Financial Frictions and the Credit Channel of Monetary Transmission*

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Abstract
This paper examines the effect of financial frictions on the strength of the credit channel of monetary transmission. We first use a DSGE model characterized by financial frictions as in Bernanke, Gertler, and Gilchrist (1999), and calibrate it using parameter values for countries with different levels of financial frictions. We find that the credit channel is stronger in countries with high levels of financial frictions. The intuition is that in these countries, external finance premiums are more sensitive to firms' financial leverage. By affecting asset prices and borrower leverage, therefore, monetary policy has greater impact on external finance premiums and output. We then test this model's result by estimating SVAR models on cross-country data to generate indicators for the strength of the credit channel of monetary transmission. We find a positive relationship between various measures of financial frictions and the strength of the credit channel, confirming the predictions of the model.

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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 the mechanism through which monetary policy impacts the real economy by altering the external finance premium. 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 widely incorporated into general equilibrium models through costly state verification to enhance the empirical relevance of these models (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. 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 finance premiums.

In this paper, we test for this relationship between financial market frictions and the strength of the credit channel of monetary transmission (hereafter MTS). To do so, we first calibrate an open-economy extension of the financial accelerator model of BGG (1999) to two

countries with relatively low and high levels of financial frictions, Brazil and Canada. The model simulations reveal that: 1) MTS is positively related to the level of financial frictions, and 2) as the level of financial frictions increases, the external finance premium is more sensitive to firms' financial leverage.

We then test, using cross-country data, whether higher levels of financial frictions are consistent with a stronger credit channel. 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. [1,2] 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 these 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 one standard deviation monetary policy 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. For most of the countries, the impulse responses do not show any evidence of the price and liquidity puzzles (the increase in prices and money aggregates following an increase in interest rates), providing some validation for our approach.

[1] See for example Djankov et al. (2007, 2008) for empirical evidence that support the stability of financial frictions.
[2] See also discussion by Elbourne and de Haan (2006) on the usefulness of estimating structural VARs in comparing the monetary transmission mechanisms across countries.

Next, we use our measure of MTS in a pooled regression of up to 61 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. Thus this study provides cross-country evidence on the importance of financial frictions in explaining the transmission mechanism of monetary policy. Although the magnitude of the coefficient varies depending on the sample period or estimation procedure, it is economically significant. 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 0.017 percentage point drop in the response of output to a monetary policy shock. A value of 0.017 implies that if Bolivia were to increase its recovery rate to the level of the UK's, it would reduce the response of output from 0.7% to 0.2%.

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, the financial accelerator model 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 another proxy for financial frictions. Using financial market data to predict financial frictions is an alternative to measuring financial frictions from survey data and is a contribution of this paper. To capture leverage sensitivity for each country, we estimate, using firm level data from 47 countries, the effect of firm leverage on the external finance premium. We approximate external finance premiums with corporate bond spreads. Using these 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, 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, borrowers may be more sensitive to a shift in the health of their balance sheet, making them sensitive to a rise in the external finance premium.[3]

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. Other studies focus on the effect of central bank independence (CBI) on inflation or the impact of financial market development on MTS. CBI is in general found to be associated with the lower levels of inflation observed in the last couple of decades (c.f. Berger et al., 2001; Klomp and de Haan, 2007), while the evidence is mixed for the effect of financial market development on 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. Moreover, many studies have pointed to the effect of deregulation in financial markets in the 1980s on the potency of the monetary transmission mechanism in the United States (Bernanke and Gertler, 1995). Specifically, deregulation and the ensuing financial innovation may have decreased monetary policy's impact on banks' ability to raise funds. Our findings are consistent with such an inverse relationship between more efficient financial markets and a weaker monetary transmission mechanism.

[3] 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).

The rest of the paper is organized as follows: Section 2 discusses the financial accelerator model that motivates our empirical tests. In Section 3 we generate our indicator of MTS. In Section 4 we estimate the effect of the bankruptcy recovery rate, our main indicator of financial frictions, on MTS. Sections 5 and 6 present robustness tests, including alternative measures of financial frictions. Section 7 concludes.

2. Theoretical Framework

Following the breakthrough studies on asymmetric information, led by Akerlof (1970), a large number of researchers have relaxed the assumption of the Modigliani-Miller theorem and investigated the role that financial frictions play in the amplification of shocks to economies. Some of these studies (BGG, 1989, 1999; Carlstrom and Fuerst, 1997; Prescott and Townsend, 1984; Townsend, 1979) introduce these frictions in the form of asymmetric information costs banks face when they agree on a loan contract. These costs are generally referred to as monitoring costs and represent the percentage of the value of a loan that banks cannot recover when there is default. BGG (1999), for example, solve a model (dubbed the financial accelerator model) characterized by these asymmetric information costs and derive an expression for external finance premium that firms face when they borrow from banks:

$$\frac{E\left[R_t^k\right]}{R_t} = v\left(\frac{Q_{t-1}K_t}{N_t}, \mu\right) \qquad v'\left(\frac{Q_{t-1}K_t}{N_t}\right) > 0 \quad , \quad v'(\mu) > 0 \tag{1}$$

where $E\left[R_t^k\right]$, R_t, Q_{t-1}, K_t, N_t, μ represent the borrowers' expected returns to capital, risk free rate, price of capital, capital stock, borrower's net worth, and the monitoring cost coefficient respectively. The implication of equation (1) is that the external finance premium, $E\left[R_t^k\right]/R_t$ is positively correlated with a borrower's leverage, given by $Q_{t-1}K_t / N_t$, and the monitoring cost

coefficient. In this paper we focus on the bankruptcy recovery rate 1- μ, which is inversely related to the monitoring cost coefficient, μ.

The second equation that the authors add to an otherwise standard new Keynesian model is the evolution of net worth given by:

$$N_{t+1} = f\left(N_t, Q_t, K_t, R_t\right) \qquad f'(\mu) > 0 \tag{2}$$

Equation (2) shows that as the monitoring cost coefficient increases, the effect of a shock on net worth, through its effects on returns to capital, asset prices and capital stock, increases as well. The high amplitude of net worth, in turn, implies larger responses of leverage and external premium. Firms decrease investment in response and generate a fall in asset prices and thereby a further fall in net worth. The fall in net worth causes a further increase in the external premium and a larger drop in output.

Given this setup, if a central bank changes its policy rates, it can affect the economy in two ways: First, lending spreads are affected directly. Second, by altering asset prices, central banks can have an effect on firms' leverage and therefore affect the level of borrowing. In each case, the effect of central bank's policy on borrowing spreads is positively related to the level of financial frictions (monitoring cost coefficient) in the economy. In line with this argument, researchers (c.f. BGG; Gertler et al., 2007) find that the impulse responses to shocks in models with positive monitoring costs are substantially higher than those from models without these costs.

In this paper, we test whether variation in monitoring costs across countries results in varying ability of central banks to affect the economy. Our main investigation strategy is the empirical methodology outlined in Sections 3 to 6. However, the financial accelerator model of BGG (1999) constitutes a convenient setup to investigate this hypothesis. As a first test, therefore,

we calibrate an open economy extension of the BGG (1999) model to two countries with relatively low and high levels of financial frictions, Brazil and Canada.[4] We then measure impulse responses to monetary policy shocks in these economies. A complete description of the model and the calibration strategy are provided in Appendix A.

Figure 1 displays the responses to a 100 annualized basis point interest rate shock that persists at the rate of 0.95 per quarter and follows a first-order auto-correlation process. The top panel shows that output responses to an interest rate shock are amplified as the monitoring cost coefficient increases in both economies. There are two reasons for this effect. First, the costs of bankruptcy in the aggregate resource constraint are proportional to the monitoring coefficient. Second, the drop in net worth is higher when the monitoring cost coefficient is larger, as shown in equation (2). The larger fall in net worth implies a higher leverage, external premium and output responses. Indeed, the responses of external finance premiums, shown in the bottom panel, reveal a positive correlation with these premiums and monitoring costs in both economies. Furthermore, when the monitoring cost coefficients are calibrated to match the lending spreads in these economies, we see that the responses of output and external premiums are much higher in the country with the higher monitoring cost coefficient (Brazil).

It is straightforward to extend this analysis to more than two countries and test our main hypothesis. However, there are several drawbacks to such an analysis. First, the debate between Neoclassicals and New Keynesians on the usefulness of New Keynesian models (such as the financial accelerator model) for policy analysis is far from settled.[5] Second, with the calibration

[4] These economies were chosen since they have similar size but have dissimilar levels of financial frictions. GDP for Canada and Brazil were 849.6 and 803.1 Billion SDRs in 2008 respectively. GDPs of these countries have also been similar in the 1998-2008 period. World Bank's Doing Business Survey reports that lenders' recovery rates when there is bankruptcy are on average 89.4% and 7.4% for Canada and Brazil respectively in the 2004-2009 period. The other bankruptcy cost measure in the survey, cost as a percentage of estate shows a similar pattern (10.5% for Brazil and 4% for Canada). There were other country pairs with similar size but dissimilar financial frictions. Brazil and Canada were chosen mainly due to data availability.

[5] See Chari, Kehoe and McGrattan (2008) for a discussion of the drawbacks to using New Keynesian models for policy analysis.

strategy used above it is difficult to asses the robustness of the model to the choice of parameter values. This is especially a concern for comparing across countries that are at similar stages of development.[6]

Therefore, in the rest of the paper, we investigate empirically the relationship between financial frictions and MTS using cross-country data.

3. 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 the external finance premium are likely to vary across countries. Nevertheless, we use the same definitions for monetary policy (the discount rate, which was by far the most widely available indicator of monetary policy) and economic activity (the monthly production index) for each country to facilitate a cross-country comparison of MTS.

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 this model 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 one standard deviation shock to interest rates. This method is preferable to FEVDs for our cross

[6] As an alternative to calibration, we used a Bayesian technique to estimate the parameters of the model using data from various countries. We found conflicting results from the simulations of this model mainly due to the high sensitivity of the model parameters' posterior distributions to the prior distributions of these parameters.

country analysis since the countries in our sample are at different stages of development and face different degrees of shocks to output and monetary policy. In addition, using maximum amplitudes allows us to take account of the sign of the impulse responses when testing the soundness of our results.

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, m_t, the central bank rate (discount 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 external developments.

The data are monthly and span the period 1984:1-2008:5.[7] The data were obtained from the International Financial Statistics (IFS) database for the 61 countries listed in Appendix B.[8]

Identification

[7] The industrial production index was available for a majority of the countries in our data set. When this data were not available, we used other indicators for monthly economic activity. These indicators (by country) are provided in Appendix B.
[8] This appendix also provides the IFS definitions of the macroeconomic variables used in our analysis.

The main shortcoming of using SVAR methods to study monetary policy is the difficulty in identifying policy shocks. Indeed, 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 increase the soundness 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, 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 an identification strategy similar to that in Kim (1999). To measure these shocks (monetary policy shocks that are not correlated with shocks to the other variables in the model), we assume that the monetary policy variable does not respond to output and prices contemporaneously and only responds to these variables with a lag, which is mainly due to lags in announcement. We also assume that output and prices are not affected contemporaneously by financial variables due to adjustment costs associated with these variables. The monetary aggregate is included to account for the liquidity puzzle and to minimize the risk that the monetary policy shock is 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 commodity 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 residuals obtained from the reduced form equations. P_{ij} denote the contemporaneous structural parameters.

Non G-8:

The above restrictions used to identify shocks have done reasonably well in replicating the response of the economy to monetary shocks in G-8 countries. Although one can argue that these restrictions would be valid for smaller economies as well, the literature (c.f. Hoffmann, 2007) has in general relied on different strategies to identify monetary shocks in developing countries. In particular, these studies assume (reasonably) that advance economy variables such as output prices and interest rates are exogenous to the model that describes a developing economy. In this section, we follow this approach and estimate the following for non G-8 countries.

$$Y_t = B(L)Y_t + C_0 X_t + C(L)X_t + e_t \qquad (3)$$

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 discount rate. To obtain impulse responses, we assume that the foreign variables are exogenously determined and that the identifying restrictions for the domestic economy are similar to Kim (1999). We use the U.S. industrial production index and discount 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] A lag length for estimating each VAR is chosen according to the corrected-AIC (Hurvich and Tsai, 1989).

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

[9] Replacing the U.S. with Germany for countries in the European Union did not change our results significantly. For countries in the European Monetary Union (EMU), we estimated the VAR model prior to EMU membership.
[10] Alternatively, we measured variables in logs and detrended them using a quadratic time trend and obtained similar results.

match those in Kim (1999). Nevertheless, we found that the price puzzle was observed in only 3 out of the 61 countries in our sample, and the liquidity puzzle in only 2 countries.[11]

Furthermore, historical forecast error variance decompositions (forecast error variance attributable to monetary policy shocks) measured using our model were 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. This provides further support for the soundness of the impulse responses obtained using the identification strategy described above.

4. 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. We capture the level of financial frictions by the percentage of the value of a loan recovered by lenders (the recovery rate) when there is default. 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 it provides a close match to the source of financial frictions discussed in BGG (1999) (the monitoring cost coefficient) and therefore allows us to more accurately test the predictions of the financial accelerator model.

Let RR_i and MTS_i denote the recovery rate and MTS for country *i*, and let x_i denote the vector of country specific control variables. The simple correlation between these two variables is -0.37. In this section we determine whether this negative relationship holds after controlling for other factors. We estimate the following model:

[11] For brevity, we do not report the impulse responses functions for each country. We provide summary statistics for the presence of the price and liquidity puzzles in each country. This information is available in Appendix C.

$$MTS_i = \alpha_0 + \alpha_1 RR_i + \beta x_i + \varepsilon_i \quad (4)$$

As control variables we include 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 ICRG. The inclusion of these variables ensures that RR_i is not picking up the effects of the overall level of development or other measures of institutional quality. We also 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 would have on MTS by providing alternative sources of finance during contractions. We also include the real interest rate since high real interest rates could indicate that monetary policy is more influenced by fiscal sustainability and the neutralization of capital inflows and outflows (especially in small open economies). Finally, it is reasonable to assume that a more independent central bank can have a greater impact on the real economy. Therefore, we control for CBI using the index in Cukierman et al. (1992), which is based on the turnover rate of central bank governors.[12] In unreported regressions we control for legal origin following Cecchetti (1999) and find virtually identical results.

The sample includes 61 countries for which all necessary data were available. We use annual data averaged over the years 1984 to 2008 for the right hand side variables to match the

[12] 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. 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. In Cukierman et al. (1992), both indices are generally available until 1989 for both advanced and developing economies and assume one value per decade. They range from 0 to 1, with higher values indicating greater CBI for the legal index and lower CBI for the turnover index. The legal index was extended through 2002 for 24 Latin American and Caribbean countries by Jácome and Vázquez (2005), who also added a few new countries to the sample, and through 1999 for advanced countries by Siklos (2008). The turnover index was supplemented with data after 1990 from Crowe and Meade (2007) and Dreher et al. (2008).

sample period used to generate the dependent variable. Thus there is only one observation per country. We estimate equation (4) using OLS with robust standard errors.[13]

Data on financial frictions: the bankruptcy recovery rate

The key parameter in the financial accelerator model 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 (creditors, tax authorities, and employees) recover from an insolvent firm."[14]

It is important to highlight a potential caveat in our analysis at this point. 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 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 the financial accelerator model and because it is a continuous variable as opposed to creditor rights which is an index from 0 to 4).[15] 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

[13] 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 (4) 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. Results were very similar to those from our baseline model when; although developing country observations were given smaller weights due to large variation in the *MTS* variable for these countries.

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

[15] This was true for the countries in our sample as well. 81% of our countries experienced no change in this index from 1978 to 2003.

from reverse causality for example, should be mitigated if recovery rates are mostly time invariant.

As an alternative to the recovery rate, the Doing Business database contains a variable measuring the bankruptcy cost as a percent of the estate, which is positively correlated with the recovery rate. While we find similar results for this variable, we expect that the recovery rate measure to be a better representation of the bankruptcy cost parameter in the financial accelerator model. The reason is that the cost variable only measures the legal costs of the bankruptcy proceedings, while the recovery rate in addition to legal fees also considers the loss in the value of firms' assets due to time spent in these proceedings. We therefore present results using the recovery rate, although results for the cost of bankruptcy are available upon request.

Results

The top panel of Table 3 presents results from the estimation of equation (4). We find a negative relationship between recovery rates and MTS. In particular, 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 0.017 percentage point drop in the response of output to a monetary policy shock. A value of 0.017 implies that if Bolivia were to increase its recovery rate to the level of the UK's, it would reduce the response of output from 0.7% to 0.2%, a change which is almost half a standard deviation of the output response across our sample. This change is also almost three times larger than the median value for the response of output and almost as large as the mean value. The results are similar when we include stock market capitalization, the real interest rate, CBI, and various combinations of these variables.[16]

[16] When we use the legal measure of CBI, the coefficient of *RR* becomes insignificant, although this is a result of the reduced sample size and not the inclusion of the legal variable itself. Specifically, if we run the regression without the legal variable but limit the sample to countries with data for the legal variable, the coefficient of *RR* is insignificant.

In the bottom panel of Table 3 we test whether the effect of financial frictions on MTS varies depending on the prevalence of small firms in the economy. Small firms are more likely to be credit constrained and so monetary policy should have a larger effect in economies with many small firms (Bean et al., 2002; Cecchetti, 1999; Kashyap and Stein, 1997). We therefore interact *RR* with indicators of small firm presence. The first indicator is the percent of firms using banks to finance investment, with higher values suggesting more small firms. We therefore expect a negative sign for the interaction term. We also use the % of workers employed by small and medium firms (Ayyagari et al., 2007). Finally, we use stock market capitalization as a % of GDP since small firms tend to depend more on bank finance. In this case, higher values suggest more large firms, and so we expect a positive coefficient on the interaction term.[17]

To facilitate a comparison with the base specification results, we first present results including only the variables in the base specification but limiting the sample to countries with data on the interaction variables. We then present results for the regressions including the interaction terms. Comparing columns 1 and 2, we see that when we include the interaction term of *RR* with the percent of firms using banks to finance investment, the coefficient of *RR* becomes insignificant while the coefficient of the interaction term has the predicted negative sign and is almost significant at the 10% level (p-value = 0.11). This suggests that the initial negative coefficient of *RR* was the result of financial frictions augmenting the effect of monetary policy for smaller firms. Further calculations reveal that the effect of an increase in *RR* is significant but only for countries with the percent of firms using banks to finance investment greater than or equal to 12% (slightly below the average value for the full sample of countries). The size of the

[17] 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.

predicted impact on *MTS* when the value of this variable is 12% is equal to 0.02 percentage points. The coefficient of *RR* * % of workers employed by small firms has the incorrect sign but is not significant. The coefficient of *RR* * Market Cap (% of GDP) has the predicted positive sign and is significant at the 5% level. Thus there is some evidence that the effect of financial frictions on *MTS* is magnified in countries with a larger presence of small firms. Finally, the coefficients of three variables measuring small firm presence by themselves (i.e. not their interaction with *RR*) have the predicted signs or are insignificant.

5. 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 artificially generated by applying different empirical models to countries that are at different stages of development. 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. The magnitude of the coefficient is somewhat smaller than in the base case. A coefficient of -0.009 implies that if Bolivia were to increase its recovery rate to the level of the UK's, it would reduce the output response from 0.7% to 0.5%.

Separate Time-Periods

Central banks in recent years have had more success stabilizing the real economy (c.f. Rogoff, 2007; Cecchetti et al., 2006). Indeed, the median value of MTS increases from 0.08 between 1984-91 to 0.13 during 1992-99 to 0.19 between 2000-08. This could be the result of increasing financial frictions, although many other factors may have caused this improvement in monetary policy effectiveness such as rising CBI. Given lack of longer time series data, we

cannot use recovery rates to assess the change in frictions over time, although the near time-invariance of the creditor rights index suggests that increasing financial frictions may not be responsible for the increase in MTS. However, it is possible that even if frictions have not changed, their effect on MTS has. In this section we aim to determine whether the *impact* of financial frictions on MTS has changed over time.

Columns 2-4 in the top panel of Table 4 provides results for the base specification but breaking the sample up into the three sub-periods mentioned above. Note that the number of countries in each experiment is smaller than the number of countries in the full sample, as some of the countries in the sample did not have data for all three periods. Nevertheless, the coefficient of *RR* has the predicted negative sign for all sample periods and is significant for the last two periods and almost significant for the first period (p-value = 0.101). The coefficient for the last two periods is much larger than for the first period, although this is purely a sample size issue. In particular, there are only 32 countries for the first period and 50 and 52 for the second and third, respectively. If we estimate the regression for the second and third period, but limit to countries in the first period sample, we also find significantly smaller coefficients. Thus the effect of financial frictions has remained fairly stable over time, perhaps suggesting that other factors such as greater CBI has increased MTS.

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).

6. Leverage Sensitivity as a Proxy for Financial Frictions

Measuring Leverage Sensitivity

The financial accelerator model makes two important predictions. First, there is a positive relationship between MTS and the level of financial frictions in an economy. The model simulations and the 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.

The financial accelerator model 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).[18] We can therefore use leverage sensitivity as another proxy for financial frictions.

To capture leverage sensitivity for each country, we estimate the effect of firm leverage on the external finance premium using firm level data. We approximate the external finance premium for each country with corporate bond spreads. We use bond deals of non-financial firms and other firm-specific data from 47 countries 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.

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,

[18] Results are available upon request.

2007; Durbin and Ng, 2005). Usually, this literature attributes the variations in corporate spreads to firm, industry and bond characteristics, macroeconomic variables, sovereign risk, and other country-specific effects. In our estimation, we follow the literature and account for these effects to the extent that data are available. Specifically, we estimate the following equation separately for each country:

$$\tilde{EFP}_{it} = \gamma_{0k} + \gamma_{1k}\tilde{LEV}_{it-1} + \xi_{1k}y_{it-1} + \xi_{2k}BC_{it} + \xi_{3k}MC_{tk} + \xi_{4k}SR_{tk} + \xi_{5k}T_k + \xi_{6k}I_k + \nu_{it} \quad (5)$$

where subscripts *i, k* and *t* denote the bond deal, the country and the time period. $\tilde{EFP}_{it}$ represents the spread on bond *i*, $\tilde{LEV}_{it-1}$ 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, $\tilde{EFP}_{it}$, as the difference between corporate and government bond yields of similar maturity.[19] 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,

$$\tilde{EFP}_{it} = YTM^{i}_{t,T} - YTM^{g}_{t,T} \quad (6)$$

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

[19] Our main reason for using yield to maturity was the availability of data. There is research, however, that highlight 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.

5-year US treasury bond when measuring the spread. Alternatively, we considered only local 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 $\widetilde{LEV}_{it}$: 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 used the leverage ratio reported at the end of 1998 or the first quarter of 1999 if quarterly data is available.

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, earnings before interest and taxes/assets, retained earnings before interest and taxes/Assets, liquidity measured by the current ratio, 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 (5) 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 (5) for each country is available in Appendix D. 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; Huang and Kong, 2003) and clearly imply that firm specific effects play an important role in determining corporate bond spreads.

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 (4) using recovery rates from 2004 to 2008, while the monetary policy proxy 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 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, reducing the number of countries in the base regression from 61 to 24-31. We therefore use recovery rates as our default measure of financial frictions.

Leverage Sensitivity and MTS

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

$$MTS_{it} = \alpha_{0i} + \alpha_1 \hat{\gamma}_{1it} + \beta x_{it} + \varepsilon_{it} \quad (7)$$

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 (or very close to it) in explaining the strength of monetary transmission. A one percentage point increase in leverage sensitivity leads to a 0.015 percentage point increase (on average) in the maximum response of output to a monetary policy shock. The results were similar when we excluded the government quality variable and GDP per capita. These results therefore provide further evidence that greater financial frictions lead to a stronger transmission mechanism of monetary policy.

7. Conclusion

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 61 countries, we confirm the prediction of the financial accelerator model that financial frictions augment the strength of the monetary transmission mechanism.

The financial accelerator model 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), or through the deregulation of financial markets within a country, monetary policy becomes less effective if these improvements center on reducing financial frictions. For example, the deregulation of financial markets is cited to explain the weakening of the MTS in the United States (c.f Bernanke and Gertler, 1995 and Gertler and Gilchrist, 1993). More recently, the link between deregulation and the potency of the MTS is found in other countries as well (c.f Agung, 1998; Brissimis and Delis, 2009; and Ferreira, 2007; Juselius and Toro, 2005).

Of course, if there are more broad improvements in institutional quality that bring more credibility to central banks, the *overall* impact on the effectiveness of monetary policy is ambiguous. For example, Krause and Rioja (2006) argue that well-developed financial markets

provide monetary policy broader scope for stabilization policy (see also Ciccarelli and Rebucci, 2006 and Genberg, 2008).[20] At the very least therefore, our results 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. Moreover, the uncertainty on the relationship between monetary policy, institutional factors, deregulation and the like, may be more deserving of attention given the recent global financial crisis. Our results indicate that higher regulation of financial markets certainly would have implications for the MTS.

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[20] One is example of such an effect is interest rate deregulation appears to have strengthened the "pass-through" a change in policy rates to other interest rates in the economy. Singh et al. (2008) find evidence of strong interest rate channels in developed countries with advanced financial systems relative to countries with less-advanced systems (c.f. Chong, 2010). Sellon (2002) finds the removal of interest rate ceilings in the U.S. (known as "Regulation Q") has made the interest rate channel more potent.

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Table 1: Summary Statistics

	obs.	mean	median	s.d.	min.	max.
MTS	61	0.59	0.18	1.22	0.00	7.22
RR	61	44.10	38.54	25.89	0.00	92.62
GDP per capita	61	14,531	10,718	10,662	663	38,574
GOVQ	61	3.84	3.79	1.24	1.54	5.95
Market Cap. % GDP	59	53.06	32.27	54.32	0.71	280.07
real interest rate	60	6.33	5.79	9.54	-28.82	51.61
CBI-Turnover	56	0.21	0.20	0.12	0.00	0.68
cost of bankruptcy (% of estate)	60	13.07	9.00	9.55	1.00	42.00
% firms using banks to finance investment	42	19.66	17.70	13.03	2.61	74.55
% workers employed by small firms	47	58.59	60.00	17.87	12.74	89.30

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	15.7%	Kim (1999) 5.9% -17.0%, Italiano (2001) 2.0% - 20.6%, Bordo and Redish (2003) 16.0%-17.9%
Czech Republic	7.2%	Anzuini and Levy (2007) 2.0%-11.9%
France	4.2%	Anzuini and Levy (2007) 5.6%-17.7%, Kim (1999) 6.2% - 17.7%
Germany	15.8%	Anzuini and Levy (2007) 9.3%-23.1%, Holtemoller (2003) 21%, Kim (1999) 7.6% - 26.9%
Greece	2.7%	Markidou and Nikoladou (2008) 1.1% - 7%
Hungary	26.0%	Anzuini and Levy (2007) 12.0%-18.1%
India	13.2%	Roy and Darbha (2000) 0.8%-11.43%
Italy	7.2%	Anzuini and Levy (2007) 4.3%-8.9%, Kim (1999) 4.3% - 8.9%
Japan	2.4%	Kim (1999) 1.8% - 8.8%
Nigeria	16.2%	Olusegun (2001)18.2%-24%
Poland	13.5%	Anzuini and Levy (2008) 7.5%-17.3%
Tunusia	13.3%	Boughrara (2008) 2%-12%
U.K.	7.2%	Anzuini and Levy (2007) 9.8%-15.3%, Kim (1999) 9.8% - 15.3%
U.S.	5.8%	Bernanke, Boivin, Eliasz (2005) 5.4%, Kim (1999) 7.6% - 26.9%, Christiano et al. (1996) 29.4%, Rossi and Zuabiry (2009) 3.5%-27.1%, 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 policy rate.

Table 3: Equation 4 - Strength of Monetary Transmission (*MTS*) and the Recovery Rate

Dependent variable: *MTS*						
RR	-0.017	-0.016	-0.019	-0.017	-0.018	-0.020
	(0.008)**	(0.008)**	(0.008)**	(0.008)**	(0.008)**	(0.009)**
log GDP per capita	-0.140	-0.122	-0.142	-0.257	-0.088	-0.157
	(0.382)	(0.392)	(0.384)	(0.440)	(0.400)	(0.466)
GOVQ	0.091	0.093	0.117	0.132	0.088	0.193
	(0.231)	(0.241)	(0.233)	(0.254)	(0.247)	(0.273)
Market Cap. % GDP		-0.002			-0.002	0.005
		(0.002)			(0.002)	(0.002)**
real interest rate			-0.035		-0.044	-0.057
			(0.016)**		(0.024)*	(0.029)*
CBI-Turnover				-0.063		1.287
				(1.155)		(1.176)
Obs.	61	59	60	56	58	53
R^2	0.14	0.14	0.22	0.16	0.24	0.29
RR	-0.028	-0.011	-0.015	-0.067	-0.017	-0.032
	(0.013)**	(0.016)	(0.009)*	(0.058)	(0.008)**	(0.013)**
log GDP per capita	-0.014	0.000	0.325	0.252	-0.138	-0.120
	(0.523)	(0.535)	(0.289)	(0.298)	(0.386)	(0.362)
GOVQ	0.040	0.040	-0.183	-0.057	0.078	0.176
	(0.380)	(0.408)	(0.212)	(0.163)	(0.238)	(0.230)
% firms using banks to finance investment		0.041				
		(0.024)				
RR * % firms using banks to finance investment		-0.001				
		(0.001)				
% workers employed by small firms				-0.037		
				(0.039)		
RR * % workers employed by small firms				0.001		
				(0.001)		
Market Cap. % GDP						-0.017
						(0.007)**
RR * Market Cap. % GDP						0.0003
						(0.000)**
Obs.	42	42	47	47	59	59
R^2	0.14	0.16	0.11	0.19	0.14	0.21

NOTES:
1. See Appendix B 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	sub-sample (1)	sub-sample (2)	sub-sample (3)
RR	-0.009	-0.003	-0.011	-0.011
	(0.004)**	(0.002)	(0.006)*	(0.006)*
log GDP per capita	-0.257	0.120	-0.143	0.015
	(0.181)	(0.130)	(0.295)	(0.153)
GOVQ	0.125	-0.003	0.082	-0.035
	(0.124)	(0.071)	(0.196)	(0.102)
Obs.	61	32	50	52
R^2	0.19	0.15	0.15	0.19

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.
4. The dependent variable is the FEVD (the percentage of output response explained by discount rate shocks) measured using the Kim/Hoffman identification.

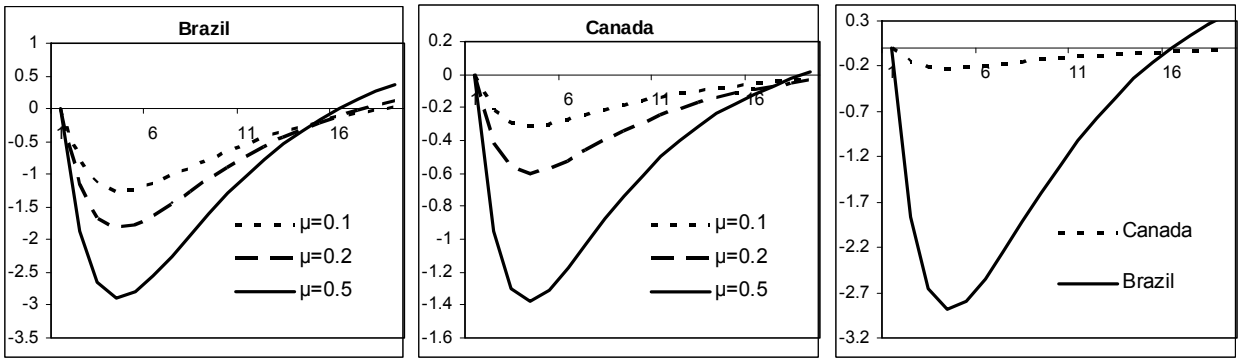
Table 5: Equation 7 - Strength of Monetary Transmission (*MTS*) and Leverage Sensitivity

Dependent variable:	financial leverage measured using:								
MTS	Proceeds/Equity			debt/capitalization			debt/equity		
	OLS	RE	FE	OLS	RE	FE	OLS	RE	FE
leverage sensitivity	0.014	0.013	0.016	0.009	0.013	0.015	0.017	0.021	0.025
	(0.007)*	(0.008)*	(0.010)	(0.006)*	(0.003)***	(0.003)***	(0.008)**	(0.005)***	(0.006)***
log GDP per capita	0.120	0.115	1.827	0.111	-0.023	0.753	0.002	-0.146	0.829
	(0.256)	(0.217)	(0.891)*	(0.249)	(0.187)	(0.686)	(0.215)	(0.194)	(0.709)
GOVQ	-0.198	-0.201	0.801	-0.155	-0.045	0.736	-0.087	0.016	0.974
	(0.228)	(0.145)	(0.442)*	(0.236)	(0.125)	(0.318)**	(0.195)	(0.133)	(0.339)**
Obs.	43	43	43	50	50	50	50	50	50
Countries	24	24	24	31	31	31	31	31	31
Hausman p-value		0.12			0.02			0.01	
R^2	0.21		0.29	0.26		0.62	0.32		0.59

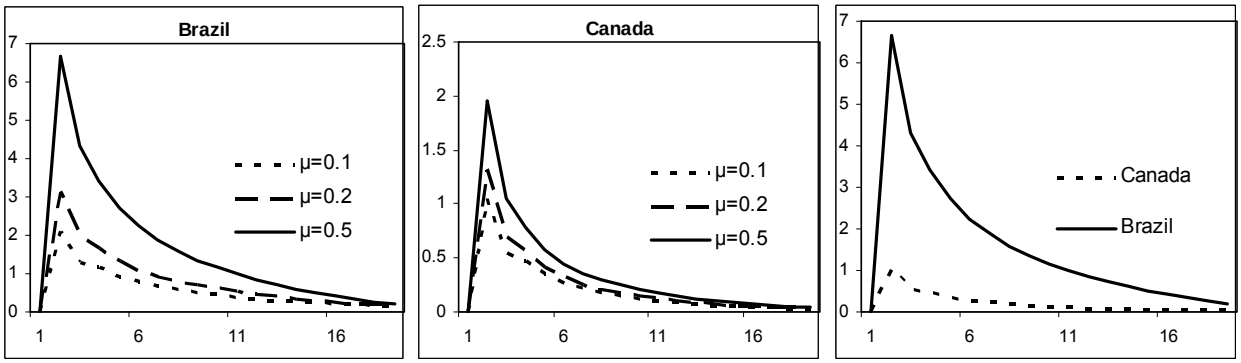
NOTES:
1. See Appendix B for variable definitions and sources.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Panel regressions, robust standard errors in parentheses.

Figure 1: Impulse Responses to a 100 basis point Annualized Interest Rate Shock

Output



External Finance Premium



Appendix A: The Model

In our simulations we use a standard dynamic New-Keynesian small open economy framework that has financial frictions and price stickiness. There are six types of agents: households, entrepreneurs, a domestic bank, retailers, capital producers, and a central bank. Households work, consume, and invest in deposits denominated in domestic and foreign currency. Entrepreneurs do not have sufficient internal funds and thus, borrow from domestic banks to finance the production of wholesale goods. The bank uses consumers' deposits to finance entrepreneurs. Retailers transform wholesale goods into final consumption goods. Retailers are monopolistically competitive in order to motivate price stickiness. Capital producers turn investment into capital goods. Finally, a central bank conducts monetary policy using a Taylor (1993) rule.

A.1 Households

Households consume a composite good, C_t; a CES aggregation of domestic and foreign goods, C_t^H and C_t^F respectively, where, C_t^H is a composite of the goods sold by the retailers.

$$C_t = \left[(\gamma)^{\frac{1}{p}} \left(C_t^H\right)^{\frac{p-1}{p}} + (1-\gamma)^{\frac{1}{p}} \left(C_t^F\right)^{\frac{p-1}{p}} \right]^{\frac{p}{p-1}} \tag{A.1}$$

The corresponding price index is given by, $P_t = \left[(\gamma)\left(P_t^H\right)^{1-p} + (1-\gamma)\left(P_t^F\right)^{1-p} \right]^{\frac{1}{p-1}}$.

Households exhibit habit formation and maximize,

$$E_t\left[\sum_{i=0}^{\infty} \beta^i \left[\left(C_{t+i} - bC_{t+i-1}\right)^{1-\Omega} / 1-\Omega + x\ln\left(M_{t+i} / P_{t+i}\right) - k\ln\left(1-L_{t+i}^h\right) \right]\right] \tag{A.2}$$

$$\text{s.t}\, C_t + \left(M_t + (1+R_{t-1})D_{t-1} + (1+R_{t-1}^*)s_t D_{t-1}^*\right)/P_t + T_t = \left(W_t^h L_t^h + M_{t-1} + D_t + s_t D_t^*\right)/P_t + \Pi_t \tag{A.3}$$

Consumers buy goods, hold money, M_t, pay lump sum taxes, T_t. Their income comes from wages, profits received from the retailers, Π_t, the returns on deposits, and their money holdings. Furthermore, consumers can borrow in terms of foreign currency at the risk free interest rate R_t^*, or in domestic currency at an interest rate R_t. Nominal foreign and domestic debt payments are denoted by $(1+R_{t-1})D_{t-1}$ and $(1+R_{t-1}^*)s_t D_{t-1}$ respectively, and s_t represents the exchange rate. Given this setup, the first order conditions are derived from the consumer's optimization problem. Consumption allocation and intertemporal efficiency:

$$\frac{C_t^H}{C_t^F} = \frac{\gamma}{1-\gamma}\left(\frac{P_t^H}{P_t^F}\right)^{-p} \tag{A.4}$$

$$\lambda_t \frac{W_t^h}{P_t} = k\frac{1}{1-L_t^h} \tag{A.5}$$

marginal utility of consumption and intermtemporal efficiency:

$$\lambda_t = \left(C_t - bC_{t-1}\right)^{-\Omega} - \beta b\left(C_{t+1} - bC_t\right)^{-\Omega} \tag{A.6}$$

$$\lambda_t = \beta E_t\left(\lambda_{t+1}(1+R_t)P_t / P_{t+1}\right) \tag{A.7}$$

uncovered interest parity condition, law of one price, and foreign demand for home goods is:

$$E_t\left(\lambda_{t+1}\frac{P_t}{P_{t+1}}\left[(1+R_t)-(1+R_t^*)\frac{s_{t+1}}{s_t}\right]\right) = 0 \tag{A.8}$$

$$P_t^H = s_t P_t^{H*}, \quad P_t^F = s_t P_t^{F*} \tag{A.9}$$

$$C_t^{H*} = \left(\frac{P_t^{H*}}{P_t^*}\right)^{-\varepsilon} Y_t^* \tag{A.10}$$

where P_t^{F*} P_t^{H*}, are the foreign price of home and foreign goods and P_t^{F*}=1 in every period. Y_t^* is foreign income, and the foreign aggregate price level P_t^* is exogenously determined.

A.2 Entrepreneurs

Wholesale firms are managed by entrepreneurs and produce according to:

$$Y_{it} = A_t K_{it}^{\alpha} L_{it}^{1-\alpha} \tag{A.11}$$

where A_t is an i.i.d. aggregate productivity shock. Aggregate production function is given by, $Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$, where the labor input $L_t = \left(L_t^h\right)^{\omega}\left(L_t^e\right)^{1-\omega}$ is a composite of household's and entrepreneurs labor supply. This modification is needed to provide some net worth to entrepreneurs that start producing for the first time. In our simulations ω is set equal to 0.05 and entrepreneurs' labor supply decision does not affect output significantly. The following sections describe the agents in the economy.

Capital expenditures are financed by banks and the entrepreneurs' net worth such that,

$$Q_{t-1} K_{it} = N_{it} + B_{it} \tag{A.12}$$

where N_{it} is the net worth of the firm at the end of period t-1 and at the beginning of period t, B_{it} denotes the funds borrowed from the banks, and Q_{t-1} is the price of assets in period t-1. In the benchmark model we assume that households' domestic deposits equal the aggregate borrowing requirement of the entrepreneurs such that $B_t = D_t / P_t$. In addition to the economy wide technology shock, entrepreneurs face idiosyncratic, iid, returns to capital shocks, A_{it} . Real returns to capital are composed of A_{it} and the real return, averaged across firms, R_t^k .

$$R_{it}^k = A_{it}\left(\alpha \frac{P_t^w A_t K_t^{\alpha} L_t^{1-a}}{P_t} + (1-\delta)\frac{Q_t}{P_t}\right) / \frac{Q_{t-1}}{P_{t-1}} = A_{it} R_t^k \tag{A.13}$$

P_t^w is the price of the wholesale good, and P_t is the price level. Firms hire labor according to:

$$(1-\alpha)\omega \frac{Y_t}{L_t} = \eta_t \frac{W_t^h}{P_t}, \quad (1-\alpha)(1-\omega)\frac{Y_t}{L_t} = \eta_t \frac{W_t^e}{P_t} \tag{A.14}$$

where $\eta_t = P_t / P_t^w$ and $1/\eta_t$ represents the relative price of wholesale goods.

The Contract between the Domestic Bank and Entrepreneurs

There is a continuum of entrepreneurs with insufficient net worth to internally finance their investments. Entrepreneurs borrow the difference between their desired investment and net worth from a domestic bank. The external finance premium is determined according to the contract with the bank. Entrepreneurs' return on investment is subject to an idiosyncratic shock.

$$\left[1-F\left(\bar{A}_{it}\right)\right]\left(R_t + x_{it}\right)B_{it} + (1-\mu)\left[\int_0^{\bar{A}_{it}} A_{it}R_t^k Q_{t-1}K_{it}\delta F\left(A_{it}\right)\right] = R_t B_{it} \tag{A.15}$$

where, A_{it} is the idiosyncratic shock to returns to capital and is log normally, i.i.d. $\bar{A}_{it}$ is the expected cutoff value of the firm specific shock below which the firm is unable to pay back its debt. x_{it} , μ , Q_{t-1} , K_{it} , and R_t represent the external finance premium, monitoring cost coefficient, price of capital, capital stock, and the risk free rate respectively. The recovery rate is given by 1-μ. Equation (A.15) shows that banks set their expected returns equal to the risk free rate. The right hand side represents the opportunity costs of financing the entrepreneur. Expected returns consist of the principal and interest payments with probability $1-F\left(\bar{A}_{it}\right)$ and whatever the firm has if it defaults net of monitoring costs. Funds borrowed from the bank, B_{it}, and the return to capital, R_t^k, are given by:

$$B_{it} = Q_{t-1}K_{it} - N_{it} \tag{A.16}$$

$$R_t^k = \left(\alpha \frac{P_t^w A_t K_t^{\alpha} L_t^{1-a}}{P_t} + \left(1-\delta\right)\frac{Q_t}{P_t}\right) / \frac{Q_{t-1}}{P_{t-1}} \tag{A.17}$$

where N_{it} and $Q_{t-1}K_{it}$ are the net worth and the desired investment of entrepreneur *i* respectively, and P_t / P_t^w is the markup of retail goods over whole sale goods. We assume that entrepreneurs

purchase their entire capital stock every period. This assumption ensures that the external finance premium is determined based on the overall leverage of the firm and not just the marginal investment. The second equation that characterizes the contract is as follows:

$$\overline{A}_{it} R_t^k Q_{t-1} K_{it} = \left(R_t + x_{it}\right) B_{it} \tag{A.18}$$

Entrepreneurs need at least the cutoff value of the idiosyncratic shock to pay the principal and interest. $\overline{A}_{it}$ and the risk premium, x_{it}, are determined simultaneously using equations (A.15) and (A.16). Entrepreneurs in the model are assumed to be risk neutral and are exposed to both idiosyncratic and aggregate shocks. Therefore, technology-related risks are transferred from risk-averse domestic consumers to the entrepreneurs via the financial intermediary.[21] From the revenue maximization problem of the entrepreneur, subject to (A.15), we derive:[22]

$$\frac{E_{t-1}\left[R_t^k\right]}{R_t} = v\left(\frac{Q_{t-1}K_{it}}{N_{it}}\right) \qquad v'\left(\frac{Q_{t-1}K_{it}}{N_{it}}\right) > 0 \tag{A.19}$$

Equation (A.19) represents the supply of capital relation. When firms become more leveraged, banks charge a higher premium to compensate for the higher probability of default. Similarly, we can show by inverting (A.19) that leverage is positively related to the relative returns to capital.

$$\frac{Q_{t-1}K_{it}}{N_{it}} = \varphi\left(\frac{E_{t-1}\left(R_t^k\right)}{R_t}\right), \qquad \varphi'\left(\frac{E_{t-1}\left(R_t^k\right)}{R_t}\right) > 0 \tag{A.20}$$

The overall demand for capital is obtained by aggregating over all entrepreneurs.

$$Q_{t-1}K_t = \varphi\left(E_{t-1}\left(R_t^k\right)/R_t\right)N_t \tag{A.21}$$

[21] Assuming that the country is exposed to an adverse aggregate shock, the standard financial accelerator framework implies that the bank collects more from entrepreneurs that survive to compensate for the losses from bad loans. A more realistic contract in which foreign banks include the expected, instead of the ex post, returns to capital in the financial contract does not change the results. Proof is available on http://homepages.uconn.edu/~ula06001/.

[22] The derivation of this relationship is provided in BGG.

According to this relation, firms base their investment decisions on the expected returns to capital relative to the risk free rate. Furthermore, we can also show that in steady state higher monitoring costs correspond to lower leverage so that $\varphi'(\mu) > 0$.[23] The entrepreneurs' net worth evolves according to the following:

$$N_{it+1} = \gamma^e V_{it} + W_t^e / P_t \tag{A.22}$$

where W_t^e / P_t, V_{it} are an entrepreneur's real wage and equity. V_{it} is given by,

$$V_{it} = R_t^k Q_{t-1} K_{it} - \left(R_t + \frac{\mu \int_0^{\bar{A}_i} A_{it} R_t^k Q_{t-1} K_{it} dF(A_{it})}{Q_{t-1} K_{it} - N_{it}} \right) (Q_{t-1} K_{it} - N_{it}) \tag{A.23}$$

The first term on the right hand side of equation (A.23) represents the returns to capital given that the firm does not go bankrupt. The second term is the expected debt payment. γ^e in equation (A.22) is the survival probability of the entrepreneur. This variable is needed to prevent entrepreneurs from building up enough net worth and becoming self sufficient.[24] Net worth is composed of the net returns to capital if the firm stays afloat and real wages. Equations (A.22) and (A.23) define the second part of the financial accelerator mechanism. In particular, if there is an increase in asset prices, returns to capital along with firms' net worth increases as well.[25] If entrepreneurs do not survive, they consume the returns to capital net of debt payments such that $C_{it}^e = (1 - \gamma^e) V_{it}$.

A.3 Capital Producers

There are increasing marginal costs to capital production. The capital stock evolves according to:

$$K_{t+1} = \Phi(I_t / K_t) K_t + (1 - \delta) K_t \tag{A.24}$$

[23] Proof is available upon request.
[24] Because internal finance is cheaper, there is an incentive to be self sufficient.
[25] Equation (A.23) can be used to show that $dV_t / dQ_t > 0$.

Capital producers are perfectly competitive. They use wholesale goods as inputs to produce capital according to the production function: $\Phi\left(I_t / K_t\right)K_t$. The price of capital goods is derived from the producers' profit maximization problem. The final component of the accelerator mechanism is given by equation (A.25).

$$E_{t-1}\left[Q_t / P_t^w - \left[\Phi'\left(I_t / K_t\right)\right]^{-1}\right] = 0 \qquad \Phi'(\bullet) > 0 \tag{A.25}$$

If entrepreneurs experience a positive asset price shock, they borrow more and demand more capital. This leads to an increase in their expected net worth for the following period. In addition, as investment increases, there is upward pressure on asset prices, amplifying the initial response.

A.4 Retail Firms

Retail firms are monopolistically competitive. They buy wholesale goods and sell them after repackaging at no resource cost. The purpose of including these firms at this stage is to have a simple contract between the firm and the banking sector.[26] The other benefit of this framework is that it allows for sticky prices and therefore monetary policy that is not neutral in the short run. The demand for goods produced by retail firms is given by,

$$Y_t^H\left(z\right) = \left(\frac{P_t^H\left(z\right)}{P_t^H}\right)^{-\upsilon} Y_t^H \tag{A.26}$$

where $Y_t^H = \left(\int_0^1 Y_t^H\left(z\right)^{\frac{\nu-1}{\nu}} dz\right)^{\frac{\upsilon}{\upsilon-1}}$. Following the pricing scheme of Calvo (1983), we assume that only θ fraction of retailers adjust their prices at a specific time.

$$P_t^H = \left(P_{t-1}^H\right)^{\theta}\left(P_{t-1}^{*H}\right)^{1-\theta} \tag{A.27}$$

[26] A financial contract with a monopolistically competitive firm would complicate aggregation due to the different levels of leverage for each monopolistic firm.

Retailers maximize an intertemporal loss function and set their optimal price $P_t^{*H} = \mu_1 \prod_{i=0}^{\infty} P_{t+i}^{w^{(1-\beta\theta)(\beta\theta)^i}}$, where $\mu_1 = 1/(1-1/\nu)$ is the desired gross mark up over wholesale prices. Given this setup, one can solve for the domestic inflation rate as,

$$\frac{P_t^H}{P_{t-1}^H} = \left(\mu_1 \frac{P_t^w}{P_t^H} \right)^{\frac{(1-\theta)(1-\beta\theta)}{\theta}} E_t \left(\frac{P_{t+1}^H}{P_t^H} \right)^{\beta} \tag{A.28}$$

where the first term is retailers' marginal cost, and the second term is the expected inflation rate.

A.5 Central Bank and the Government

The central bank follows a Taylor rule, and sets interest rates to stabilize output and inflation rates around their target values:

$$R_t = \left[\left(1 + rr^{ss}\right) \left(P_t / P_{t-1}\right)^{\gamma_\pi} \left(Y_t^H / Y_t^{ss}\right)^{\gamma_y} \right]^{1-\tau} R_{t-1}^{\tau} \tag{A.29}$$

The last item on the right hand side is the interest rate smoothing term. Y_t^{ss} and rr^{ss} are the steady state levels of output and the real interest rate respectively.

A.6 Closing the Model

To close the model, we assume that the government finances its expenditures by printing money and collecting lump sum taxes, and the resource constraint in the economy holds:

$$G_t = \left(M_t - M_{t-1}\right)/ P_t + T_t \tag{A.30}$$

$$Y_t^H = C_t^H + C_t^{eH} + C_t^{H*} + I_t^H + \mu \left(\int_0^{\bar{A}_i} A_i f(\bar{A}_i) \delta A_i \right) R_t^k Q_{t-1} K_t \tag{A.31}$$

where C_t^{eH} is entrepreneurial consumption, and $\mu \left(\int_0^{\bar{A}_i} A_i f(\bar{A}_i) \delta A_i \right) R_t^k Q_{t-1} K_t$ are the total monitoring costs. Finally, we obtain the balance of payments condition in the economy by adding consumers' and entrepreneurs' budget constraints:

$$C_t + C_t^e + I_t + \left[(1+R_{t-1})D_{t-1} + (1+R_{t-1}^*)s_t\left(D_{t-1}^* + B_{t-1}\right)\right]/P_t + \mu\left(\int_0^{\bar{A}_i} A_i f(\bar{A}_i)\delta A_i\right)R_t^k Q_{t-1}K_t = Y_t + \left[D_t + s_t\left(D_t^* + B_t\right)\right]/P_t + \Pi_t \quad \text{(A.32)}$$

A.7 Calibration Summary

Parameter	Description	Value	
		Brazil	Canada
β	quarterly discount factor	0.961	0.99
Ω	coefficient of relative risk aversion	2	1.21
λ	1- (import share in consumption)	0.8	0.88
ρ	elasticity of substitution between home and foreign goods	5	0.76
κ	labor supply elasticity	2	1.63
θ	Calvo parameter (probability of not adjusting prices)	0.65	0.48
γ_π	Taylor rule inflaiton parameter	0	3.27
γ_y	Taylor rule output parameter	0	0.47
τ	Taylor rule interest rate smoothing parameter	0.33	0.85
ε	price elasticity of export demand	1	1
α	capital share parameter	0.41	0.35
δ	depreciation rate	0.031	0.025
ι	elasticity of price of capital with respect to the investment capital ratio	0.25	0.25
χ	elasticity of marginal depreciation with respect to the utilization rate	1	1
η	markup rate	1.2	1.2
μ	bankruptcy cost coefficient	0.5	0.07
γ^e	survival rate of an entrepreneur	0.9728	0.9768
σ^i	standard deviation of the idiosyncratic shock	0.78	0.44

Parameter values used to calibrate the model to Canadian data are summarized in in the table above. Parameters pertaining to preferences, the Taylor rule and Calvo pricing were obtained from Justiniano and Preston (2004). Bankruptcy cost coefficient is calibrated using data from the Doing Business database. Values for the survival rate of entrepreneurs and the standard deviation of the idiosyncratic imply that financial leverage and the annual failure rate are 2 and 1.14% respectively. The annual failure rate was obtained from Lecavalier (2006). Rest of the values are from BGG, and Gertler et al. (2007). We also calibrated the model using data from New Zealand and Australia our results did not change significantly. In calibrating the model to Brazilian data, we adopt the parameter values used in Aysun (2008), as shown above.

Appendix B: Data Summary

Table B.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.
Discount Rate	Source: IFS variable 60 + central bank websites.
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	One observation per decade (1950's to 1980's). Source: Cukierman, et al., (1992). Data updated by Jácome and Vázquez (2005) and Siklos (2008).
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. 2003). Data averaged over certain years during the 1990s. The years vary by country.
COSTESTATE	The cost of the bankruptcy proceedings as a percentage of the estate's value. The cost is calculated on the basis of survey responses by insolvency practitioners and includes court fees as well as fees of nsolvency practitioners, independent assessors, lawyers and accountants. Respondents provide cost estimates from among the following options: less than 2%, 2–5%, 5–8%, 8–11%, 11–18%, 18–25%, 25–33%, 33–50%, 50–75% and more than 75% of the value of the business estate. Source: World Bank Doing Business database.

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: Bahamas: tourist arrivals index; Bahrain: refined petroleum production; Belarus: number of employed; Bolivia, Ecuador, Gabon, Kuwait, Oman, Venezuela: crude petroleum production; Botswana, Congo Dem. Rep.: mining production; Chile, Latvia, Peru, Russia, Ukraine: industrial employment index; Colombia, Indonesia, Panama, Philippines, Singapore, South Africa, Uruguay, Zimbabwe: manufacturing production; Estonia, Hong Kong, Moldova, Thailand: number of employed; Taiwan: employees on payroll (source: Directorate-General of Budget, Accounting and Statistics).
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 B.2: Countries

Algeria	Hong Kong	Portugal
Armenia	Hungary	Romania
Australia	Indonesia	Russia
Austria	Italy	Serbia & Montenegro
Bahrain	Japan	Singapore
Bangladesh	Jordan	Slovakia
Belarus	Kenya	Slovenia
Bolivia	Korea, South	South Africa
Botswana	Kuwait	Spain
Brazil	Lithuania	Sweden
Bulgaria	Malawi	Switzerland
Canada	Malaysia	Thailand
Chile	Mexico	Trinidad & Tobago
China	Moldova	Turkey
Colombia	Netherlands	Ukraine
Croatia	New Zealand	United Kingdom
Czech Republic	Nigeria	United States
Denmark	Norway	Uruguay
Estonia	Peru	Venezuela
France	Philippines	
Germany	Poland	

Appendix C: Impulse Response Summary Statistics

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

	max. amplitude of inflation	error band includes zero at max. amp.	price puzzle	max. amplitude of money	error band includes zero at max. amp.	liquidity puzzle		max. amplitude of inflation	error band includes zero at max. amp.	price puzzle	max. amplitude of money	error band includes zero at max. amp.	liquidity puzzle
Algeria	-0.37			-0.77			Latvia						
Armenia	-0.97			-0.42			Libya						
Australia	-0.15			-0.16			Lithuania	-0.12			-0.34		
Austria	-0.01			-0.05			Luxembourg						
Bahamas	-0.31			-0.23			Malawi	-0.36	X		-0.11		
Bahrain	-1.44			-0.19			Malaysia	-0.75			-3.57		
Bangladesh	-0.64			-0.47			Malta	0.00		X	-0.10		
Belarus	-0.45			-0.36			Mexico	-0.76	X		-1.08		
Belgium							Moldova	-0.35			-1.22		
Bolivia	-0.23	X		0.15		X	Netherlands	0.55		X	-0.06		
Botswana	-0.43			-0.86			New Zealand	-0.41			-0.49		
Brazil	-0.78			-2.28			Nigeria	-0.23	X		-0.43		
Bulgaria	-0.78			-1.99			Norway	-0.08			-0.05	X	
Canada	-0.18			-0.49			Oman	-0.60			-1.43		
Chile	-0.45			-1.11			Panama						
China	-0.51			-0.44			Peru	-0.40			-3.45		
Colombia	-0.52			-0.70			Philippines	-0.93			-1.59		
Congo							Poland	0.13		X	-0.31		
Croatia	-0.16			-0.51			Portugal	-0.01			-0.58		
Cyprus	-0.22			0.08		X	Romania	-0.13			-0.01	X	
Czech Republic	-0.68			-0.19			Russia	-0.50			-0.37		
Denmark	-0.59			-0.43			Serbia & Montenegro	-0.19			-0.45		
Ecuador							Singapore	-0.35			-0.87		
Estonia	-0.16			-0.68			Slovakia	-0.78			-1.17		
Finland							Slovenia	0.16		X	-0.60		
France	-0.06			-0.21			South Africa	-0.10			-3.37		
Gabon							Spain	-0.07			-0.26		
Germany	-0.12			-0.10			Sweden	-0.03	X		-0.17		
Greece							Switzerland	-0.12			-0.35		
Hong Kong	-0.01			-0.07	X		Taiwan	-0.66			-1.53		
Hungary	-0.17			-0.66			Thailand	-1.13			-0.78		
India							Trinidad & Tobago	-0.36	X		-0.70		
Indonesia	-0.92			-1.05			Tunisia						
Ireland							Turkey	-2.71			-0.95		
Israel							Ukraine	-0.45			-2.25		
Italy	-0.15			-0.10			United Kingdom	-0.06			-0.21		
Japan	-0.13			-0.06	X		United States	-0.19			-0.44		
Jordan	-0.34			-0.60			Uruguay	-0.59			-0.66		
Kenya	-0.45			-2.02			Venezuela	-0.68			-0.17		
Korea, South	-0.29			-0.15			Zimbabwe						
Kuwait	-0.05			-0.52									

Notes: The table reports the maximum amplitude of the inflation and monetary aggregate responses to a one standard deviation shock to interest rates.

Appendix D: Leverage Sensitivities

Table D.1. Equation (5) – 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 (3). γ_{1k} is the coefficient of the leverage variable in Equation (3) and σ_{1k} is the standard error of this coefficient.