al. (2007) find that a more broad creditor rights index is very stable over the past 30 years (we focus on recovery rates since it matches the financial friction parameter in costly-state-verification models and because it is a continuous variable as opposed to creditor rights which is an index from 0 to 4).[17] This might suggest that bankruptcy recovery rates are also fairly time-invariant.

To the extent that recovery rates are fairly constant over time, they can provide a source of exogenous variation in MTS across countries. In particular, potential endogeneity, arising from reverse causality for example, should be mitigated if recovery rates are mostly time invariant. An argument can be made, however, that recovery rates are not stable over time. Although institutional factors that affect recovery rates like the degree of contract enforcement or creditor rights are quite stable, factors such as collateral requirements that do change over time also affect how much lenders can recover.[18] However, our source of identification of the effect of financial frictions is cross-country variation in the recovery rate variable. Therefore, even if recovery rates are not very stable, to the extent that cross-country differences are fairly stable, we can still identify the effect of financial frictions. Nevertheless, our results should be interpreted with caution given this potential issue.

Results

The top panel of Table 3 presents results from the estimation of equation (2). We find a negative relationship between recovery rates and MTS in column 1 where *RR* is included by itself and when the control variables are included in columns 2 and 3. Column 2 presents results

[17] This was true for the countries in our sample as well. 71% of our countries experienced no change in this index from 1978 to 2003.

[18] Note that while we argue that there is potential correlation between recovery rates and institutional quality, both of which are included as regressors, the key issue here is endogeneity, not correlation between regressors (as can be seen from Table 3, the coefficient of *RR* is completely unaffected by the inclusion of institutional variables). Even if measures of institutional quality were *not* included as controls, we would make the same argument that reverse causality from MTS to *RR* is less likely to the extent that *RR* is correlated with time-invariant institutional features.

from our base regression. The coefficient of *RR* is negative and significant at the 5% level. The coefficient of the recovery rate variable implies that a one percentage point increase in the recovery rate leads to a 0.02 percentage point drop in the response of output to a monetary policy shock. A value of 0.02 implies that if Malaysia were to increase its recovery rate to the level of the UK's, it would reduce the response of output from 0.72% to 0.13%, a change that is more than half a standard deviation of the output response across our sample. This change is also five times larger than the median value for the response of output and slightly larger than the mean value. The results for *RR* are nearly identical when we include additional control variables in the third column.

Turning to the control variables, the existing literature is mixed on the effect of financial market development on MTS (Elbourne and de Haan, 2006). We find no effect using stock market capitalization as a % of GDP as a measure of financial development.[19] We also do not find that CBI affects MTS, even though the literature has found that it affects average inflation. Although we argued that CBI might increase MTS, one counterargument is that when an independent and credible central bank raises interest rates during a disinflation, output does not have to fall dramatically if the expectations-augmented Phillips curve adjusts quickly. Instead, more of the adjustment comes from prices.

We do, however, find that legal origin can impact MTS, as in Cecchetti (1999). In particular, countries with German legal origin, which has relatively strong creditor rights (Djankov et al., 2007), have significantly weaker MTS than those with French legal origin. Based on the point estimates, the ranking of legal origin in order of increasing MTS is: Socialist,

[19] As mentioned previously, stock market capitalization is also an indicator of small firm presence. We found insignificant coefficient estimates using other measures of small firm presence as well, namely the percent of firms using banks to finance investment and the percent of workers employed by small and medium firms (Ayyagari et al., 2007). The coefficient of *RR* remained significant.

German, English, Scandinavian, French (countries with Socialist legal origin also tend to have strong creditor rights according to Djankov et al., 2007). This is identical to the ordering in Cecchetti (1999) except that there are no countries with Socialist legal origin in his sample, and MTS is greatest in German legal origin countries whereas it is relatively weak in our ranking. His sample, however, only includes 11 advanced economies, whereas our sample includes 47 countries, including emerging and developing nations. Note that in the last column, the German legal dummy loses significance, although it is still almost significant at the 10% level (p-value = 0.13). This may result from the fact that GOVQ accounts for legal aspects of institutional quality that are correlated with legal origin.

Finally, as discussed above, the log of GDP per capita and the measure of general institutional quality are insignificant, suggesting that while financial frictions matter, the level of economic development and more broad institutional quality do not affect MTS.

4. Robustness Tests

Common Specification for G-8 and non G-8 countries

In this section, we test whether the negative relationship between financial frictions and MTS is observed when we use the same model to identify monetary policy shocks for every country (instead of using different models for G-8 and non G-8 countries). To do so, we use the identification strategy originally applied to only G-8 countries for every country in our sample.

The results are provided in the first column of Table 4. The coefficient of *RR* is again negative and significant. A coefficient of -0.018 implies that if Malaysia were to increase its

recovery rate to the level of the UK's, it would reduce the output response from 0.72% to 0.19%.[20]

Using a vector error correction model (VECM) to measure MTS

As an additional robustness check, we consider the possibility that the first stage variables may be cointegrated (and thus there may be a long-term relationship between these variables) and that the endogenous variables may be nonstationary by using a VECM model. Although this model restricts the endogenous variables to converge to their long-run relationship, it is convenient because it allows us to capture the short-run effects of monetary policy. We transform equation (1) to the following vector error correction form:

$$\Delta Y_t = B(L)\Delta Y_t + C(L)\Delta X_t + \alpha Y_{t-1} + e_t \tag{3}$$

where Y_t is the vector of endogenous variables, $Y_t = [ip_t, cpi_t, m_t, r_t, wxpi_t]'$ and X_t is the vector of exogenous variables that includes the U.S. production index and federal funds rate. In estimating this model and obtaining the impulse responses, we use the identifying restrictions in Section2, we use the corrected-AIC (Hurvich and Tsai, 1989) to determine the lag length, and we include intercepts and trends. The results are displayed in the second column of Table 4 and indicate a similar negative relationship between MTS and recovery rates.

Alternative measures of financial market development

In unreported regressions, we used other measures of financial market development, in addition to stock market capitalization. The results were very similar using the stocks-traded turnover ratio defined as the total value of shares traded during the year divided by the average market capitalization for the year, the total value of stocks traded (% of GDP), and domestic credit to the private sector (% of GDP).

[20] As an additional robustness test, we broke up the sample period in half, estimated MTS for each sub-period, and re-estimated equation (2). The results were very similar, suggesting that the effect of financial frictions has remained stable over time. The results are available upon request.

Alternative Measures of Financial Frictions

We included a number of alternative measures of financial frictions. The bottom panel of Table 4 presents the results. From the Doing Business Database, we have included the cost as a % of the claim to enforce a contract and contract enforceability rank (higher numbers mean lower rank for both variables). In both cases, larger numbers mean greater financial frictions and so we expect a positive coefficient. This is in fact what we find, and the results are significant. We also included the time to collect on a bounced check (Djankov et al., 2003), which is insignificant. However, this variable is not as close a match as the recovery rate to the notion of financial frictions in the costly-state-verification models, which relates to insolvency of corporations. Finally, we include a measure of capital market governance (Daouk et al., 2006), which is also insignificant although the inclusion of this variable cuts the sample size in half, resulting in only 25 observations.

5. Leverage Sensitivity as a Proxy for Financial Frictions

Credit channel theory makes two important predictions. First, there is a positive relationship between MTS and the level of financial frictions in an economy. Our cross-country regressions provided support for this prediction. Second, and perhaps more subtle, external finance premiums are more sensitive to leverage when financial frictions are high. The reason is that when monitoring costs are low, creditors are not as affected by bankruptcy since they can retrieve a greater portion of a bankrupt firm's assets. In this case, the risk free rate is a relatively more important determinant of external finance rates. In contrast, when monitoring costs are high, leverage plays a more predominant role.

Theory therefore predicts that as the level of financial frictions increases, the external finance premium becomes more sensitive to firm leverage, i.e. leverage sensitivity increases (we

verify that this relationship holds again using recovery rates as a proxy for financial frictions).[21] We can therefore use leverage sensitivity as another proxy for financial frictions and then re-estimate the effect of financial frictions on MTS. There is in fact a strong negative correlation between leverage sensitivity (the construction of which is described below) and the recovery rate. Depending on which measure of leverage is used, the correlation across countries is -0.28, -0.45, and -0.42, confirming the predictions of the model.

Measuring Leverage Sensitivity

To capture leverage sensitivity for each country, we estimate the effect of financial leverage on external finance premiums using firm level data. In doing so, we approximate external finance premiums with corporate bond spreads. We use bond deals of non-financial firms and other firm-specific data over the period 1995:1 to 2008:5. Data were obtained from the Thomson One Banker database. We chose this data range to maximize the number of observations and thus include as many countries as possible in our estimation. In a similar study, Levin et al. (2004) use balance sheet data, probability of default and bond spreads for 918 publicly traded U.S. firms over the period 1997Q1 to 2003Q3 to estimate financial frictions and to investigate how they evolve over time. The "Expected Default Frequency" variable (constructed by Moody's/KMV Corp.) allows them to more precisely obtain the bankruptcy cost coefficients that provide the best fit to the observed credit spreads. Our approach is similar to this study. However, since we do not have the expected default frequency for the countries in our sample, we approximate financial frictions as simply the leverage sensitivity of bond spreads.

There is ample research on the determinants of corporate bond spreads both in developing and advanced economies (Collin-Dufresne et al., 2001; Cavallo and Valenzuela, 2007; Durbin and Ng, 2005). Usually, this literature attributes the variations in corporate spreads

[21] Results are available upon request.

to firm, industry and bond characteristics, macroeconomic variables, sovereign risk, and other country-specific effects. In our estimation, we account for these effects to the extent that data are available. We begin by estimating the following equation separately for each country:

$$E\tilde{F}P_{it} = \gamma_{0k} + \gamma_{1k} L\tilde{E}V_{it-1} + \xi_{1k} y_{it-1} + \xi_{2k} BC_{it} + \xi_{3k} MC_{tk} + \xi_{4k} SR_{tk} + \xi_{5k} T_k + \xi_{6k} I_k + v_{it} \quad (4)$$

where subscripts *i*, *k* and *t* denote the bond deal, the country and the time period. $E\tilde{F}P_{it}$ represents the spread on bond *i*, $L\tilde{E}V_{it-1}$ is the financial leverage of the firm, and y_i denotes a vector of firm specific control variables. T_k and I_k are the time and industry dummy variables and BC_{it}, MC_{tk}, and SR_{tk} represent a vector of bond characteristics, a vector of macroeconomic conditions, and the sovereign risk measured at time *t*. We refer to the coefficient of the leverage variable, $\hat{\gamma}_{1k}$, as leverage sensitivity in the rest of the paper.

We follow the standard practice in the literature and measure corporate bond spreads, $E\tilde{F}P_{it}$, as the difference between corporate and government bond yields of similar maturity.[22] Let $YTM^{i}_{t,T}$ and $YTM^{g}_{t,T}$ denote yield to maturity at time *t* of corporate and government bonds that mature at time *T*, respectively. Corporate bond spreads can be expressed as,

$$E\tilde{F}P_{it} = YTM^{i}_{t,T} - YTM^{g}_{t,T} \quad (5)$$

In our benchmark data set, we include bonds that are denominated in local and foreign currency. If a 5 year Brazilian bond is denominated in dollars for example, we use the yield on a 5-year US treasury bond when measuring the spread. Alternatively, we considered only local

[22] Our main reason for using yield to maturity was data availability. There is research, however, that highlights the limitations of using this variable. For example, Cavallo and Valenzuela (2007) argue that it is very difficult, especially in developing countries, to find bonds of similar maturity and/or to determine maturity when there are contingent cash flows. The authors use option-adjusted spreads from Bloomberg to make bond spreads more comparable. In our estimation we only use bonds that don't have contingent cash flows due to such features as put or call options. Therefore, using yield to maturity is not unreasonable.

currency denominated bonds. Despite decreasing the number of countries with sufficient observations, this alteration did not change our results significantly.

The Thomson One Banker database has three ratios that can approximate the financial leverage variable $L\tilde{E}V_{it}$: total debt/equity, total debt/market capitalization, and proceeds/equity. In our analysis, we use all three variables. To limit causality concerns, we use the leverage data that was last reported prior to the issue date. For example, if the issue date is May 23rd 1999, we use the leverage ratio reported at the end of 1998 or the first quarter of 1999 if data are quarterly.

Recent research finds that firm-specific characteristics explain the largest portion of variation in corporate bond spreads (c.f. Cavallo and Valenzuela, 2007). Therefore, in addition to financial leverage, we follow Altman (2000) and include other firm specific variables. These variables are: return on assets, retained earnings before interest and taxes, liquidity measured by the current ratio (current assets/current liabilities), capitalization measured by Equity/Capital, and size measured by Total Assets. Additionally, we accounted for the openness of the firm (foreign sales/total sales) and tried different ratios that proxy liquidity, debt structure and profitability. The results were robust to these alterations.

To capture the non-default component of corporate spreads, we control for several bond-specific characteristics such as issue size, the credit rating of the bond, and time to maturity. We use issue size to proxy for the liquidity of the bond as bonds with higher issue sizes are usually more liquid (Chacko et al., 2008).

Sovereign risk and macroeconomic indicators are included to measure the asymmetric effects these variables may have across firms. For example, Durbin and Ng (2005) find that the sovereign ceiling (the concept that no firm is more creditworthy than its government) does not apply to every emerging market firm in their sample. We included the GDP growth rate, inflation,

and the external balance in our estimation to account for macroeconomic conditions. There is recent evidence that there are significant differences -- considerably larger than cross country differences -- in the transmission of monetary policy across industries. Therefore we include sector specific dummies to account for these differences. We also include annual time dummies.

In estimating the dynamic panel data model in equation (4) we explored two options. First, we used ordinary least squares (OLS) with robust standard errors. Second, to account for the potential endogeneity that may arise from including the lags of the dependent variable on the right hand side, we used the general method of moments (GMM) estimator of Arellano and Bond (1991). We only discuss the results obtained by using OLS simply because the parameter estimates and the standard errors were not too different across these methodologies.

A table reporting leverage sensitivities that are estimated using equation (4) for each country is available in Appendix C. The results indicate for the most part a positive and statistically significant relationship between leverage and corporate bond spreads. Furthermore, changes in leverage have a considerable effect on corporate spreads. In particular, a 1 percentage point increase in leverage leads to a 0.23 percentage point increase in bond spreads on average. These results are consistent with recent findings in the literature (Cavallo and Valenzuela, 2007; Collin-Dufresne et al., 2001; Durbin and Ng, 2005) and clearly imply that firm specific effects play an important role in determining corporate bond spreads.

Leverage Sensitivity vs. the Recovery Rate

There are two main advantages of using leverage sensitivity instead of recovery rates as a measure of financial frictions. First, this approach allows financial market data to predict the level of financial frictions as an alternative to measures based on survey data, such as recovery rates. Second, we were forced to estimate equation (2) using recovery rates from 2004 to 2008,

while MTS was estimated using data from 1984-2008. The data on leverage sensitivity, on the other hand, is available beginning in 1995. This longer time period, compared to recovery rate data, allows us to estimate panel regressions in which the sample period 1995-2008 is divided into two sub-periods. This gives us two observations per country for MTS and leverage sensitivity. The main disadvantage of using leverage sensitivity, however, is that data availability restricts the sample considerably by reducing the number of countries (the Thomson One Banker database did not have sufficient data for all the countries in our baseline sample).

Leverage Sensitivity and MTS

To determine the effect of leverage sensitivity on the strength of monetary transmission, we estimate the following panel regression:

$$MTS_{it} = \alpha_{0i} + \alpha_1 \hat{\gamma}_{1it} + \beta x_{it} + \varepsilon_{it} \tag{6}$$

where $\hat{\gamma}_1$ denotes leverage sensitivity. Table 5 presents the results. We present pooled OLS, random effects (RE) and fixed effects (FE) estimation results. The three groups of columns correspond to which measure of financial leverage was used to generate the leverage sensitivity variable. Under all estimation procedures, the coefficients of the different leverage sensitivity variables are positive and significant in explaining the strength of monetary transmission. A one percentage point increase in leverage sensitivity leads to a 0.012 percentage point increase (on average) in the maximum response of output to a monetary policy shock. These results therefore provide further evidence that greater financial frictions lead to a stronger monetary transmission. Note that the coefficients of turnover and legal origin cannot be estimated with the fixed effects estimator since these variables are time-invariant during the sample period.

Robustness Tests

In Table 6 we present robustness tests for the effect of leverage sensitivity, similar to those performed in Table 4. The top panel shows results when we use a common specification for G-8 and non G-8 countries. The bottom panel shows results using a vector error correction model (VECM) to measure the dependent variable. Again the coefficients of leverage sensitivity are (mostly) positive and significant in about half of the specifications. Thus, while not as strong as the results in Table 5, the results still indicate a positive relationship between financial frictions and the strength of monetary transmission.

6. Concluding remarks and a brief discussion of monetary policy during crisis periods

In this paper we focus on two predictions of general equilibrium models that have agency costs and financial frictions. First of these is the well documented positive relationship between the level of financial frictions and the effects of monetary policy shocks on the economy. This paper, to the best of our knowledge, is the first attempt at examining the relationship between MTS and the level of financial frictions across a broad group of countries. Using data on bankruptcy recovery rates for 56 countries, we confirm the prediction of credit channel theory that financial frictions augment the strength of the monetary transmission mechanism.

Credit channel theory also predicts a positive relationship between financial frictions and the leverage sensitivity of borrowing costs. Based on this prediction, we proxy financial frictions with leverage sensitivity. Using firm level data, we measure the sensitivity of bond spreads (our measure for borrowing costs) to financial leverage of firms that issue these bonds. The results again indicate a positive relationship between financial frictions and MTS.

One important implication of our results is that as institutions improve, perhaps as part of the process of joining political unions with countries with stronger institutions (Djankov et al., 2008), monetary policy becomes less effective if these improvements center on reducing

financial frictions. Of course, if there are more broad improvements in institutional quality that augment MTS, the *overall* impact on the effectiveness of monetary policy is ambiguous. For example, institutional reform could promote CBI, which has been argued to affect MTS.[23] Our results, therefore, imply that the effect of institutional improvement on the strength of monetary policy is not clear-cut and that any analysis in this area requires a nuanced approach.

Finally, our results are also consistent with evidence on the strength of monetary transmission during the global financial crisis. While the linear models used in this paper are not capable of capturing the nonlinear dynamics that govern crisis periods, the positive relationship that we find between financial frictions and monetary policy effectiveness suggest that monetary transmission can be stronger during crisis episodes. The reason is that the fall in asset prices and thus the net worth of both lenders and borrowers typically observed during financial crises exacerbate the asymmetric information problems, and hence the financial frictions, in lending contracts. At this point monetary policy plays a crucial role. If monetary policy is loose, as it was in the U.S. and in Europe during and after the 2007-2009 global crisis (through low interest rates and the expansion of the central balance sheet with purchases of unconventional assets), monetary policy can ease the credit market tightening that follows decreasing lender/borrower net worth and higher uncertainty. In contrast, if monetary policy is tightened during crises, as it was in the 1990's (the Asian financial crisis, for example) and early 2000's in defense of fixed exchange rate regimes, monetary policy can further worsen the credit constraints that borrowers face and amplify the negative impact of the financial crisis.

Studying the recent crisis, Gambacorta and Marques-Ibanez (2010) find that the monetary transmission mechanism that operates through the lending and risk-taking channels has increased

[23] We also presented arguments that CBI could *reduce* MTS. Our results, for the most part, suggest that it does not significantly impact MTS.

in strength during the crisis compared to the period before the crisis. They also find that monetary policy played a stabilizing role in the U.S. and in Europe. Mishkin (2009, 2012) reaches a similar conclusion that monetary policy is even more potent during crisis periods because it prevents adverse feedback loops such as the financial accelerator mechanism. This, the author explains, opposes the view (as reported in FOMC meetings and a New York Times column by Paul Krugman in 2008) that monetary policy has been ineffective in preventing the tightening in credit markets (how the Fed responded to ease credit conditions both domestically and internationally, through swap agreements, is detailed in Ben Bernanke's December 1, 2008 speech). Conversely, Ferri and Kang (1999) and Kim (1999) find that Korea's tight monetary policy during the financial crisis in 1997 aggravated the crisis by restricting credit availability and increasing borrowing costs. Cecchetti et al., (2011) find that Korea and other emerging market countries responded differently to the recent crisis. The authors show that for an overwhelming majority of the countries in their sample monetary policy loosened during the crisis and they argue that the limited negative effects of the crisis were partially due to these sound policy decisions.[24] Thus there is evidence that monetary policy can be quite effective during financial crises, in accordance with the empirical results in this paper.

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[24] Similarly, Alp and Elekdag (2011) provide evidence that the flexible exchange rate and inflation targeting policies of the Central Bank of the Republic of Turkey (CBRT) during the recent crisis mitigated the loss of output that could have occurred. The CRBT adopted a flexible exchange rate and inflation targeting approach to policy after a 2001 financial crisis (Alp et al. (2012) provide similar evidence for Malaysia). Quispe and Rossini (2010) find a similar success story in Latin America for Peru, while Islam and Rajan (2011) credit the aggressive actions of India's central bank with softening the blow of the financial crisis.

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Table 1: Summary Statistics

	obs.	mean	median	s.d.	min.	max.
MTS	56	0.48	0.11	1.10	0.00	7.01
RR (%)	56	46.80	40.72	26.27	4.08	92.62
GDP per capita	56	16,004	12,003	10,983	1,474	50,512
GOVQ	56	4.04	3.97	1.27	1.85	5.99
Market Cap. % GDP	55	54.77	32.90	54.75	0.71	280.07
CBI-Turnover	51	0.20	0.18	0.12	0.00	0.68
cost of bankruptcy (% of estate)	55	12.99	9.00	9.46	1.00	42.00
% firms using banks to finance investment	38	19.38	17.70	13.33	2.61	74.55
% workers employed by small firms	48	59.89	60.15	18.10	12.74	90.27

NOTES:

1. Unless otherwise noted, all data are annual. Growth rates and ratios are expressed in percentage terms. All variables are averaged over the sample period.

Table 2: Forecast Error Variance Decompositions: Our results vs. Literature

Country	FEVD	Literature
Canada	16.8%	Kim (1999) 5.9% -17.0%, Italiano (2001) 2.0% - 20.6%, Bordo and Redish (2003) 16.0%-17.9%
Czech Republic	5.8%	Anzuini and Levy (2007) 2.0%-11.9%
France	10.7%	Anzuini and Levy (2007) 5.6%-17.7%, Kim (1999) 6.2% - 17.7%
Germany	19.4%	Anzuini and Levy (2007) 9.3%-23.1%, Holtemoller (2003) 21%, Kim (1999) 7.6% - 26.9%
Hungary	15.5%	Anzuini and Levy (2007) 12.0%-18.1%
Italy	2.1%	Anzuini and Levy (2007) 4.3%-8.9%, Kim (1999) 4.3% - 8.9%
Japan	2.0%	Kim (1999) 1.8% - 8.8%
Poland	13.8%	Anzuini and Levy (2008) 7.5%-17.3%
U.K.	12.2%	Anzuini and Levy (2007) 9.8%-15.3%, Kim (1999) 9.8% - 15.3%
U.S.	8.7%	Bernanke, Boivin, Eliasz (2005) 5.4%, Kim (1999) 7.6% - 26.9%, Christiano et al. (1996) 29.4%, Bordo and Redish (2003) 10.85%-13.5%

NOTE: This table compares our FEVD with those found in other studies. The FEVD column shows the forecast error variance decomposition of output explained by shocks to the interest rate.

Table 3: Equation 2 - Strength of Monetary Transmission (*MTS*) and the Recovery Rate

Dependent variable: *MTS*		baseline regression	
RR	-0.018	-0.020	-0.018
	(0.007)***	(0.008)**	(0.009)**
Market Cap. % GDP		-0.001	-0.001
		(0.002)	(0.002)
CBI-Turnover		-0.519	-0.553
		(1.352)	(1.452)
Legal Origin (French is the excluded dummy)			
German		-0.607	-0.566
		(0.355)*	(0.364)
English		-0.367	-0.377
		(0.348)	(0.502)
Scandinavian		-0.111	-0.086
		(0.241)	(0.362)
Socialist		-0.860	-0.831
		(0.610)	(0.563)
log GDP per capita			-0.101
			(0.841)
GOVQ			0.005
			(0.385)
Obs.	56	47	47
R^2	0.19	0.27	0.28

NOTES:
1. See Appendix A for variable definitions and sources.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Cross-section regressions estimated by Ordinary Least Squares (OLS). Robust standard errors in parentheses.

Table 4: Equation 2 - Strength of Monetary Transmission (MTS) and the Recovery Rate - Robustness Tests

Dependent variable: *MTS*	Kim	Vector Error Correction Model
RR	-0.018	-0.024
	(0.009)**	(0.009)**
Market Cap. % GDP	-0.003	-0.002
	(0.003)	(0.004)
CBI-Turnover	-0.765	-1.008
	(1.498)	(1.288)
German	-0.540	-0.813
	(0.398)	(0.425)*
English	-0.230	-0.129
	(0.292)	(0.628)
Scandinavian	-0.287	-0.376
	(0.249)	(0.512)
Socialist	-1.214	-0.728
	(0.540)**	(0.547)
Obs.	49	47
R^2	0.22	0.30

Dependent variable: *MTS*				
cost (% of claim) to enforce contract	0.056			
	(0.010)***			
contract enforceability rank		0.015		
		(0.007)**		
time to collect on bounced check			0.038	
			(0.154)	
capital market governance				-0.070
				(0.042)
Market Cap. % GDP	-0.002	-0.001	-0.003	0.001
	(0.002)	(0.002)	(0.003)	(0.002)
CBI-Turnover	2.584	-0.977	0.241	1.074
	(1.243)**	(1.480)	(1.109)	(0.609)*
German	0.053	-0.361	-0.811	-0.336
	(0.266)	(0.244)	(0.453)*	(0.192)*
English	0.017	-0.182	-0.628	0.048
	(0.267)	(0.330)	(0.434)	(0.182)
Scandinavian	-0.021	0.014	-0.875	-0.177
	(0.292)	(0.222)	(0.448)*	(0.173)
Socialist	-0.443	-0.887	-0.555	
	(0.606)	(0.932)	(0.466)	
Obs.	47	47	47	25
R^2	0.66	0.36	0.13	0.37

NOTES:
1. See Appendix A for variable definitions and sources.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Cross-section regressions estimated by Ordinary Least Squares (OLS). Robust standard errors in parentheses.

Table 5: Equation 6 - Strength of Monetary Transmission (*MTS*) and Leverage Sensitivity

Dependent variable:	financial leverage measured using:								
MTS	Proceeds/Equity			debt/capitalization			debt/equity		
	OLS	RE	FE	OLS	RE	FE	OLS	RE	FE
leverage sensitivity	0.011	0.012	0.015	0.008	0.008	0.008	0.017	0.016	0.015
	(0.003)***	(0.003)***	(0.004)***	(0.001)***	(0.001)***	(0.002)***	(0.002)***	(0.002)***	(0.003)***
Market Cap.	0.001	0.001	-0.002	0.001	0.001	0.001	0.001	0.000	0.000
% of GDP	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	0.000	(0.001)	(0.002)
CBI-Turnover	1.199	1.115		1.283	1.276		1.103	1.159	
	(0.366)***	(0.485)**		(0.314)***	(0.331)***		(0.222)***	(0.296)***	
German	-0.407	-0.337		-0.153	-0.138		-0.078	-0.078	
	(0.162)**	(0.226)		(0.100)	(0.120)		(0.083)	(0.110)	
English	-0.095	-0.066		0.066	0.064		0.102	0.104	
	(0.127)	(0.164)		(0.082)	(0.101)		(0.075)	(0.091)	
Scandinavian	-0.290	-0.288		-0.069	-0.067		-0.108	-0.125	
	(0.101)***	(0.189)		(0.062)	(0.125)		(0.073)	(0.111)	
Socialist	0.587	0.616		0.751	0.752		0.798	0.783	
	(0.125)***	(0.268)**		(0.083)***	(0.185)***		(0.046)***	(0.166)***	
Obs.	26	26	26	31	31	31	31	31	31
Countries	15	15	15	19	19	19	19	19	19
Hausman p-value		0.41			0.97			0.81	
R^2	0.76		0.57	0.83		0.68	0.87		0.72

NOTES:
1. See Appendix A for variable definitions and sources.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Panel regressions, robust standard errors in parentheses (for OLS).

Table 6: Equation 6 - Strength of Monetary Transmission (*MTS*) and Leverage Sensitivity - Robustness Tests

Dependent variable:	financial leverage measured using:								
MTS **(Kim)**	Proceeds/Equity			debt/capitalization			debt/equity		
	OLS	RE	FE	OLS	RE	FE	OLS	RE	FE
leverage sensitivity	0.003	0.009	0.039	0.031	0.031	0.022	0.034	0.034	0.037
	(0.024)	(0.021)	(0.030)	(0.018)*	(0.006)***	(0.010)**	(0.019)*	(0.012)***	(0.018)*
Market Cap.	-0.001	0.000	0.010	-0.001	-0.001	0.009	-0.001	-0.001	0.008
% of GDP	(0.002)	(0.005)	(0.016)	(0.002)	(0.003)	(0.012)	(0.002)	(0.004)	(0.012)
CBI-Turnover	-0.107	-0.044		-0.002	-0.003		-0.701	-0.687	
	(1.266)	(2.423)		(0.985)	(1.532)		(0.823)	(1.972)	
German	-1.160	-1.138		-0.230	-0.232		-0.470	-0.476	
	(0.745)	(0.763)		(0.225)	(0.419)		(0.271)*	(0.529)	
English	-1.035	-1.032		-0.126	-0.127		-0.282	-0.270	
	(0.735)	(0.729)		(0.316)	(0.441)		(0.353)	(0.553)	
Scandinavian	-0.533	-0.512		0.482	0.480		0.144	0.140	
	(0.976)	(0.865)		(0.504)	(0.562)		(0.519)	(0.711)	
Socialist	-1.128	-1.153		-0.495	-0.495		-0.425	-0.428	
	(0.563)*	(1.475)		(0.262)*	(1.047)		(0.230)*	(1.222)	
Obs.	39	39	39	50	50	50	50	50	50
Countries	22	22	22	27	27	27	27	27	27
Hausman p-value		0.21			0.37			0.69	
R^2	0.17		0.14	0.42		0.21	0.25		0.18

Dependent variable: *MTS* **(VECM)**									
	OLS	RE	FE	OLS	RE	FE	OLS	RE	FE
leverage sensitivity	-0.003	-0.003	-0.004	0.008	0.008	0.005	0.014	0.014	0.011
	(0.005)	(0.008)	(0.013)	(0.002)***	(0.003)***	(0.005)	(0.006)**	(0.005)**	(0.009)
Market Cap.	-0.000	-0.000	-0.014	-0.000	-0.000	-0.010	-0.000	-0.000	-0.011
% of GDP	(0.001)	(0.002)	(0.008)	(0.001)	(0.001)	(0.006)	(0.001)	(0.001)	(0.006)*
CBI-Turnover	-0.194	-0.194		-0.249	-0.249		-0.438	-0.438	
	(0.564)	(0.781)		(0.446)	(0.617)		(0.499)	(0.642)	
German	-0.433	-0.433		-0.033	-0.033		-0.026	-0.026	
	(0.212)*	(0.294)		(0.124)	(0.181)		(0.142)	(0.187)	
English	-0.028	-0.028		0.283	0.283		0.286	0.286	
	(0.226)	(0.262)		(0.183)	(0.177)		(0.181)	(0.181)	
Scandinavian	-0.434	-0.434		-0.026	-0.026		-0.072	-0.072	
	(0.173)**	(0.290)		(0.134)	(0.214)		(0.147)	(0.217)	
Socialist	-0.046	-0.046		0.259	0.259		0.301	0.301	
	(0.152)	(0.497)		(0.081)***	(0.396)		(0.108)***	(0.408)	
Obs.	29	29	29	39	39	39	39	39	39
Countries	18	18	18	23	23	23	23	23	23
Hausman p-value		0.23			0.20			0.14	
R^2	0.21		0.26	0.34		0.23	0.31		0.25

NOTES:
1. See Appendix A for variable definitions and sources.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Panel regressions, robust standard errors in parentheses (for OLS).

Appendix A: Data Summary:

Table A.1: Variables and Data Sources

Variable	Description and Source
RECOVERY RATE	The recovery rate is recorded as cents on the dollar recouped by creditors through the bankruptcy or insolvency proceedings. The calculation takes into account whether the business emerges from the proceedings as a going concern as well as costs and the loss in value due to the time spent closing down. If the business keeps operating, no value is lost on the initial claim, set at 100 cents on the dollar. If it does not, the initial 100 cents on the dollar are reduced to 70 cents on the dollar. Then the official costs of the insolvency procedure are deducted (1 cent for each percentage of the initial value). Finally, the value lost as a result of the time the money remains tied up in insolvency proceedings is taken into account, including the loss of value due to depreciation of the hotel furniture. Consistent with international accounting practice, the depreciation rate for furniture is taken to be 20%. The furniture is assumed to account for a quarter of the total value of assets. The recovery rate is the present value of the remaining proceeds, based on end-2006 lending rates from the International Monetary Fund's International Financial Statistics, supplemented with data from central banks. Source: World Bank Doing Business database.
Bureaucracy Quality	Bureaucratic Quality, scale of 0-4. Source: International Country Risk Guide, published by The PRS group.
Corruption	Corruption in Government, scale of 0-6. Source: International Country Risk Guide, published by The PRS group.
Law and Order	Measures law and order tradition, scale of 0-6. Source: International Country Risk Guide, published by The PRS group.
Real GDP per capita	GDP per capita, (constant 2000 international $). Source: WDI
real interest rate	Source: WDI.
Money market rate	Source: IFS, central bank websites. Austria, M1, source: Oesterreichischen Nationalbank; Chile, Interbank rate, source: Banco Central de Chile; Colombia, Interest rate of 90-days certificate of deposit - DTF 1/ Annual Effective rate, source: Banco de la República; Cyprus: Interbank offer rate, source: Central Bank of Cyprus; Czech Republic, M1, 1-month interbank rate, PRIBOR, source: Czech National Bank; Hong Kong, M1, 7-day, Yield of Exchange Fund Bills & Notes, source: Hong Kong Monetary Authority; Hungary, interbank rates, source: Magyar Nemzeti Bank; Israel, M1, interbank rates, source: Bank of Israel; Luxembourg, M1, source: Banque Centrale du Luxembourg; Nigeria: Interbank rate, source: Central Bank of Nigeria; Russia, Interbank rate, source: The Central Bank of the Russian Federation
M1	Source: IFS. The sum of currency outside deposit money banks (line 14a) and demand deposits other than those of the central government (lines 14d, 14e, 14f, 14g, and 24) plus, where applicable, lines 24..i and 24..r.
TURNOVER	*TURNOVER* is the average number of changes in the central bank governor per year in each decade. For example, if *TURNOVER* = 0.2, there are 2 changes per decade for an average tenure of 5 years. One observation per decade. (1950's to 1980's). Source: Cukierman, et al. (1992). Data after 1990 obtained from Crowe and Meade (2007) and Dreher, et al. (2008).
Legal Origin	Source: Djankov et al., 2007
Stock market capitalization (% of GDP)	Source: WDI.
Domestic credit provided by banking sector (% of GDP)	Domestic credit provided by banking sector (% of GDP): includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available. Source: WDI.
Stocks traded, total value (% of GDP)	Total value of stocks traded as percent of GDP. Source: WDI.
Stocks traded, turnover ratio %	The total value of shares traded during the year divided by the average market capitalization for the year. Average market capitalization is calculated as the average of the end-of-year values for the current year and the previous year. Source: WDI.
% of firms using banks to finance investment	Source: WDI.

% of workers employed by small and medium enterprises.	Source: Ayyagari et al., 2007). Data averaged over certain years during the 1990s. The years vary by country.
Cost as a % of claim to enforce contract	Source: World Bank Doing Business database.
Contract Enforcement Rank	Higher numbers mean lower rank. Source: World Bank Doing Business database.
Time to collect on a bounced check	Source: Djankov et al., 2003
Industrial Production Index	Source: IFS. Generally, the coverage of industrial production indices comprises mining and quarrying, manufacturing and electricity, and gas and water, according to the UN International Standard Industrial Classification (ISIC). The indices are generally compiled using the Laspeyres formula. For many developing countries the indices refer to the production of a major primary commodity, such as crude petroleum. Monthly indicators for economic activity when industrial production index is not available: Belarus: number of employed; Bolivia, Oman, Venezuela: crude petroleum production; Chile, Peru, Russia, Ukraine: industrial employment index; Colombia, Indonesia, Philippines, South Africa, Uruguay: manufacturing production; Estonia, Hong Kong, Moldova, Thailand: number of employed.
CPI	Source: IFS.
World Export Price Index	Source: IFS. Indices for export prices are compiled from survey data for wholesale prices or directly from the exporter or importer (called "direct pricing").
Bond characteristics and firm level data	Thomson One Bankers Database

Table A.2: Countries

Armenia	Indonesia	Poland
Australia	Ireland	Portugal
Austria	Israel	Romania
Belarus	Italy	Russia
Bolivia	Japan	Serbia & Montenegro
Brazil	Jordan	Slovakia
Bulgaria	Korea, South	Slovenia
Canada	Lithuania	South Africa
Chile	Luxembourg	Spain
Colombia	Malaysia	Sweden
Croatia	Mexico	Switzerland
Cyprus	Moldova	Thailand
Czech Republic	Netherlands	Turkey
Denmark	New Zealand	Ukraine
Estonia	Nigeria	United Kingdom
France	Norway	United States
Germany	Oman	Uruguay
Hong Kong	Peru	Venezuela
Hungary	Philippines	

Appendix B: Impulse Response Summary Statistics

Table B.1: Checking for the price and liquidity puzzles

	mean response of inflation	maximum positive response of inflation	The error band does not include zero	mean response of the monetary aggregate	maximum positive response of the monetary aggregate	The error band does not include zero		mean response of inflation	maximum positive response of inflation	The error band does not include zero	mean response of the monetary aggregate	maximum positive response of the monetary	The error band does not include zero
Armenia	-0.04	0.00		-0.01	0.00		Malaysia	0.00	0.00		0.00	0.02	
Australia	-0.03	0.01		-0.08	0.01		Mexico	-0.16	0.00		-1.20	0.00	
Austria	0.00	0.22		-0.05	0.87		Moldova	0.00	0.05		-0.01	0.00	
Belarus	0.07	0.00		0.00	0.00		Netherlands	0.00	0.00		0.00	0.00	
Bolivia	-0.07	0.10	X	-0.02	0.00		New Zealand	-0.01	0.02		-0.01	0.00	
Brazil	0.00	0.01		-0.05	0.11		Nigeria	-0.10	0.00		-0.02	0.00	
Bulgaria	-0.03	0.12		-0.01	0.00		Norway	0.00	0.00		0.00	0.02	
Canada	-0.01	0.00		0.00	0.00		Oman	0.00	0.00		0.00	0.03	X
Chile	-0.18	0.30		-0.77	1.10		Peru	0.01	0.10	X	-0.02	0.00	
Colombia	-0.08	0.09		-0.14	0.41	X	Philippines	0.00	0.01		0.00	0.02	
Croatia	-0.01	0.05		0.00	0.00		Poland	-0.21	0.00		-0.02	0.02	
Cyprus	-0.04	0.01		-0.07	0.00		Portugal	0.00	0.00		-0.01	0.00	
Czech Rep.	-0.03	0.00		-0.01	0.00		Romania	-0.04	0.06		-0.02	0.00	
Denmark	0.00	0.01		0.00	0.00		Russia	-0.02	0.00		0.00	0.00	
Estonia	-0.39	0.00		-0.23	0.93		Serbia & Montenegro	0.00	0.10		0.02	0.07	X
France	0.00	0.00		-0.01	0.02		Slovakia	0.00	0.00		-0.04	0.00	
Germany	0.00	0.00		0.00	0.01		Slovenia	-0.01	0.03		0.00	0.01	X
Hong Kong	-0.12	1.27		-0.69	0.07	X	South Africa	0.00	0.00		-0.01	0.01	
Hungary	0.00	0.00		-0.02	0.00		Spain	0.00	0.01		0.00	0.00	
Indonesia	0.01	0.00		0.00	0.01		Sweden	0.00	0.00		-0.02	0.00	
Ireland	-0.03	0.00		-0.01	0.00		Switzerland	0.00	0.00		0.00	0.00	
Israel	0.00	0.00		-0.02	0.00		Thailand	0.03	0.76	X	-0.21	0.04	
Italy	0.00	0.00		0.00	0.00		Turkey	0.00	0.00		-0.01	0.04	
Japan	0.00	0.00		-0.01	0.00		Ukraine	0.03	0.14	X	-0.01	0.00	
Jordan	-0.01	0.00		-0.01	0.01		United Kingdom	-0.01	0.00		-0.01	0.00	
S. Korea	-0.01	0.01		-0.19	0.00		United States	0.00	0.00		-0.01	0.00	
Lithuania	0.00	0.02		-0.01	0.02		Uruguay	-0.01	0.00		-0.01	0.05	
Luxembourg	-0.01	0.00		-0.01	0.00		Venezuela	-0.01	0.00		0.00	0.00	

Notes: The table reports the maximum positive response of inflation and monetary aggregate responses to a 100 basis points shock to interest rates. The columns entitled "The error band does not include zero" report the presence of the price and liquidity puzzles. *X* indicates that the one-standard-deviation error band does not include zero and thus indicates that there is a puzzle. A 24-month forecast horizon was used to compute the maximum positive responses. If the maximum positive response is zero, this indicates that the response for each horizon (up to 24 months) is negative.

Appendix C: Leverage Sensitivities

Table C.1. Equation (4) – External Finance Premium – Leverage

	NOBS	In our sample	$\hat{\gamma}_{1k}$	$\hat{\sigma}_{\gamma_{1k}}$	t-stats	R-Squared
Argentina	1242	730	0.52	0.05	10.09	0.90
Australia	7514	3155	0.17	0.01	21.06	0.91
Austria	1707	1142	0.34	0.02	14.98	0.52
Belgium	698	324	0.35	0.06	5.55	0.79
Bolivia	171	161	-0.01	0.00	-2.37	0.74
Brazil	2130	699	0.06	0.01	4.23	0.91
Canada	8816	4636	0.11	0.01	15.86	0.92
Chile	821	469	0.08	0.04	2.07	0.35
China	949	580	0.16	0.04	4.61	0.73
Colombia	1031	113	-0.13	9.10	-0.01	0.33
Denmark	1055	615	0.03	0.01	2.51	0.28
Finland	963	653	0.28	0.04	7.84	0.55
France	7056	3799	0.06	0.01	9.03	0.92
Germany	16052	9111	0.22	0.01	28.81	0.40
Greece	367	149	0.28	0.57	0.48	0.91
Hong Kong	3425	1800	0.48	0.02	21.18	0.97
Iceland	314	79	0.04	0.23	0.16	0.39
India	3760	2921	0.09	0.02	5.49	0.69
Indonesia	667	497	1.31	0.12	11.25	0.48
Ireland	4148	900	0.18	0.02	9.51	0.46
Israel	347	275	0.17	0.04	4.06	0.38
Italy	3527	886	0.11	0.02	5.04	0.19
Japan	12225	9078	0.12	0.00	39.63	0.33
Korea, South	18138	8542	-0.37	0.08	-4.53	0.58
Luxembourg	3859	3859	-0.05	0.02	-2.49	0.09
Malaysia	1965	1647	0.53	0.04	13.48	0.34
Mexico	1717	607	0.07	0.04	1.63	0.74
Netherlands	8349	4306	0.08	0.01	7.00	0.56
New Zealand	447	201	0.09	0.19	0.49	0.38
Norway	1306	716	0.36	0.02	17.54	0.73
Panama	269	105	0.12	0.05	2.36	0.82
Peru	1020	529	0.84	0.28	2.99	0.41
Philippines	583	398	0.63	0.13	4.72	0.36
Portugal	846	175	0.37	0.05	6.83	0.92
Puerto Rico	688	508	0.10	0.04	2.48	0.89
Russia	398	290	0.21	0.11	1.87	0.74
Singapore	1398	970	0.04	0.01	3.00	0.93
South Africa	205	93	0.04	0.28	0.13	0.59
Spain	3051	986	0.12	0.02	6.22	0.36
Sweden	2534	1439	0.27	0.02	13.86	0.56
Switzerland	2000	1709	0.05	0.01	4.04	0.61
Taiwan	3510	2573	0.05	0.01	8.51	0.24
Thailand	961	687	0.06	0.02	3.22	0.32
Turkey	217	146	0.40	0.29	1.39	0.01
United Kingdom	17453	5555	0.10	0.01	14.32	0.38
United States	40424	17269	0.23	0.00	56.48	0.38
Venezuela	242	114	0.46	0.02	22.95	0.90

NOTE: This table displays the results from the estimation of Equation (4). γ_{1k} is the coefficient of the leverage variable in Equation (4) and σ_{1k} is the standard error of this coefficient.