

**The Channels for the Real Collateral Damage of the 2007-2009 Global Financial Crisis:  
Evidence from Firms in 44 Countries**

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**Abstract**

Using accounting data for firms from 44 developed and developing countries, we examine how the 2007-2009 financial crisis affected non-financial firms and how linkages propagated shocks across national borders. We separate the effects of changes in external financing conditions, domestic demand shocks, and international trade shocks on firms' profits, sales and investment. We find that the crisis affected firms with large liquidity needs of working capital more, particularly in those countries more financially integrated with the rest of the world. All of these findings are, however, subject to change as new data come in and as we refine the methodologies.

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## **Introduction**

The 2007-2009 crisis that originated in the United States shocked the core of the global financial system. It led to a sharp drop in international trade in goods and services in a degree not seen since the end of the WWII and triggered a global recession, dubbed the “Great Recession,” unparalleled since the Great Depression. A small literature is emerging that studies the transmission of the latest crisis across national borders and cross-country differences in how countries have been affected. The evidence of these studies is mixed. For example, while Rose and Spiegel (2010a, 2010b) and Cetorelli and Goldberg (2009) fail to find strong evidence that many country factors, including bilateral linkages with the US, to be associated with how the crisis impacted individual countries, Claessens et. al. (2010) document some evidence that countries integrated with global financial markets suffered more during this crisis (see also Rose and Spiegel (2010c) for an update).<sup>2</sup>

The mixed evidence is perhaps not surprising since these macroeconomic approaches cannot shed much light on the individual contagion channels, as they aggregate the effects of multiple underlying factors. The crisis clearly spread through a combination of real (e.g., trade) and financial channels, as well as by affecting expectations of consumers and corporations, in turn changing consumption and investment behaviors. The existing literature has attempted to distinguish these channels by including proxies for trade or financial integration using aggregate, macroeconomic data (see Rose and Spiegel (2010) and Milesi-Ferretti and Lane (2010)). But these proxies per se tend to be highly correlated with each other and hence do not provide for a means to cleanly separate the different channels through which spillovers may occur. For example, a reversal of capital flows or a reduction in demand for exports can both induce a contraction of investment or a worsening of corporate sector performance. Aggregate indicators to proxy for trade and financial openness are very correlated and thus cannot separate the multitude of factors.

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<sup>2</sup> That papers reports to find few clear reliable indicators in the pre-crisis data that can help explain the incidence of the Great Recession across countries, except that countries with current account surpluses seemed better insulated from slowdowns.

To separate the importance of these various channels, one needs to go to the firm-level, micro data. The firm level analysis to study how crises in emerging markets spread to other financial markets was done by Forbes (2004). Few other firm-level analyses of contagion exist (see Claessens and Forbes (2001) for an early review of the contagion literature and Pritsker (2010) for a recent review). For the current crisis, micro firm-level evidence has been limited as well, to date at least, partly because firm-level investment and performance data across countries are only released with a lag. The lack of suitable data in turn has prevented the examination of the responses across firms to the crisis and possible differences across countries.

The only substitute has been to use stock market data, as Tong and Wei (2010) do. They report evidence of tightening liquidity crunch across emerging market economies by showing that the decline in stock prices was more severe for firms that are intrinsically more dependent on external finance for working capital. In terms of transmission mechanisms, however, Tong and Wei focus only on the composition of a country's pre-crisis capital inflows (specifically, the relative importance of FDI to financial capital inflows). And they were not able to show the impact of the financial crisis on the actual behavior and performance of firms. By using actual firm level real variables, broadening the set of potential transmission channels and investigating these, this project will fill an important void.

### **The Framework**

The aim is to build on the existing literature, but using firm-level data to more clearly distinguish the transmission channels through the financial crisis spilled over from the US and other advanced countries to the rest of the world. We examine three channels: financial channel, domestic demand channel and trade channel. The techniques we use to distinguish between these three channels share a similar structure. To isolate the transmission from the finance channel, we make use of the following idea: if a credit crunch plays an important role, it should be reflected in the relative performance of those firms that intrinsically rely more on external finance for investment and working capital, versus those firms that rely less. Similarly, if a domestic demand shock exists, it should be reflected in the relative performance of those firms that are more demand-sensitive versus those firms that are less.

And, if a trade shock exists, it should be reflected in the relative performance of those firms that export more heavily versus those firms that exports less.

The basic empirical strategy is then to check whether an *ex ante* classification of firms by their characteristics – in terms of degree of financial dependence, demand sensitivity and exposure to trade, helps to predict their *ex post* “performance” (i.e., profits, sales and investments). To be precise, our specification is given by the following equation:

$$(1) \text{Performance}_{i,k,j,t} = \beta * \text{FinancialDependence}_k * \text{Crisis}_t + \gamma * \text{DemandSensitivity}_k * \text{Crisis}_t + \lambda * \text{TradeSensitivity}_k * \text{Crisis}_t + \text{Control}_{i,k,j,t} + \text{firm fixed effects} + \varepsilon_{ikjt}$$

where  $i$  stands for company,  $k$  for sector,  $j$  for country, and  $t$  for time.

As the propagation can depend not just on firm characteristics, but also on country features (for example, more advanced countries could have better mechanisms to protect their firms from external shocks), we also explore cross-country heterogeneity. While we start by assuming the same  $\beta$ ,  $\gamma$ , and  $\lambda$  for all countries in order to estimate an average effect, we next allow for variations in these parameters across countries. We do so by interacting firm features with country features, such as country-level exposure to global capital flows, its overall level of openness and development, etc., and then include these interactions terms in the regressions. For example, to see how a pattern of pre-crisis exposure to capital flows affects the extent of a liquidity crunch, we consider the interaction between a country’s pattern of financial integration and its manufacturing firms’ dependence on external finance. In other words, we assume that:

$$(2) \beta = \beta_1 + \beta_2 \text{ linkages}_j$$

where the  $\text{linkages}_j$  measures country  $j$ ’s trade and financial linkages with the developed countries, including patterns of capital inflows, trade openness, financial and general development, etc.

### **Data Sources and Variables**

The ex-post period we plan to study is from the start of the global crisis (taken as July 31 2007) to Dec 31, 2010. Since data are not yet available for the complete year 2009, we are limited to using 2008 data for now, but expect to have much of 2009 data by the June

2011 conference date and most of 2010 data by the September 2011 conference. We use annual data from Worldscope on balance sheet, cash flow and income for all listed manufacturing companies (we exclude financial institutions). The number of listed manufacturing firms is listed in Table 1. The data cover 44 advanced countries and emerging markets. Key dependent variables we study are firm-level profits/assets, sales/assets and investments/assets. These dependent variables are winsorized at the 1% level to reduce the impact of extreme values.

The key regressors related to the three possible channels of spillovers are defined as follows:

*i. Sector-level financial dependence indexes*

We develop two measures of firms' intrinsic dependence for external finance:

- Intrinsic dependence on external finance for investment (DEF\_INV)
- Intrinsic dependence on external finance for working capital (DEF\_WK)

We construct a sector-level approximation of a firm's intrinsic demand on external finance for capital investment following the methodology developed in Rajan and Zingales (1998). Specifically, we define:

$$(3) \text{ Dependence on external finance for investment} = \frac{\text{capital expenditures} - \text{cash flow}}{\text{capital expenditures}},$$

Besides capital needed for investment, working capital is required for a firm to operate and to satisfy both short-term debt payment and ongoing operational expenses. We construct such a sector-level measure of intrinsic need for external finance using the notion of "cash conversion cycle", which is commonly used in financial analysis to measure the liquidity position of a firm. The cycle measures the time elapsed from the moment a firm pays for its inputs to the moment it receives payment for the goods it sells. Specifically,

$$\text{Cash conversion cycle} = 365 * \left( \frac{\text{inventories} - \text{account payables}}{\text{cost of goods sold}} + \frac{\text{account receivables}}{\text{total sales}} \right)$$

Following Tong and Wei (2010), both indexes are constructed as follows: First, for each U.S. firm during 1990-2006, we calculate the dependence on external finance and the cash conversion cycle based on the annual data from Compustat USA Industrial Annual. Second,

we define the sector-level value of the index (for each SIC 3 digit sector) by calculating the median across all firms in the sector. While the original Rajan and Zingales (1998) paper covers only 40 (mainly SIC 2-digit) sectors, we will expand the coverage to around 250 SIC 3-digit sectors as in Tong and Wei (2010). All the numbers are based on U.S. firms, which are judged to be least likely to suffer from financing constraints (during a normal time) relative to firms in other countries and we assume the same intrinsic external financing dependence applies to firms in all other countries.

*ii. Sector-level demand sensitivity indexes*

Another regressor is an index of a firm's relative sensitivity to a contraction in aggregate consumer demand. As noted, a financial crisis likely affects consumer and corporate sector confidence and in turn investment and consumption. These demand effects likely vary by sectors with, for example, consumer durables more affected than consumer necessities. Tong and Wei (2008) develop such an index at the sector level based on the stock price reactions of the firms in various sectors to the September 11, 2001 terrorist attack. To construct the index, they compute the change in log stock price for each U.S. firm from September 10, 2001 to September 28, 2001. They then calculate the mean log stock price change for each three-digit SIC sector, and use it as a measure of the sector-level demand sensitivity. Excluding financial sector firms, they include in total 361 three-digit level sectors. To be sure this index reflects the relative sensitivity of a firm's stock price to an unexpected shock in consumer demand, and is not contaminated by a firm's sensitivity to liquidity shocks or other factors, they provide a few arguments.<sup>3</sup> In their paper, they subsequently use this index to study the sensitivity of US stocks to demand and external financing supply shocks. Similarly to the external financing dependence measures, we assume that in relative

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<sup>3</sup> First they verify that there was indeed a big downward shift in expected aggregate demand, as reflected by a downward adjustment in the consensus forecast of subsequent U.S. GDP growth in the aftermath of the shock at the same time. Second, they argue that because the Federal Reserve took timely and decisive actions, the relative stock price moves do not reflect effect of the 9/11 shock on firms' financial constraints since that was small or at most short lived. Indeed they show that for that episode, both the level of the real interest rate and the TED spread (risk premium), after initial spikes, quickly returned to a level only moderately higher than the pre-9/11 level, suggesting that the market regarded the Federal Reserve's actions as sufficient to restore the market's desired level of liquidity. They therefore conclude that the cumulative stock price change from September 10 to 28, 2001, is unlikely to also reflect firms' reactions to a deterioration of credit availability.

terms, firms in other countries experience the same aggregate demand shocks across sectors due to the global financial crisis as US firms did at the time of the 9/11.

### *iii. Firm-level trade sensitivity indexes*

Once additional channel by a global financial crisis and subsequent recession could affect a firm's earnings and investment is through reduced exports. We therefore also examine if the firm-level sensitivity to trade plays a significant role during the crisis. We employ the following procedure to construct a measure of pre-crisis sensitivity to trade. We regress a firm's annual change of profit on a constant and the annual percentage change in the country's exports in the relevant 3-digit sector from 2000 to 2006. Export data are obtained from the World Integrated Trade Solution (WITS) developed by the World Bank. The coefficient on the exports variable is then used to proxy the pre-crisis trade sensitivity of the particular firm. Note that this measure is firm specific, and hence varies across firm, country and sector.

### **Preliminary Findings Using Data Until 2008**

We estimate panel regressions of Equation 1 using firm-level annual variables from 2005 to 2008. We construct a crisis dummy for the period of global recession that equals one when the year is 2008 (and 2009 when the relevant data become available), and zero otherwise. We then include the crisis dummy as well as its interaction with the Financial Dependence, Demand and Trade Sensitivity. We control for both firm fixed effects and year dummies.

The basic regression results are presented in Table 2 using various measures of firm performance. In Column 1, we look at the impact of crisis on the profit/asset ratio. We find the impact of crisis on profits to be more pronounced for those sectors that are intrinsically more sensitive to demand shocks, suggesting that a global demand contraction was an important reason for the stock price declines. In Column 2, we look at the impact of crisis on sales over assets, and find the impact to be larger for sectors with greater intrinsic needs for working capital. This result suggests that the disruption to the supply of working capital has reduced firm-level sales. In Column 3, we examine the impact on capital investment and find no significant impact of crisis here. But investment is slow to adjust, this result may change after we include newer data from 2009.

In Table 3, we include various country features to further examine differential effects across countries. We include the following country characteristics: financial openness (defined as total international assets plus liabilities over GDP), trade openness (defined as imports plus exports over GDP), and the share of consumption in total demand. These country features are measured at year 2006, and hence do not vary over time. In Table 3, financial openness is interacted with DEP\_WK and DEP\_RZ; trade openness is interacted with firm-level trade sensitivity; and consumption share is interacted with sector-level demand sensitivity. These interaction terms are then further interacted with the crisis dummy to investigate whether there was a change over time. Column 1 reports the results for profits. Here we find a significantly negative coefficient for the triple interaction term of crisis dummy, the dependence on external finance for working capital, and financial openness. Column 2 reports the results for sales. Again we find the same triple interaction term to have significant and negative coefficient. Hence, financial openness reduces firm's sales and profit and increases the severity of crisis, with the channel to operate through the supply of external financing.

In Table 4, we replace financial openness and trade openness with the bilateral exposure to the U.S. since the financial crisis originated in the U.S. For the financial linkage with the U.S., we use the share of banking borrowing from the U.S., with the data coming from the BIS. For the trade linkage with the U.S., we use the bilateral exports to and imports from the U.S., with the data coming from the IMF Direction of Trade Statistics. We do not find any significant impact of bilateral financial linkage and trade linkage with the U.S. This suggests that the impact on firms is due to the global crisis and not just due to the recession in the U.S. This supports the findings of Rose and Spiegel (2010a).

### **Tentative conclusions**

We find that crisis indeed has real impacts on firm-level sales and profits. Moreover, the impact is related to country-level features such as financial openness.

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Table 1. Number of Listed Manufacturing Firms in Each Country	
COUNTRY	Obs #
ARGENTINA	28
BRAZIL	90
CHILE	47
CHINA	893
COLOMBIA	8
CZECH REPUBLIC	5
EGYPT	27
HONG KONG	322
HUNGARY	12
INDIA	516
INDONESIA	112
ISRAEL	61
KOREA (SOUTH)	624
MALAYSIA	418
MEXICO	38
PAKISTAN	66
PERU	19
PHILIPPINES	32
POLAND	84
RUSSIAN FEDERATION	24
SINGAPORE	242
SOUTH AFRICA	57
THAILAND	214
TURKEY	120
AUSTRALIA	225
AUSTRIA	34
BELGIUM	50
CANADA	263
DENMARK	52
FINLAND	65
FRANCE	222
GERMANY	280
GREECE	100
IRELAND	17
ITALY	103
JAPAN	1582
NETHERLANDS	62
NEW ZEALAND	30
NORWAY	51
PORTUGAL	18
SPAIN	39
SWEDEN	130
SWITZERLAND	107
UNITED KINGDOM	421
Total	7911

Table 2. The Impact of Crisis on Firm Variable

	Profit/asset	Sales/asset	CE/asset	Profit/asset	Sales/asset	CE/asset
crisis==1	-0.0260*** [0.00814]	0.0891*** [0.0251]	-0.00212 [0.00190]	-0.0296*** [0.00825]	0.0921*** [0.0246]	-0.00296 [0.00188]
(crisis==1)*DEP_WK	0.00125 [0.00177]	-0.0148** [0.00661]	0.000273 [0.000622]	0.00199 [0.00176]	-0.0136** [0.00627]	0.00033 [0.000623]
(crisis==1)*DEP_INV	0.000136 [0.00161]	-0.00228 [0.00223]	0.000363 [0.000504]	-0.000119 [0.00194]	-0.0035 [0.00255]	0.000168 [0.000509]
(crisis==1)*Demand sensitivity	-0.00940*** [0.00269]	-0.00407 [0.00492]	-0.000778 [0.00101]	-0.00954*** [0.00351]	-0.0038 [0.00515]	-0.00028 [0.000888]
(crisis==1)*trade sensitivity				0.00265 [0.00371]	0.00749 [0.00628]	0.000816 [0.000702]
Size	0.0772*** [0.0170]	-0.145*** [0.0293]	0.00470*** [0.00161]	0.0931*** [0.0178]	-0.185*** [0.0184]	0.00615*** [0.00164]
lag leverage	0.0177 [0.0179]	0.0662* [0.0347]	-0.0584*** [0.00720]	0.0266 [0.0209]	0.0609 [0.0386]	-0.0563*** [0.00784]
Observations	34021	34529	34162	28653	29037	28746
R-squared	0.075	0.055	0.023	0.081	0.072	0.023
Number of firms	10268	10328	10270	8596	8639	8600
Firm fixed effects	y	y	Y	y	y	y

Table 3. The Impact of Country Feature

	Profit/asset	Sales/asset	CE/asset	Profit/asset	Sales/asset	CE/asset
crisis==1	-0.0343*** [0.00857]	0.0855*** [0.0227]	-0.00215 [0.00183]	-0.0335*** [0.00870]	0.0843*** [0.0229]	-0.00171 [0.00186]
(crisis==1)*DEP_WK	0.00459** [0.00223]	-0.0110* [0.00554]	0.000182 [0.000741]	0.00514** [0.00222]	-0.0115** [0.00546]	0.000212 [0.000719]
(crisis==1)*Finopen*DEP_WK	-0.000656** [0.000311]	-0.000727* [0.000389]	-1.08E-05 [7.47e-05]	-0.000714** [0.000325]	-0.00062 [0.000406]	-1.54E-05 [7.38e-05]
(crisis==1)*DEP_INV	-0.000247 [0.00182]	-0.000555 [0.00327]	0.000432 [0.000614]	-0.000406 [0.00211]	-0.00116 [0.00337]	0.000354 [0.000598]
(crisis==1)*Finopen*DEP_INV	0.00024 [0.000190]	-0.00048 [0.000316]	-2.35E-05 [6.81e-05]	0.000284 [0.000236]	-0.000525 [0.000325]	-2.15E-06 [6.82e-05]
(crisis==1)*Demand sensitivity	-0.0238 [0.0163]	0.0113 [0.0143]	-0.00306 [0.00309]	-0.0235 [0.0157]	0.0185 [0.0147]	-0.00259 [0.00342]
(crisis==1)*Consum*sensitivity	0.0242 [0.0242]	-0.021 [0.0228]	0.00405 [0.00473]	0.0222 [0.0239]	-0.0312 [0.0230]	0.00281 [0.00506]
(crisis==1)*tradesensi				0.00112 [0.00299]	0.00759 [0.00479]	0.000301 [0.000751]
(crisis==1)*tradeopen*sensi				0.0204 [0.0150]	-0.0123 [0.0323]	0.00508 [0.00582]
size	0.103*** [0.0190]	-0.219*** [0.0244]	0.00628** [0.00239]	0.106*** [0.0197]	-0.218*** [0.0249]	0.00603** [0.00251]
lag leverage	0.0728*** [0.0186]	0.0917*** [0.0332]	-0.0583*** [0.00961]	0.0756*** [0.0199]	0.0905** [0.0341]	-0.0583*** [0.00976]
Observations	23188	23525	23265	22073	22373	22142
R-squared	0.093	0.099	0.021	0.095	0.096	0.021
Number of firms	8865	8926	8872	8379	8431	8386

Table 4. The Impact of Country Feature-Exposure to US

	Profit/asset	Sales/asset	CE/asset	Profit/asset	Sales/asset	CE/asset
crisis==1	-0.0327*** [0.00975]	0.105*** [0.0164]	-0.000812 [0.00158]	-0.0319*** [0.00964]	0.103*** [0.0168]	-0.000679 [0.00178]
(crisis==1)* DEP_WK	-6.55E-05 [0.00267]	-0.0149*** [0.00540]	0.00025 [0.000795]	0.000391 [0.00278]	-0.0142** [0.00530]	0.000224 [0.000754]
(crisis==1)*Bank Exposure to US*DEP_WK	0.0462 [0.0525]	-0.0375 [0.0497]	-0.00745 [0.00540]	0.0431 [0.0517]	-0.0451 [0.0433]	-0.00606 [0.00525]
(crisis==1)* DEP_INV	0.00239 [0.00236]	-0.00232 [0.00311]	0.000579 [0.000501]	0.00235 [0.00268]	-0.00346 [0.00318]	0.000589 [0.000559]
(crisis==1)* )*Bank Exposure to US*DEP_INV	-0.0418 [0.0389]	-0.046 [0.0335]	-0.00348 [0.00377]	-0.0406 [0.0411]	-0.0361 [0.0320]	-0.00416 [0.00455]
(crisis==1)* Demand sensitivity	-0.0199 [0.0198]	-0.000398 [0.0150]	-0.00451* [0.00242]	-0.0189 [0.0192]	0.00482 [0.0162]	-0.00335 [0.00256]
(crisis==1)* Consum*sensitivity	0.0175 [0.0283]	-0.00868 [0.0220]	0.00632* [0.00364]	0.0144 [0.0283]	-0.0156 [0.0234]	0.00431 [0.00380]
(crisis==1)*tradesensi				0.0042 [0.00561]	0.0051 [0.00673]	0.000858 [0.000838]
(crisis==1)* trade exposure to US*tardesensi				-0.000143 [0.000407]	8.50E-05 [0.000220]	-1.64E-05 [3.14e-05]
size	0.113*** [0.0184]	-0.217*** [0.0269]	0.00534** [0.00247]	0.116*** [0.0190]	-0.215*** [0.0276]	0.00521* [0.00266]
lag leverage	0.0719*** [0.0208]	0.0806** [0.0344]	-0.0499*** [0.00771]	0.0749*** [0.0219]	0.0774** [0.0352]	-0.0499*** [0.00795]
Observations	20545	20869	20632	19569	19856	19648
R-squared	0.101	0.101	0.018	0.103	0.097	0.018
Number of firms	7693	7751	7698	7273	7322	7278