

Real Effects of the 2007-08 Financial Crisis around the World

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Abstract

This paper proposes a simple framework (a) to quantify the importance of the finance shock to non-financial firms in 45 countries by exploring cross-firm heterogeneity in dependence on external finance for working capital and investment, and (b) to study whether and how the type of financial system, the nature of monetary and exchange rate regime, and the magnitude of pre-crisis credit expansion affect the transmission of the finance shocks internationally by exploring cross-country heterogeneity in these dimensions. We find that stock price performance was worse for firms with larger *ex ante* sensitivity to shocks to external finance, particularly in countries with rapid pre-crisis credit expansion.

Key words: financial crisis, spillover, liquidity constraint

JEL codes: G2, G3

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“[A]s a whole, the nonfinancial business sector remains in good financial condition, with strong profits, liquid balance sheets, and corporate leverage near historical lows.”

Federal Reserve Chairman Ben S. Bernanke, “*Semiannual Monetary Policy Report to the Congress,*” before the Committee on Financial Services, U.S. House of Representatives, February 27, 2008

“The claim that disruptions to the banking system necessarily destroy the ability of non-financial businesses to borrow from households is highly questionable.”

Chari, Christiano and Kehoe (October 2008)

1. Introduction

The 2007-2008 crisis started off in August 2007 as a subprime mortgage crisis primarily concentrated in the United States but quickly metamorphosized into a global financial crisis where financial institutions teeter on the edge of bankruptcy in many countries in addition to the United States. A global economic crisis ensues in which non-financial firms around the world appear to spiral downward as well. A key potential contributor to the plight of the non-financial firms is the financial crisis itself, in the form of a negative shock to the supply of external finance needed by non-financial firms. However, as the two quotes by some leading policymakers and scholars at the beginning of the paper indicate, the idea that non-financial firms suffer from a strongly negative supply-of-finance shock is not universally shared. In addition, if non-financial firms do not do well, there can certainly be other causes, such as a contraction of demand for their products.

This paper has three objectives. First, it aims to develop a simple framework that can capture and quantify the relative importance of the finance shock to the economic health of non-financial firms. Second, in a cross-country context, it aims to investigate whether the responsiveness of the real economy to a given finance shock varies by country features that the literature suggests that could matter, such as the type of a financial system, the nature of a monetary and exchange rate regime, or the extent of credit expansion. Third, it applies both frameworks to understanding the effects of the 2007-2008 global financial crisis on the real economy around the world.

The view that the real economy may suffer from a credit crunch as a result of the subprime meltdown is far from self-evident. As Bates, Kahle, and Stulz (2007) carefully document, non-financial firms held an abundance of cash prior to the crisis. According to

them, “the net debt ratio (debt minus cash, divided by assets) exhibits a sharp secular decrease and most of this decrease in net debt is explained by the increase in cash holdings. The fall in net debt is so dramatic that average net debt for US firms is negative in 2004. In other words, on average, firms could have paid off their debt with their cash holdings.” Given the apparent secular downward trend in cash holdings, the net debt ratio was likely even further into negative territory by mid-2007, right before the start of the full-blown subprime crisis. This at least suggests the possibility of no serious liquidity tightening outside the financial sector. Probably out of this belief, Federal Reserve Chairman Ben S. Bernanke called strong corporate balance sheets “a bright spot in the darkening forecast” during his testimony at the U.S. Congress on monetary policy on February 27, 2008.

While there may have been an increase in the recognition over time that there is a credit supply shock to non-financial firms, it is still by no means a consensus view. For example, in a recent paper, Chari, Christiano and Kehoe (2008) rejected the idea that bank lending to non-financial firms or commercial paper issuance by non-financial firms has declined sharply during the 2007-2008 financial crisis (at least up to the time they issued the paper in October, 2008).

Rather than looking at aggregate data which is the approach taken by Chari, Christiano and Kehoe, we explore systematic cross-firm heterogeneity in stock price response to the financial crisis. The basic idea is this: Since different firms have different degrees of reliance on external finance for their working capital need and for their long-term investment, a supply of finance shock, if it exists, should impact different firms differently.

We construct separate measures of intrinsic dependency on external finance for long-term investment (DEF_INV) and intrinsic dependency on external finance for working capital (DEF_WK). The DEF_INV variable is based on Rajan and Zingales (1998) except that we compute the measure using data for a more recent period during 1990-2006 and for each 3-digit SIC sector as opposed to their 2-digit sector. Thus, we have 253 sectors as opposed to their 36 sectors. Our measure of DEF_WK is modified from Raddatz (2006). While Raddatz defines his measure by the ratio of all inventories to sales, we think it more sensible to exclude financial goods inventory (which could reflect changes in the demand for a firm’s product) and focus on the ratio of input inventories to sales.

As control variables, we add beta, firm size, and book/market ratio from the Fama-French (1992) three factor model, and the fourth factor of momentum suggested by Lakonishok, Shleifer, and Vishny (1994). These factors are often but not always statistically significant. However, our two key regressors: DEF_INV and DEF_WK, are statistically significant with a correct sign most of the times. Our interpretation is that during the financial crisis period, our two variables may reflect aspects of firm risks that are not completely captured by the three-factor, or the four-factor, model.

To address the endogeneity issue, we make sure that our key regressors are pre-determined with respect to the full-fledged financial crisis. In other words, our thought experiment is this: If we classify non-financial firms into different baskets, based on their *ex ante* sensitivity to shocks to external finance (in terms of investment and working capital needs), would this classification help us to forecast the *ex post* stock price performance of these firms? If there is forecasting ability associated with these classifiers, would it carry over beyond what can be explained by the Fama-French three factors and the momentum factor?

We find that the answer to each question is yes. An increase in DEF_INV from the bottom quartile to the top quartile is associated with an additional decline in the stock price of at least six percentage points during July 31, 2007 – August 31, 2008. An increase in DEF_WK from the bottom quartile to the top quartile is associated with an additional decline in the stock price of five percentage points during the same period.

The second part of the empirical exercise is to examine the role of various country features in understanding cross-country differences in the transmission of the supply-of-finance shock. We zoom in on three country features in particular that the literature suggests may be important. First, an active literature in finance has discussed whether a bank-centered or a capital market-centered financial system is more conducive to economic growth. Here, we investigate whether the real effects of the financial crisis depends on the type of financial system during the 2007-2008 crisis.

Second, a key idea in the field of international finance is that a country's choice of the exchange rate regime (i.e., fixed vs. floating exchange rates) determines whether it can effectively deflect or passively import foreign shocks. More specifically, a flexible exchange rate regime is supposed to provide a better buffer against foreign shocks. This proposition

was part of the Robert Mundell’s Nobel Prize-winning “optimal currency area” theory, and has been codified in leading textbooks on international economics such as Krugman and Obstfeld (2008) and Caves, Frankel and Jones (2007). Therefore, we also investigate whether and to what degree the real effect of the U.S. originated financial crisis on any economy depends on its chosen exchange rate regime.

Third, a popular thesis on the origin of financial crisis is that excessive credit expansion often predates a crisis (Kaminsky and Reinhart, 1999). Therefore, we investigate whether the rate of credit expansion in a country in the period leading up to the 1997 U.S. subprime crisis affects how much non-financial firms in that country suffer from the eventual financial crisis.

We interact these country features with firms’ sensitivity to external finance. We find that in countries with rapid pre-crisis credit expansion, finance-sensitive firms experienced significantly worse performance of stocks. The exchange rate regime and the market-vs-bank financial system, however, do not present a significant difference.

This paper is linked to the literature on credit crunches (for example, Bernanke and Lown 1991; Borensztein, and Lee 2002; Dell’Ariccia, Detragiache, and Rajan 2008, among others). This paper is also related to a small but growing literature on the origin and consequences of the subprime problem as a *financial crisis*, including recent work by Mian and Sufi (2008), Reinhart and Rogoff (2008), Dell’Ariccia, Igan and Laeven (2008), and Greenlaw, Hatzius, Kashyap, and Shin (2008). As of now, we have not come across a paper directly documenting and quantifying the mechanisms by which the subprime mortgage crisis spills over from the financial sector to the real economy in a global setting. In this sense, this paper fills an important void.

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

2. Specification and Key Variables

2.1 Basic specification

Our basic empirical strategy is to check whether an *ex ante* classification of firms by their characteristics in terms of degree of liquidity constraint help to predict the *ex post*

magnitude of their stock price changes since August 2007. To be precise, our basic specification is given by the following equation:

$$(1) \text{ StockReturn}_{ijt} = \alpha_j + \beta_1 \text{ FinancialDependence}_{ij,t-1} + \varepsilon_{it}$$

where i stands for stock, j for country. α_j is the country fixed effects. Note that this is a purely cross-sectional regression, and the key regressors are pre-determined.

As a basic robustness check, we also control for sector-level sensitivity to the demand contraction shock from Tong and Wei (2008). We further add the three factors from Fama and French (1992): firm size (log of assets), the ratio of the market to book values, and beta (the correlation of the firm's stock return with the overall market). In some specifications, we also add a fourth control variable: a momentum factor from Lakonishok, Shleifer and Vishy (1994). The expanded specification is:

$$(2) \text{ Stockreturn}_{ijt} = \alpha_j + \beta_1 \text{ FinancialDependence}_{ij,t-1} + \gamma_1 \text{ DemandSensitivity}_{ij} + \gamma_2 \text{ Size}_{ij,t} \\ + \gamma_3 \text{ Market / Book}_{ij,t-1} + \gamma_4 \text{ Beta}_{ij,t-1} * \text{ MarketReturn}_{jt} + \gamma_5 \text{ Momemtum}_{ij,t-1} + \varepsilon_{ijt}$$

We follow Whited and Wu (2006) and incorporate the four factors by entering the relevant firm characteristics directly in our regressions rather than entering them indirectly by going through a factor model first. As control variables, these two ways of incorporating the four factors should be equivalent. Entering firm characteristics directly in our regressions is easier to implement, though the interpretation of the coefficients on these factors is a bit less straightforward.

While subprime loans were sporadically reported as problematic in late 2006 and early 2007, it began to be widely recognized as a crisis in August 2007. We conduct a search of news articles that contain the words “subprime” and “crisis” in all newspapers in the United States, excluding pricing and market data and republished news, and report the results in Figure 1. There was a clear spike in such news in early August 2007. The International Monetary Fund, as quoted at the beginning of the paper, also clearly thought of August 2007 as the starting date of a serious crisis. We therefore implement our main regressions for the

period from early August 2007 – end of August 2008. We will also consider other sample periods as extensions or placebo tests.

Finally, we examine if the impacts of financial constraints vary with country-level characteristics.

$$(2) \text{ Stockreturn}_{ijt} = \alpha_j + \beta_1 \text{FinancialDependence}_{ij} * \text{Macro}_{jt-1} + \gamma_1 \text{DemandSensitivity}_{ij} \\ + \gamma_2 \text{Size}_{ij,t} + \gamma_3 \text{Market / Book}_{ij,t-1} + \gamma_4 \text{Beta}_{ij,t-1} * \text{MarketReturn}_{jt} \\ + \gamma_5 \text{Momentum}_{ij,t-1} + \varepsilon_{ijt}$$

Macro_{jt-1} reflects country's macroeconomic and institutional factors such as monetary policy, credit growth and market system. Again all the macroeconomic variables are predetermined.

2.2 Key Data

Percentage change in stock price

The stock price data is from Datastream, with adjustments for dividends and capital actions such as stock splits and reverse splits. Table 2 presents the stock price index for non-manufacturing sectors for each country over the period from July 2007 to August 2008. From there, we see that the cumulative decline of stock price index was 28% on average, with a standard deviation as large as 58%.

Key regressors are measures of external finance dependence. We discuss these in turn.

Financial dependence indexes

Rajan-Zingales index

The Rajan and Zingales (RZ) index gives a sector-level approximation of a firm's intrinsic demand for external finance. Following Rajan and Zingales (1998), we define a firm's intrinsic demand for external financing by:

$$(4) \quad \text{Dependence on external finance} = \frac{[\text{capital expenditures} - \text{cash flow}]}{\text{capital expenditures}},$$

where Cash flow = cash flow from operations + decreases in inventories + decreases in receivables + increases in payables. All the numbers are based on US firms, which are judged

to be least likely to suffer from financing constraints relative to firms in other countries. The original Rajan and Zingales (1998) paper covers only 40 (mainly SIC 2-digit) sectors. Here, we expand the number of sectors to around 250 3-digit SIC sectors. Our measure of intrinsic demand for external financing may be useful for other researchers as well. (we also construct indexes for four hundred 4-digit sectors in Tong and Wei (2008). But here we use the 3-digit SIC sectors so that we can have more matches of sectors with those from the Worldscope dataset)

To calculate the demand for external financing for US firms, we take the following steps. First, every firm in the COMPUSTA USA is sorted into one of the 3-digit SIC sectors. Second, we calculate the ratio of dependence on external finance for each firm from 1990-2006. Third, we calculate the sector-level median from firm ratios for each SIC 3-digit sector that contains at least 5 firms, and the median value is then chosen, to be the index of demand for external financing in that sector.

Conceptually, the Rajan-Zingales (RZ) index aims to identify sector-level features, i.e. which sectors are naturally more dependent on external financing for their business operation. It ignores the question of which firms within a sector are more liquidity constrained. What the RZ index measures could be regarded as a “technical feature” of a sector, almost like a part of the production function.

Working capital

Besides capital need for investment, positive working capital is required to ensure that a firm is able to continue its operations and that it has sufficient funds to satisfy both maturing short-term debt and upcoming operational expenses. Firms may use line of credit, term loans or commercial papers to cover their working capital needs. But the shrinkage of these funding sources during the current crisis has made it difficult to finance working capital. For industries which tend to use more working capital than others due to their production feature, they may then experience larger decline of stock prices.

We construct an index of sector-level intrinsic working capital needs. The first proxy is similar to Raddatt (2006), where the ratio of inventory over sales for US firms is used as an industry’s intrinsic demand for working capital. Higher ratio means that a smaller fraction of inventory investment can be financed by ongoing revenue and therefore represents a higher level of external liquidity needs. The index for the US firms is then extrapolated to other

countries, because industries use relatively more working capital for technological reason, such as differences across industries in the length of the production process and the mode of operation. Raddatt (2006) relies on US firm data in that the supply of liquid funds is much more elastic in the US, and hence observed differences in relative working capital levels across industries are mainly demand driven.

But Raddatt (2006) uses total inventory, which includes finished goods, working in progress and raw materials. We argue that the last two components will better capture the intrinsic need for working capital, while the first component is more driven by consumer demand than by the production process. Hence we construct an alternative definition of working capital: $(\text{working in progress} + \text{raw materials})/\text{sales}$.

More specifically, the index is constructed in the following way: First, we calculate working in progress plus raw materials over sales for each US firm, based on its annual balance sheet from the dataset of Compusta USA. Then we calculate the median of the firm-level ratio for each US 3-digit sector over the period from 1990 to 2006, and apply it as the sector's intrinsic dependence on external finance for working capital.

Intangible assets

There may be less uncertainty for outsiders in measuring the value of tangible assets and such assets may more easily be used as collateral in obtaining financing relative to intangibles. As firms need to put on tangible collaterals when borrowing from creditors, hence firms with relatively fewer tangible assets may find it more difficult to borrow.

Again, certain industries will have relatively higher intangible assets compared with others. Common intangibles include corporate intellectual property (items such as patents, trademarks, and copyrights), goodwill and brand recognition. Based on the Compusta USA dataset, we calculate the ratio of intangible assets in a firm's total assets. Then we calculate the median of this ratio for each SIC 3 digit sector over the period from 1990 to 2006. We regard this median value as the sector's intrinsic share of intangible assets, and apply the same index across countries.

{Kroszner, Laeven, and Klingebiel (2007) find that industries that tend to have a high proportion of intangible assets are disproportionately negatively affected in countries with deep financial systems during a financial crisis compared with the pre-crisis period.}

Demand Sensitivity Index

Another regressor is an index of a firm's sensitivity to a contraction in consumer demand. There are no existing measures in the literature, so we have to invent one. Ideally, we want this index to reflect the sensitivity of a firm's stock price to a sudden, unexpected change in consumer confidence, or future consumer demand. We do not want the index to be contaminated by a firm's sensitivity to a liquidity shock or other factors.

Tong and Wei (2008) propose to construct such an index at the sector level based on the stock price reactions of the firms in that sector to the September 11, 2001 terrorist attack (from September 10, 2001 to September 28, 2001). The 9/11 shock can be argued to have been large and unexpected. We verify that there was a big downward shift in consumer confidence and expected future consumption demand, as reflected by a downward adjustment in the forecast of subsequent US GDP growth, by the International Monetary Fund and other professional forecasters, in the aftermath of the shock.¹ At the same time, because the Federal Reserve took timely and decisive actions, it may be argued that the effect of the 9/11 shock on firms' financial constraint was small or at most short lived. In the 2001 episode, both the level of real interest rate and the TED spread (risk premium), after an initial spike, quickly returned to a level that was only moderately higher than the pre-9/11 level. This suggests that the market likely regarded the Federal Reserve's actions in the first few days following the terrorist attack as sufficient to restore the market's desired level of liquidity. We therefore conclude that the cumulative stock price change over September 10-28, 2001, is unlikely to also reflect a firm's reaction to a deterioration of credit availability.² [In contrast, the subprime crisis news is associated with a much greater increase in the TED spread.]

¹ The consensus forecast for the year of 2001 Real GDP growth rate dropped from 1.6% to 1%, after the September 11 attack. Meanwhile, the consensus forecast for the year of 2002 dropped from 2.7% to 1.2%.

² We also look at the revision of consensus analyst forecast of US firm earnings around the 9/11. We calculate the revision as the consensus at October (for 2002 earnings) minus the consensus at August (for 2002 earnings), normalized by the absolute value of the consensus forecast at October, with the forecast data from the IBES dataset. This revision has a correlation of 0.31 with the firm-level stock return from 9/10 to 9/28, 2001.

To construct the index, we first compute the change in log stock price for each US firm from September 10, 2001 to September 28, 2001. We then look at the mean of log stock price change for each three-digit SIC sector, and use it as the sector-level demand sensitivity. In this exercise, we drop the airlines, defense, and insurance sectors, which were affected directly by the terrorist attack. Excluding financial sector firms, we are left with 361 3-digit level sectors in total. We choose the three week window carefully. If the window is shorter than one week, the index may also reflect a firm's reaction to a perceived tightening of liquidity. If the window is longer than three months, the prospect for US GDP growth might be revised upward sufficiently by January 2002 that the index may not capture a firm's reaction to a perceived economic downturn.

Other Variables and Summary Statistics

In subsequent statistical analyses, we sometimes add other control variables, such as the three factors from the Fama-French (1992), which includes firm size (as measured by the log of book assets), market asset to book asset ratio, and beta from the datasets of Worldscope and Datastream. The firm-level market beta is based on the correlation between monthly firm stock price and the country-level market index over the past five years. We also add the momentum factor, which is the firm level stock return from January 1st, 2007 to June 30, 2007.

Table 1a reports summary statistics of the key variables. Table 1b reports pair-wise correlations among the variables. Table 2 reports summary statistics for stock returns of non-financial firms in 45 country over the sample period from July 31, 2007 to August 31, 2008. It shows significant variation both within a country and across countries.

3. Empirical Analysis

3.1 Basic Results

We examine percentage change in stock price (or more precisely, difference in log stock price) from July 31, 2007 to August 31, 2008 for US non-financial firms. In Column 1 of Table 3, we have the financial dependence indices and the demand sensitivity index as the only regressors. All indices of financial dependences have a negative coefficient and are statistically significant: across firms, those that with large dependence on external finance for

investment (DEF_INV), or with large dependence on external finance for working capital (DEF_WK), or with large share of intangible assets, experienced a greater fall in stock price during the subprime crisis.

Comparing two industries: one with the DEF_INV index at the 25% threshold of the sample (-0.13), and the other one with the DEF_INV index at the 75% threshold (0.77). The latter will experience an additional drop of 6% based on our estimations ($=(0.77+0.13)*6.4$). Now comparing another two industries: one with the DEF_WK index at the 25% threshold of the sample (0), and the other one with the DEF_WK index at the 75% threshold (1.3). The latter will then suffer additional drop of stock price by 5% ($=(1.3-0)*2.86$). Further, comparing additional two industries: one with the intangible-asset index at the 25% threshold (0.07), and the other one with the intangible-asset index at the 75% threshold (0.7). The latter will see stock price dropping by 1% addition ($=(0.7-0.07)*1.2$). Hence sectors with large financial dependence overall see additional drop of stock price by 12%, which is about a third of the average decline of stock prices (39%).

In Column 2 of Table 2, we add the three factors from the Fama-French model and the momentum factor as controls. Three of the three factors are statistically significant. Firms with a high market to book ratio experience a greater decline in price. The firm size variable is significant, as firms with large size may have more access to credit in the times of crisis. The coefficient on the “beta*market return” variable is positive and significant. This is intuitive it says that firms with a smaller beta experience a smaller reduction in stock price during the market downturn, other things being equal. In any case, even with these factors controlled for, financial dependence factors are still statistically significant. Hence, our key conclusion appears robust: relatively more-constrained firms suffered a larger drop in stock price.

3.2 Macroeconomic and Institutional Variables

So far we have analyzed how the stock returns vary by sector’s external finance dependence. Now we further explore one more layer of heterogeneity, and analyze whether the same sector also fares differently across countries. That is, whether countries macroeconomic situations and institutional features matter. We start with the macroeconomic factors.

Pre-crisis Credit Growth

Here we examine if the credit growth leading to the crisis affects the impact of financial constraint on stock returns. We calculate the growth rate of banks' lending to private sector over GDP for the period from 2000 to 2006, based on the World Development Indicators. The magnitude of credit growth is listed in Table 4 for each country. The credit growth rate is then interacted with all three measures of external finance dependence. And we reexamine Table 3 with these additional factors.

Column 1 of Table 5 shows that firms with large external finance dependence experiences more severe decline of stock prices in countries with large pre-crisis credit growth. The interactions of credit growth with the DEF_INV index, the DEF_WK index and the intangible are all significantly different from zero. To gauge the economic impact, let us compare two countries with large difference of pre-crisis credit growth, Japan and the UK. Japan has a pre-crisis credit growth of -42%, while the UK has a credit growth of 43%. For Japan, the impact of the DEF_INV index is -2.3 ($= -5.79 + 42 * 0.0824$), while it is -9.3 ($= -5.79 - 43 * 0.0824$) for the UK. For firms at the 75% threshold of the DEF_INV index, the country difference will translate into a stock return difference of 5.4% ($= (-9.3 + 2.3) * 0.77$). Similarly, for Japan, the impact of the DEF_WK index is -0.1 ($= -2.53 + 42 * 0.058$), while it is -5.0 ($= -2.53 - 43 * 0.058$) for the UK. Then again, for firms at the 75% threshold of the DEF_WK index (1.3), the country difference will translate into a stock return difference of 6.5%. Moreover, for Japanese and UK firms at the 75% threshold of the intangible assets index (0.7), the country difference could further translate into a stock return difference of 2.4%. Taken together, this is a total stock return difference of 14.3%.

In Column 2, we include the three factors of Fama-French model and the momentum factor. Again, we find results comparable to those in Column 1.

As the magnitude of bank credit is related to financial development, an alternative explanation follows: it is the level of financial development rather than the pre-crisis credit growth that affects the severity of stock market crash. To test this hypothesis, we define financial development as the ratio of bank credit to private sector over GDP at the end of 2006. We then interact this ratio with all the three measures of external financial dependence. None of these measures tend out to be significant at the 20% level.

Monetary and Exchange Rate Regimes

Here we examine whether monetary and exchange rate regimes affect the stock prices through the channel of financial dependence. We separate countries into three groups, based on IMF de facto classifications at the year 2006.³ Group A includes fixed exchange rate regime and managed float with low flexibility, group B includes floating regimes with an inflation target, while group C includes other floating regimes (see Table 4). We then construct two dummies: one for whether country belongs to Group B, and the other for whether country belongs to group C. We interact these dummies with the various measures of external financial dependence.

The results are presented in Columns 3 and 4 of Table 5. The interactions of inflation targeting with the DEF_INV index and with the DEF_WK index have significant impacts, while the interaction with the intangibles have weak impacts. These result are intuitive in that countries with inflation targeting probably would be less reluctant to inject liquidity to help banks, and hence financially-constrained firms suffer more. Column 4 adds the firm-level factors, and confirms the findings in Column 3. Columns 5 and 6 combine credit growth with monetary policy. Now monetary policy becomes insignificant. Hence, pre-crisis credit growth dominates the monetary and exchange rate regimes in explaining the stock market decline if we focus on the financial dependence channel.

Current Account Deficit

We also add the cumulative current account surplus over GDP from 2001 to 2006. It is then interacted with the measures of financial dependence. The interaction terms turn out to be positive, but not significant for DEF_INV, and weakly significant for DEF_WK at the 10% level (Column 1 of Table 6). In column 2, we add the firm-level factors. Now DEF_WK becomes insignificant, while the interaction term with the intangible assets becomes significant at the 5% level. Hence overall, for countries with relatively large current account

³ www.imf.org/external/np/mfd/er/2006/eng/0706.htm

surplus, the impact of financial dependence is smaller, but the cross-country difference is not huge.

These findings concord with a UBS Investment Comment on 6 October 2008 (Anderson, 2008). The Comment uses the interbank interest rates as a measure of liquidity shortages. It argues that for the current crisis, “what really matters for the health of financial markets is not external indebtedness per se so much as the amount of overall leverage in the system.”

Market Structure

We look at a country’s relatively reliance on capital market vs banking system. We construct the ratio of stock market capitalization plus bonds over bank loans, averaged over the years from 2000 to 2005. It then is interacted with all the measures of financial dependence. But none of the interaction turns out to be significant.

We further construct an alternative measure of capital market dependence. It is a dummy measure, equal to one if $(\text{market cap} + \text{bonds}) / \text{bank loans}$ is above the sample median and $(\text{market cap} + \text{bonds}) / \text{GDP}$ is also above the median. This dummy then is interacted with all measures of financial dependence. Now the interaction term with DEF_WK turns out to be significantly negative, suggesting that firms with external dependence on working capital suffer more in countries with market-based system.

Country-by-country analysis

So far, we have relied on the pooled country analysis. Now we further perform the analysis country-by-country. We regress stock return onto DEF_INV, DEF_WK, intangible shares and demand sensitivity from 7/31/07 to 08/31/08 for each country separately.⁵ Then we look at how the coefficients for these variables are related to pre-crisis credit growth from the years 2000 to 2006.

⁵ We leave out firm-level Fama-French factors so as to have more observations for small and median countries; although including these factors will not alter the key findings.

The results are illustrated in Figure 2.⁶ It shows that the magnitude of stock market decline is systematically related to country's pre-crisis credit growth. On the vertical axis is the coefficient for the finance dependence variable, with smaller numbers associated with more severe credit crunch. On the horizontal axis is the pre-crisis credit growth. We fit two linear lines across the countries: one is the simple linear regression, while the other one is weighted by the country's number of stocks in our sample. Figure 2 demonstrates that higher pre-crisis credit growth causes credit crunch to be more severe in the current financial turmoil, whether the external financial dependence is measured by DEF_INV, DEF_WK, or intangible shares.

3.3 Placebo Test

We now conduct a placebo test, replicating the key regressions in Table 3, but on a sample period prior to the subprime trouble being recognized as a generalized crisis. Table 8 reports the Placebo test for the period from Jan 1, 2006 to June 30, 2007. Column 1 shows that none of the three financial dependence measures is statistically significant at the 10% level. Column 2 further shows that none of the interaction term with the pre-crisis credit growth is significantly different from zero. This leads us to conclude that the data patterns in Tables 3 and 5 are really those associated with the subprime crisis period, and not with other factors present in earlier periods.

3.4 Additional Robustness Checks

Here we examine if firm-level sensitivity to trade matters during the current crisis. Firm's earnings could suffer if it has exposure to the global recession through the international trade channel. To construct the sensitivity to trade, firm annual stock return is regressed onto a constant and the percentage change of the country's exports at the 3-digit SIC level, over the period from 1992 to 2006. The coefficient of the exports is then used as the trade sensitivity of the firm. We then reexamine Table 3. Adding this trade sensitivity

⁶ We winsorize the country coefficients at the 5% level to reduce the impact of countries with few observations.

reduces the sample size in Table 3 by about a half, as only tradable sectors have this index. In any case, this index does not turn out to be significant.

4. Conclusion

In this paper, we propose a methodological framework to study the underlying mechanisms by which a financial-sector crisis may affect the real sector, and apply it to the case of the ongoing global financial crisis. In particular, we are interested in documenting and quantifying the importance of tightening liquidity constraints on non-financial firms. We ask the question: If we classify non-financial firms into different baskets, based on their *ex ante* sensitivity to shocks to external finance (in terms of investment and working capital needs), would this classification help us to forecast the *ex post* stock price performance of these firms? We find the answer to be a resounding yes. The sensitivity to external finance appears to be significant quantitatively in explaining cross firm differences in the magnitude of stock price declines.

We further examine the role of various country features in understanding cross-country differences in the transmission of the supply-of-finance shock. We zoom in on three country features: bank-vs-market-centered financial system, exchange rate regime, and pre-crisis credit growth. We interact these country features with firms' sensitivity to external finance. We find that in countries with rapid pre-crisis credit expansion, finance-sensitive firms experienced significantly worse performance of stocks.

Correctly diagnosing the transmission channels for a financial crisis to affect the real economy has implications for designing appropriate policy responses to the crisis. For the subprime mortgage crisis, our analysis suggests that policies that could relax liquidity constraints faced by non-financial firms are likely to be indispensable. Our methodology should also be useful in other contexts where effects of a financial shock to the real economy need to be measured. We leave these applications for future work.

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Table 1a. Summary Statistics

| | N | p50 | mean | sd | min | max |
|--------------------|-------|--------|--------|-------|---------|-------|
| Stock return | 27181 | -14.66 | -32.31 | 51.22 | -220.68 | 76.35 |
| DEF_INV | 19376 | 0.24 | 0.27 | 0.63 | -0.91 | 1.80 |
| DEF_WK | 19267 | 0.56 | 0.69 | 0.72 | 0.00 | 2.94 |
| Intangible assets | 19474 | 0.27 | 0.56 | 0.84 | 0.00 | 6.59 |
| Demand sensitivity | 21207 | 1.46 | 1.51 | 1.00 | -1.05 | 4.81 |
| Company size | 21052 | 13.52 | 13.67 | 3.34 | 0.00 | 25.12 |
| Market/book | 17249 | 1.83 | 2.93 | 3.75 | 0.32 | 27.10 |
| Beta | 24109 | 0.77 | 0.78 | 0.35 | 0.00 | 2.74 |
| Momentum | 26522 | 0.00 | 0.09 | 0.33 | -4.65 | 5.74 |

Note: DEF_INV is the external finance dependence for investment, and DEF_WK is the external finance dependence for working capital.

Table 1b. Correlations among Variables

| | Stock return | DEF_INV | DEF_WK | Intangible assets | Demand sensitivity | Market / book | Beta |
|--------------------|-----------------|---------|--------|----------------------|-----------------------|------------------|-------|
| Stock return | 1.00 | | | | | | |
| DEF_INV | -0.07 | 1.00 | | | | | |
| DEF_WK | -0.03 | -0.09 | 1.00 | | | | |
| Intangible assets | 0.02 | -0.41 | -0.09 | 1.00 | | | |
| Demand sensitivity | -0.01 | -0.04 | -0.07 | -0.01 | 1.00 | | |
| Market/Book | -0.07 | 0.11 | -0.06 | 0.01 | -0.03 | 1.00 | |
| Beta | -0.18 | 0.09 | 0.00 | -0.08 | 0.00 | 0.08 | 1.00 |
| Momentum | -0.04 | -0.03 | 0.06 | -0.01 | 0.00 | -0.08 | -0.05 |

Table 2: Stock Return from 7/31/07 to 8/31/08 for Non-financial Firms (%)

| COUNTRY | # of firms | Median | Mean | Std dev | p10 | p90 |
|------------------|------------|--------|-------|---------|--------|------|
| ARGENTINA | 68 | 0.0 | 3.7 | 31.4 | -37.2 | 44.8 |
| AUSTRALIA | 1681 | -42.5 | -52.5 | 65.9 | -144.5 | 14.6 |
| AUSTRIA | 94 | -12.8 | -27.7 | 38.3 | -85.0 | 0.1 |
| BELGIUM | 123 | -9.8 | -23.5 | 39.0 | -75.8 | 12.9 |
| BRAZIL | 274 | -4.5 | -19.0 | 51.5 | -90.0 | 34.9 |
| CANADA | 1618 | -13.2 | -36.7 | 63.9 | -126.5 | 23.5 |
| CHILE | 136 | -4.2 | -12.9 | 34.7 | -52.3 | 20.2 |
| CHINA | 1496 | -63.0 | -59.3 | 44.6 | -112.5 | 0.0 |
| COLOMBIA | 27 | 0.0 | -9.8 | 47.9 | -51.6 | 20.6 |
| CZECH REPUBLIC | 17 | 0.0 | -13.1 | 41.9 | -45.9 | 12.7 |
| DENMARK | 125 | -20.5 | -30.5 | 45.1 | -82.8 | 5.6 |
| EGYPT | 38 | 1.4 | 8.3 | 37.9 | -37.7 | 59.9 |
| FINLAND | 130 | -24.2 | -30.6 | 35.8 | -76.2 | 3.7 |
| FRANCE | 892 | -16.1 | -28.9 | 44.0 | -84.4 | 6.9 |
| GERMANY | 844 | -19.6 | -34.7 | 54.0 | -107.0 | 11.3 |
| GREECE | 301 | -33.1 | -39.4 | 43.8 | -102.4 | 1.0 |
| HONG KONG | 845 | -51.1 | -59.9 | 65.6 | -150.4 | 4.6 |
| HUNGARY | 30 | -15.1 | -30.6 | 50.5 | -76.3 | 8.5 |
| INDIA | 902 | -12.3 | -17.6 | 42.9 | -72.1 | 33.7 |
| INDONESIA | 270 | -7.0 | -15.8 | 50.4 | -78.7 | 52.6 |
| IRELAND | 58 | -45.2 | -56.1 | 61.9 | -147.8 | 1.1 |
| ISRAEL | 161 | -34.2 | -41.2 | 54.4 | -99.4 | 14.9 |
| ITALY | 245 | -40.9 | -43.8 | 43.6 | -101.8 | 0.0 |
| JAPAN | 3868 | -31.7 | -38.7 | 43.0 | -92.6 | 0.1 |
| KOREA (SOUTH) | 965 | -39.5 | -46.2 | 49.9 | -110.1 | 1.9 |
| MALAYSIA | 916 | -29.5 | -38.4 | 50.6 | -103.6 | 10.8 |
| MEXICO | 124 | 0.0 | -9.8 | 33.6 | -53.5 | 21.0 |
| NETHERLANDS | 187 | -16.4 | -28.3 | 44.0 | -88.2 | 6.4 |
| NEW ZEALAND | 111 | -2.4 | -22.6 | 52.9 | -76.0 | 8.8 |
| NORWAY | 200 | -13.1 | -28.7 | 48.3 | -88.1 | 11.7 |
| PAKISTAN | 81 | -28.4 | -36.7 | 45.0 | -100.3 | 8.7 |
| PERU | 68 | -1.1 | -18.3 | 56.9 | -92.8 | 55.4 |
| PHILIPPINES | 140 | -16.7 | -24.7 | 43.6 | -84.5 | 22.2 |
| POLAND | 217 | -70.7 | -72.6 | 56.0 | -140.6 | 0.0 |
| PORTUGAL | 73 | 0.0 | -25.1 | 37.9 | -87.5 | 1.6 |
| RUSSIAN FEDERATI | 85 | -9.4 | -12.8 | 46.2 | -70.4 | 56.6 |
| SINGAPORE | 618 | -48.0 | -55.7 | 57.7 | -135.7 | 0.0 |
| SOUTH AFRICA | 350 | 0.0 | -18.0 | 42.9 | -74.3 | 21.5 |
| SPAIN | 117 | -28.2 | -36.0 | 39.2 | -95.8 | 0.0 |
| SWEDEN | 328 | -23.5 | -33.7 | 44.7 | -91.6 | 5.9 |
| SWITZERLAND | 205 | -12.0 | -22.2 | 36.4 | -70.3 | 7.4 |
| THAILAND | 437 | -7.1 | -12.5 | 40.0 | -64.2 | 36.8 |
| TURKEY | 190 | -28.2 | -28.2 | 40.1 | -75.0 | 20.3 |
| UNITED KINGDOM | 1990 | -22.1 | -43.5 | 64.0 | -137.0 | 12.2 |
| Total | 21673 | -28.4 | -39.1 | 53.7 | -109.9 | 10.5 |

Table 3. Change in Stock Price during the Subprime Crisis
(July 31, 2007 – August 31, 2008)

| | 1 | 2 |
|--------------------|-----------|----------|
| DEF_INV | -6.375*** | -2.990** |
| | [1.35] | [1.34] |
| DEF_WK | -2.859*** | -2.722** |
| | [0.84] | [1.07] |
| Intangible | -1.188* | -1.229 |
| | [0.65] | [0.82] |
| Demand Sensitivity | -0.417 | -1.007 |
| | [1.19] | [1.18] |
| Beta*Market Return | | 1.40** |
| | | [0.69] |
| Size | | 4.955*** |
| | | [0.85] |
| Market/Book ratio | | -0.431** |
| | | [0.18] |
| Momentum | | 2.336 |
| | | [7.07] |
| Observations | 18934 | 13960 |
| R-squared | 0.07 | 0.13 |

Notes: DEF_INV is the external finance dependence for investment, and DEF_WK is the external finance dependence for working capital. Standard errors in brackets; ***, **, and * denote p-value less than 1%, 5%, and 10%, respectively. Country fixed effects are included.

Table 4. Pre-crisis Credit Growth, Monetary and Exchange Rate Regimes

| COUNTRY | Credit Growth from 2001 to 2006 | Floating & Inflation Targeting | Floating & NO Inflation Targeting | Fixed or Managed Floating |
|----------------|---------------------------------------|--------------------------------------|---|---------------------------------|
| ARGENTINA | -10.88 | 0 | 0 | 1 |
| AUSTRALIA | 27.63 | 1 | 0 | 0 |
| AUSTRIA | 13.26 | 0 | 1 | 0 |
| BELGIUM | 5.19 | 0 | 1 | 0 |
| BRAZIL | 8.18 | 1 | 0 | 0 |
| CANADA | 99.58 | 1 | 0 | 0 |
| CHILE | 8.44 | 1 | 0 | 0 |
| CHINA | 0.71 | 0 | 0 | 1 |
| COLOMBIA | 9.05 | 0 | 0 | 1 |
| CZECH REPUBLIC | -8.09 | 0 | 0 | 1 |
| DENMARK | 49.82 | 0 | 1 | 0 |
| EGYPT | -3.40 | 0 | 0 | 1 |
| FINLAND | 24.67 | 0 | 1 | 0 |
| FRANCE | 13.72 | 0 | 1 | 0 |
| GERMANY | -8.75 | 0 | 1 | 0 |
| GREECE | 31.43 | 0 | 1 | 0 |
| HONG KONG | -13.27 | 0 | 0 | 1 |
| HUNGARY | 24.01 | 0 | 0 | 1 |
| INDIA | 15.93 | 0 | 0 | 1 |
| INDONESIA | 4.71 | 0 | 0 | 0 |
| IRELAND | 77.54 | 0 | 1 | 0 |
| ISRAEL | 9.30 | 1 | 0 | 0 |
| ITALY | 19.63 | 0 | 1 | 0 |
| JAPAN | -42.59 | 0 | 1 | 0 |
| KOREA (SOUTH) | 10.85 | 1 | 0 | 0 |
| MALAYSIA | -69.86 | 0 | 0 | 1 |
| MEXICO | 3.81 | 1 | 0 | 0 |
| NETHERLANDS | 42.05 | 0 | 1 | 0 |
| NEW ZEALAND | 32.64 | 1 | 0 | 0 |
| NORWAY | | 1 | 0 | 0 |
| PAKISTAN | 6.62 | 0 | 0 | 1 |
| PERU | -8.28 | 0 | 0 | 1 |
| PHILIPPINES | -13.81 | 1 | 0 | 0 |
| POLAND | 6.72 | 1 | 0 | 0 |
| PORTUGAL | 25.94 | 0 | 1 | 0 |
| RUSSIAN | 17.41 | 0 | 0 | 1 |
| SINGAPORE | -14.07 | 0 | 0 | 1 |
| SOUTH AFRICA | 27.03 | 1 | 0 | 0 |
| SPAIN | 69.72 | 0 | 1 | 0 |
| SWEDEN | 74.06 | 1 | 0 | 0 |
| SWITZERLAND | 13.36 | 0 | 1 | 0 |
| THAILAND | -20.45 | 0 | 0 | 1 |
| TURKEY | 7.55 | 1 | 0 | 0 |
| UNITED KINGDOM | 43.38 | 1 | 0 | 0 |

Table 5. The Effect of Pre-Crisis Credit Growth and Monetary Regimes

| | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------------------------|------------|------------|-----------|-----------|-----------|------------|
| DEF_INV | -5.790*** | -2.696** | -4.195*** | -0.264 | -4.750*** | -1.087 |
| | [1.10] | [1.10] | [0.88] | [1.51] | [1.48] | [1.89] |
| Credit growth*DEF_INV | -0.0824* | -0.0779** | | | -0.0471 | -0.0532 |
| | [0.041] | [0.035] | | | [0.047] | [0.037] |
| DEF_WK | -2.525*** | -2.572*** | -1.087** | -1.261* | -1.760*** | -2.577*** |
| | [0.62] | [0.78] | [0.42] | [0.69] | [0.62] | [0.89] |
| Credit growth*DEF_WK | -0.0581*** | -0.0590*** | | | -0.0436** | -0.0694*** |
| | [0.0053] | [0.012] | | | [0.017] | [0.018] |
| Intangible | -0.742 | -0.864* | -0.261 | 0.427 | -0.562 | -0.0309 |
| | [0.57] | [0.50] | [0.78] | [0.78] | [1.12] | [0.88] |
| Credit growth*Intangible | -0.0442*** | -0.0585*** | | | -0.0480** | -0.0422** |
| | [0.015] | [0.0099] | | | [0.021] | [0.016] |
| Demand Sensitivity | -0.742 | -1.276 | -0.773 | -1.177 | -0.825 | -1.259 |
| | [1.07] | [1.03] | [1.06] | [1.11] | [1.04] | [1.04] |
| Beta* Market Return | | 1.40** | | 1.40** | | 1.41** |
| | | [0.69] | | [0.69] | | [0.69] |
| Firm size | | 4.866*** | | 4.914*** | | 4.882*** |
| | | [0.86] | | [0.86] | | [0.87] |
| Market over book ratio | | -0.433** | | -0.426** | | -0.432** |
| | | [0.18] | | [0.18] | | [0.18] |
| Momentum | | 2.091 | | 2.192 | | 2.079 |
| | | [7.09] | | [7.12] | | [7.15] |
| Inflation Targeting*DEF_INV | | | -6.700** | -6.900** | -4.254 | -3.896 |
| | | | [2.78] | [2.92] | [2.73] | [2.84] |
| Fixed Regime*DEF_INV | | | 0.888 | -1.496 | 0.874 | -1.406 |
| | | | [1.22] | [1.66] | [1.73] | [1.91] |
| Inflation Targeting*DEF_WK | | | -4.475*** | -3.144* | -2.034 | 1.018 |
| | | | [1.22] | [1.76] | [1.76] | [1.92] |
| Fixed Regime*DEF_WK | | | -0.483 | -1.402 | -0.417 | -1.124 |
| | | | [2.09] | [1.83] | [2.03] | [1.57] |
| Inflation Targeting*Intangible | | | -2.261 | -4.546*** | 0.09 | -2.376 |
| | | | [1.36] | [1.20] | [1.58] | [1.59] |
| Fixed Regime*Intangible | | | -0.477 | -0.123 | -0.781 | -0.346 |
| | | | [1.53] | [1.45] | [1.49] | [1.24] |
| Observations | 18755 | 13846 | 18934 | 13960 | 18755 | 13846 |
| R-squared | 0.07 | 0.13 | 0.07 | 0.13 | 0.07 | 0.13 |

Notes: DEF_INV is the external finance dependence for investment, and DEF_WK is the external finance dependence for working capital. Standard errors in brackets; ***, **, and * denote p-value less than 1%, 5%, and 10%, respectively. Country fixed effects are included.

Table 6. The Effect of Current Account Surplus

| | 1 | 2 |
|--------------------|---------------------|---------------------|
| DEF_INV | -7.080*** [1.55] | -3.371** [1.52] |
| CurrAcc*DEF_INV | 5.454 [3.58] | 3.159 [3.13] |
| DEF_WK | -3.384*** [0.85] | -2.770*** [1.01] |
| CurrAcc*DEF_WK | 3.855* [2.22] | 0.642 [2.21] |
| Intangible | -1.495** [0.66] | -1.760** [0.77] |
| CurrAcc*intangible | 2.809 [1.92] | 5.764** [2.41] |
| Demand Sensitivity | -0.551 [1.15] | -0.935 [1.18] |
| Beta*Market Return | | 1.400** [0.69] |
| Firm size | | 4.969*** [0.86] |
| Market over book | | -0.433** [0.18] |
| Momentum | | 2.308 [7.09] |
| Observations | 18932 | 13959 |
| R-squared | 0.07 | 0.13 |

Notes: DEF_INV is the external finance dependence for investment, and DEF_WK is the external finance dependence for working capital. Standard errors in brackets; ***, **, and * denote p-value less than 1%, 5%, and 10%, respectively. Country fixed effects are included.

Table 7. The Impact of Market vs Bank-Centered Financial System

| | 1 | 2 | 3 | 4 |
|------------------------------|----------|----------|-----------|----------|
| DEF_INV | -6.800** | -1.406 | -5.110*** | -0.315 |
| | [2.90] | [3.76] | [0.77] | [1.23] |
| Market over bank *DEF_INV | -0.0345 | -0.212 | -4.374 | -3.772 |
| | [2.27] | [2.55] | [3.11] | [2.96] |
| DEF_WK | 0.315 | 1.722 | -0.661 | 0.153 |
| | [1.73] | [1.77] | [0.85] | [0.70] |
| Market over bank *DEF_WK | -1.877 | -2.254 | -4.331*** | -4.387** |
| | [1.22] | [1.36] | [1.54] | [1.77] |
| Intangible | -1.554 | -2.898 | -1.046 | -0.902 |
| | [1.76] | [2.38] | [0.66] | [1.04] |
| Market over bank *Intangible | 0.305 | 1.249 | -0.257 | -0.62 |
| | [1.29] | [1.44] | [1.71] | [1.99] |
| Demand Sensitivity | -0.16 | -0.185 | -0.424 | -0.423 |
| | [1.23] | [1.10] | [1.13] | [1.06] |
| Beta*market index | | 2.678*** | | 2.680*** |
| | | [0.39] | | [0.39] |
| Firm size | | 5.822*** | | 5.784*** |
| | | [0.70] | | [0.70] |
| Market to book ratio | | -0.394* | | -0.386* |
| | | [0.22] | | [0.22] |
| Momentum | | 8.551 | | 8.504 |
| | | [6.70] | | [6.65] |
| Observations | 16892 | 12425 | 16892 | 12425 |
| R-squared | 0.06 | 0.15 | 0.06 | 0.15 |

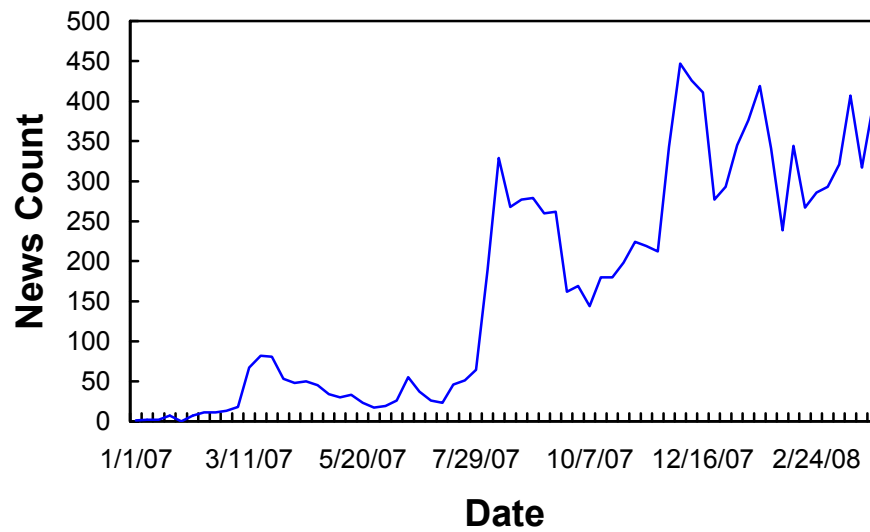
Notes: DEF_INV is the external finance dependence for investment, and DEF_WK is the external finance dependence for working capital. Standard errors in brackets; ***, **, and * denote p-value less than 1%, 5%, and 10%, respectively. Country fixed effects are included.

Table 8. Placebo Test of Financial Dependence Indicators

| | 1 | 2 |
|--------------------------|------------------|--------------------|
| DEF_INV | -1.702 [1.63] | -2.024 [1.33] |
| DEF_WK | 3.811 [2.30] | 4.047* [2.31] |
| Intangible | -1.034 [0.65] | -1.201* [0.63] |
| Credit growth*DEF_INV | | 0.0563 [0.043] |
| Credit growth*DEF_WK | | -0.0338 [0.053] |
| Credit growth*Intangible | | 0.0177 [0.012] |
| Observations | 17453 | 17297 |
| R-squared | 0.25 | 0.25 |

Notes: DEF_INV is the external finance dependence for investment, and DEF_WK is the external finance dependence for working capital. Standard errors in brackets; ***, **, and * denote p-value less than 1%, 5%, and 10%, respectively. Country fixed effects are included.

Figure 1: News Count of “Subprime” and “Crisis”



This graph reports a weekly count of news articles containing the words “subprime” and “crisis” in all US newspapers, excluding republished news, recurring pricing and market data. A week is defined as from Sunday to Saturday. The count was 64 for the week of July 29th, 189 for the week of August 5th, and 329 for the week of August 12, 2007, respectively. Source: Factiva.

Figure 2: Pre-crisis Credit Growth and the Severity of Current Financial Constraint

