Crisis "Shock Factors" and the Cross-Section of Global Equity Returns*

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Abstract

We study stock returns over the period of the global financial crisis of 2007-2008 and identify three crisis "shock factors" related to unique features of the crisis: (1) the collapse of global demand, (2) the contraction of credit supply, and (3) selling pressure on firms' equity. All three of these "shock factors" are reflected in large and statistically significant influences on residual equity returns during the crisis period (after controlling for normal risk factors that are associated with expected returns). Similar analysis for the placebo period of August 2005-December 2006 shows that the influences identified during the 2007-2008 sample period are unique to the crisis. A month-by-month analysis shows that the time variation of the importance of each of the shock factors tracks related changes in the global economic environment.

Keywords: stock returns, crisis

JEL: F30, G01, G12

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I. Introduction

The financial crisis of 2007-2008 was a significant shock to the financial system and the global economy. The shock that originated in the mortgage market and banking system reduced the supply of credit, led to distressed sales of risky assets as banks and investors scrambled to shore up their liquidity and capital ratios, and plunged the global economy into a severe recession, one in which economic activity slowed or contracted, and global trade collapsed. While the crisis originated in the US and other developed economies, it quickly spread over the globe, affecting all economies, which saw their stock prices collapse as investors panicked.

Stock returns are a unique measure of performance that is comparable across firms and countries, forward-looking, comprehensive in scope, and insensitive to differences in accounting rules. In normal times, a firm's stock returns reflect a combination of expected returns (its loadings on risk factors) and residual returns that are associated with firm-specific news. At times of significant economy-wide shocks, however, the cross-section of residual returns can be understood as reflecting the exposure of firms to unexpected shocks.

Three categories of crisis-related shocks – reduced global product demand, contraction in the supply of credit, and selling pressure in the equity markets – could have contributed to the decline of equity prices worldwide during the financial crisis of 2007-2008. These shocks were unexpected prior to the crisis. Equity prices, as forward-looking measures of value, should capitalize the effects of these shocks on the prospective cash flows of firms and the rates at which those cash flows are discounted. In this paper, we consider whether the financial crisis of 2007-2008 was a unique event from the standpoint of stock returns and isolate crisis-related "shock factors" that can explain the cross-section of residual returns during the crisis.

Our strategy is to construct measures of "shock factors" for each of the three categories of shocks described above and then identify their relative contribution to the observed declines in equity returns. As a measure of sensitivity to global product demand shocks, we employ measures of global trade exposure. The sensitivity to selling pressure is captured by the structure of stock ownership and stock trading prior to the crisis. We measure firms' sensitivity to credit supply shocks through a combination of variables relating to the capital structure, its dividend behavior, and the ability of the firm to cover its debt obligations.

We use data on over 17,000 firms in 44 countries around the world to study whether cross-sectional stock returns over the period of August 2007 to December 2008 can be explained by the crisis "shock factors" described above. We use a methodology similar to Tong and Wei (forthcoming) which employs a cross-sectional model of stock returns and captures expected returns with a standard set of control variables.[1] In this framework, our "shock factors" capture unexpected influences of crisis-related shocks on residual stock returns. Empirically, we use values from 2006 to construct our shock factors, which are based on firm characteristics observed prior to the crisis. We then compare our results for the crisis period with a similarly structured model of the "placebo" period (that runs from August 2005 to December 2006 and uses predetermined values from 2004 to construct shock factors).

To preview our results, we find that credit supply shocks, global demand shocks and selling pressures in the equity market had negative influences on stock returns during the crisis but positive or not significant effects during the placebo period. Our results are robust to three ways of modeling the influence of "shock factors": (1) as three sets of individual variables that enter separately as regressors in the model of residual returns, (2) as the first principle

[1] Tong and Wei (forthcoming) follow Whited and Wu (2006) in incorporating Fama and French (1992) factors directly in cross-sectional regressions of returns.

component of the set of individual regressors used to measure each category of influence, and (3) as dummy variables that divide firms in groups according to combinations of regressor values.

A month-by-month analysis shows that the time variation of the importance of each of the "shock factors" tracks related changes in the global economic environment. The magnitude of the negative coefficients associated with the global demand shock factor rises during times of greatest decline in exports. Time variation in the coefficients associated with the credit-supply factor are similar to those found in credit risk spreads that reflect the timing of credit-supply shocks. The variation over time in the coefficients that measure the stock market selling pressure shock factor closely tracks the variation in the returns to the stock market.

While our methodology builds on Tong and Wei (forthcoming), our focus is different. Tong and Wei explore the role of country-level exposure to financial globalization, specifically through the composition of capital flows. They also find an important firm-specific factor in cross-sectional returns related to financial dependence (specifically, working capital financing needs). Our focus is entirely on firm-specific "shock factors" which arise as a result of an unexpected crisis event. We abstract from the effect of country characteristics by using country fixed effects. Didier, Love, and Martinez Peria (2010) provide a detailed analysis of country-specific factors in aggregate equity returns during the crisis. In considering firm-specific factors, we explore a broader range of firm characteristics, both relating to financing structure and other characteristics of firms than did Tong and Wei.

There have been numerous studies of the effects of the crisis and the role of credit contraction and illiquidity crisis-induced selling on the redemptions of money market debts and the widening of bond spreads. These studies identify important effects of correlated selling

pressure traceable to illiquidity problems in generating the contraction of quantities and the declines in prices in different debt markets.[2]

In publicly traded equity markets, crisis-related shocks should have had even greater consequences than in debt markets, given the consequences of the crisis for firms' immediate and future incomes and their debt financing options. Just as in debt markets, problems of "funding illiquidity" for investors in publicly traded firms (due to declines in investor equity, rising market volatility, and the decline in available credit), should have been transformed into "market illiquidity" as owners of publicly traded shares were forced to liquidate their shares. Billio, Pelizzon, Getmansky, and Lo (2010) examine correlations in returns across different equity investors and document apparent crisis-specific linkages in returns that they argue reflect this selling pressure.[3] Additionally, publicly traded firms' expected performance was itself affected by declining expected sales and by contraction in the supply of credit. Equity selling pressure, therefore, should have magnified declines in share prices that reflected the influences of declining demand and tight credit in reducing the discounted expected future cash flows of firms.

We find that each of the three categories of crisis-related shock factors accounts for significant proportions of the declines in equity prices observed during the crisis. Of course, it is not possible to completely disentangle the influences of demand contraction, credit scarcity, and selling pressure through these three shock factors. Each of our three measured shock factors is likely to have been influenced by all three sources of shock. Nevertheless, we argue that the

[2] See Schwarz (2009) on the Libor market, Heider, Hoerova and Holthausen (2009) on the Euribor market, Gorton and Metrick (2010) on the repo market, Corvitz, Liang, and Suarez (2009) on the asset-backed commercial paper market, Duca (2010) on the commercial paper market, and Mitchell and Pulvino (2010) on the bond market.

[3] Cella, Ellul, and Giannetti (2010) find that investors with short trading horizons are inclined or forced to sell their holdings to a larger extent than investors with longer trading horizons, amplifying the effects of market-wide shocks on stock prices.

dominant influences on each of the three shock factors are likely to be primarily traceable to one of the three categories of shocks.

This paper is related to the emerging literature on the origin and consequences of the crisis. Most of the existing papers have focused on the causes and consequences of the crisis and thus have mostly analyzed its epicenter, the United States.[4] A few others have studied the global transmission of this crisis. For instance, Fratzscher (2009) and Obstfeld, Shambaugh, and Taylor (2009) focus on the transmission via exchange rates. Dooley and Hutchison (2009) provide evidence of transmission to credit default swap spreads in emerging markets. Rose and Spiegel (2009a and 2009b) conduct an analysis of the international propagation of the crisis based on a measure of crisis incidence and severity which combines changes in real GDP, stock markets, credit ratings, and exchange rates. However, these papers use macro data to analyze the incidence and determinants of the propagation of the crisis. Ehrmann, Fratzscher, and Mehl (2009) study the transmission of the US 2007-2008 crisis to stock markets around the world by focusing on the performance of about 450 industry-equity portfolios across 64 countries. That paper focuses primarily on the role of macro factors on the performance of industry portfolios rather than the role of the crisis shock factors we consider here.

The rest of our paper is organized as follows. Section II explains our approach to identifying shock factors. Section III describes the data and empirical model. Section IV presents our main empirical results for the global cross-section of stock returns during the crisis, and shows that our identified shock factors played a uniquely important role in explaining equity returns during the crisis, as compared with the pre-crisis "placebo" period. Section V examines

[4] See Caprio, Demirguc-Kunt, and Kane (2008), Reinhart and Rogoff (2008), Brunnermeier (2009), Calomiris (2009), Cecchetti (2009), and Taylor (2009), among many others.

the cross-section of returns during the crisis period in more detail, performing a month-by-month analysis of the changing importance of shock factors over time. Section VI concludes.

II. Identifying Shock Factors

Global Demand Shock

The financial crisis was associated with a remarkable decline in global trade. World exports fell by 9 percent between July 2007 and December 2008. This decline reflected a variety of potential influences, including the sensitivity of export financing to credit supply contraction (Amiti and Weinstein 2009, Chor and Manova 2009). Our interest, of course, is not in explaining export decline, but rather using the crisis-related collapse in exports to measure firms' differing sensitivity to the decline in global demand during the crisis. Firms that had positioned themselves prior to the crisis to be more dependent on trade were relatively vulnerable to global demand shocks during the financial crisis. We, therefore, measure global demand shock sensitivity using firm-specific variables that capture the exposure of a firm to global trade. Our two measures are (1) the firm's pre-crisis proportion of sales outside the company's home country, and (2) the proportion of company assets held outside the company's home country.

Stock Market Selling Pressure Shock

We measure the sensitivity of a firm's equity to selling pressures in the stock market using two variables: pre-crisis free float relative to the total market value of equity, and pre-crisis stock turnover (the volume of trading relative to outstanding market value of equity). These measures are intended to capture the relative liquidity of a stock prior to the crisis.

In theory, the effect of stock liquidity on returns is ambiguous. On the one hand, greater liquidity may be associated with steeper declines in equity prices, as investors select their most liquid risky assets to sell during a liquidity squeeze. On the other hand, liquidity becomes more valuable during a crisis, implying that relatively illiquid stocks may experience relative price declines.

Of course, the meaning of observed relative declines related to relative liquidity is also controversial. One could argue that relatively illiquid stocks also experienced large declines in value during the crisis, which were masked by the lack of sales of these stocks. In other words, had someone tried to sell a large amount of an illiquid stock, its price would have been much lower. Selectivity bias related to endogenous decisions to sell, therefore, complicates the interpretation of the meaning of the effects of liquidity on stock returns during the crisis.

Credit-Supply Shock

Several studies show dramatic declines in credit supply during the crisis. Ivashina and Scharfstein (2009) find that banks curtailed new lines of credit, and thus, that credit supply contracted much faster than would be apparent by only examining outstanding aggregates amounts of commercial and industrial lending. Campello, Graham, and Harvey (2010) survey chief financial officers (CFOs) of 1,050 firms in 40 countries after the September 2008 market collapse and find that a substantial proportion of those surveyed report that they were forgoing positive net present value investments due to financing constraints.[5] Almeida, Campello,

[5] "[T]he inability to borrow externally caused many firms to bypass attractive investment opportunities, with 86% of constrained U.S. CFOs saying their investment in attractive projects was restricted during the credit crisis of 2008. More than half of the respondents said they canceled or postponed their planned investments."

Laranjeira, and Weisbenner (2010) find that firms that are more exposed to debt rollover risk experienced much greater investment decline during the financial crisis.[6]

Although the contraction of credit supply affects all firms, either directly (through reduced credit) or indirectly (through reduced demand by customers who face reduced credit), some companies should be harder hit by a contraction in credit supply than others. Companies with intrinsically high costs of external finance – for example, small, growing firms, specializing in new products, or with short histories of public trading – will find their prospects of attracting financing reduced relative to other firms during times of general economic contraction, or credit-supply stringency.[7]

For a given degree of exogenous difference in the costs of external finance, a company with higher leverage and lower cash flows relative to debt service requirements (i.e. interest coverage) prior to the crisis should experience greater vulnerability to credit supply shocks associated with a financial crisis. All firms experience reductions in their "debt capacities" during a crisis (the maximum degree of leveraging that their cash flow prospects will permit); therefore, companies with high leverage and lower interest coverage prior to the onset of a credit

[6] Almeida, Campello, Laranjeira and Weisbenner (2010) use long-term debt maturing in the near term as a particularly exogenous indicator of firms' exposures to rollover risk. They argue that while a reliance on short-term contractual debt may proxy for other firm attributes, long-term debt maturing in the near term is a purer measure of exposure to rollover risk.

[7] There is a long literature examining indicators of firms' costs of external finance. Fazzari, Hubbard and Petersen (1988) used dividend payout as their key indicator. Of course, dividend payout may reflect other differences, and has been criticized in some studies (Kaplan and Zingales 1997, but see the response by Fazzari, Hubbard and Petersen 2000, and the further evidence against the usefulness of Kaplan and Zingales's approach to identifying financing constraints by Campello and Chen 2010 and Almeida, Campello and Weisbach 2004). Many studies also employ firm size as an indicator, although this measure captures many other differences, including risk, and size is a risk factor employed in our study. Gilchrist and Himmelberg (1998) argue that sales/PPE (which they argue measures the marginal product of fixed capital) captures the effects of financing constraints in raising the shadow cost of external finance, and confirmation for the importance of that variable is also found in other studies of cross-sectional differences in accessing debt markets (Calomiris, Himmelberg, and Wachtel 1995) or in the cost of accessing the equity market (Calomiris and Tsoutsoura 2010).

crunch will be more adversely affected than other firms, as credit supply constraints will be more likely to bind on them.[8]

Thus, vulnerability to credit-supply shocks should reflect both the exogenous external finance costs of the firm and its endogenous financial choices. To capture both sorts of contributors to financial fragility, we considered a variety of measures that had been identified in the literature, and settled on a subset of indicators that capture endogenous leverage choices as well as exogenous characteristics related to external financing costs.[9]

Previous research on the effects of financial constraints on stock returns confirms that the effects are relatively pronounced during macroeconomic downturns. Lamont, Polk, and Saa-Requejo (2001) surprisingly found "no evidence that the relative performance of constrained

[8] A large body of empirical and theoretical research supports the view that "corporate finance vulnerability" should matter for the cross-section of stock returns (Anginer and Yildizhan, 2010 is an exception), and that it should matter more for the cross-section of returns in adverse states of the world (i.e., recessions, credit crunches, or financial panics). The theoretical foundations of "corporate finance vulnerability" for stock returns dates back to the seminal work of Brock and LeBaron (1990), who showed that financing constraints (i.e., differences in the marginal cost of external finance across firms and across time) could explain variation in stock returns above and beyond those predicted by standard risk models. Brock and LeBaron (1990) showed that an adverse macroeconomic shock should cause a larger decline in the stock returns of financially constrained firms (those with relatively high costs of external finance) than other firms. They illustrated their model by comparing the returns behavior of small and large firms, and argued that the greater sensitivity of small firms' returns to shocks may reflect their higher costs of external finance. With respect to the effects of leverage in magnifying financial constraints, Sharpe (1994) and Calomiris, Orphanides, and Sharpe (1994) find that although high leverage tends not to be useful for explaining cross-sectional differences in investment and employment decisions during expansions, during recessions US firms that had chosen to increase their debt to high levels during the preceding booms suffered larger contractions of employment, fixed investment and inventory accumulation in reaction to declines in their sales growth during the recession. In other words, highly levered firms experience relatively large declines in expected cash flows in adverse economic states, but not in other economic states.

[9] Unlike Tong and Wei (2010) we do not confine our investigation to exogenous influences on external finance dependence related to working capital. We consider financial structure characteristics more broadly for two reasons. We note that working capital use, like other financial structure characteristics is endogenous to firm-specific costs of external finance. Calomiris, Himmelberg and Wachtel (1995) show that, ceteris paribus, firms that face greater external financing constraints tend to choose combinations of productive factors that make greater use of working capital. While that finding supports Tong and Wei's emphasis on working capital to measure financing constraints, it also indicates that their measure is endogenous to choices that reflect financing constraints, which are related more broadly to age, opacity, and other firm characteristics. We do not regard endogeneity as a problem; on the contrary, we believe that it makes sense to consider the ways in which endogenous choices of firms' financing structure make them differentially vulnerable to crisis-related credit-supply shocks. We consider a wide range of such measures. In particular, we show that endogenous decisions by firms – for example, the decision to increase leverage – mattered for firms' sensitivity to the crisis.

firms reflects monetary policy, credit conditions, or business cycles." Subsequent research by Campello and Chen (2010), however, shows that macroeconomic conditions do affect the magnitude of the financial constraint factor, once one properly identifies cross-sectional variation in the extent of financing constraints, which they show Lamont et al. did not do.

In light of these theoretical and empirical findings, we chose four indicators to capture the sensitivity of firms to the credit-supply shock aspect of the crisis: (1) dividends to sales, (2) total debt to assets, (3) a dummy variable that is a threshold measure of potential financial distress, which distinguishes whether firms' debt service payments are very high relative to their cash flows – firms that have debt service coverage greater than one are defined as "good coverage" firms, and (4) an interaction effect that considers the effect of leverage interacted with good coverage.

Dividend payout, as discussed above, is a useful indicator of the exogenous cost of external finance; firms with high dividend payout tend to have high cash flows relative to investment, and are relatively mature. Our three leverage measures allow us to distinguish between the effects of financial distress, per se, and the effect of the financial crisis in reducing the effective debt capacity of non-distressed firms with significant pre-crisis leverage ratios. In particular, the interaction of leverage and good coverage highlights this potential effect of the crisis.

Limits to Shock Factor Identification

We believe that our seven observable measures (the ratio of foreign sales, the ratio of foreign assets, the ratio of free floating shares, the share of firms traded, the dividend to sales

ratio, the leverage ratio, and the interest coverage) capture firms' sensitivities to the three categories of "shock factors" reasonably well. Our identification assumptions linking each of these seven observable variables primarily to one of the three shock factors (global product demand shocks, market sell-off pressure shocks, and credit-supply shocks) are plausible, but we recognize that all three shock factors probably affect each of the seven observable variables to some extent. For example, firms with high pre-crisis costs of external finance will be more sensitive to reductions in cash flow (related to contractions in product demand) than other firms, even if credit supply were not declining. Nevertheless, we believe that the three sets of variables are naturally divisible into three groups based on our priors about the factor to which one would expect them to be most closely related.

III. Methodology and data

To explore the role of crisis-related "shock factors" in driving the performance of firms' stocks we estimate a cross-section model of returns represented by equation (1)

$$y_{f,i,c} = \alpha_1 \textit{Standard Risk Factors}_f + \alpha_2 \textit{Crisis Shock Factors}_f + \mu_i + \gamma_c + \varepsilon_{f,i,,c} \qquad (1)$$

where f represents the firm, i the industry, and c the country where each firm operates. The dependent variable in our study, $y_{f,i,c}$, is the return of each firm f, in each industry i, and each country c. *Standard Risk Factors* refer to a set of variables which the asset pricing literature have shown to drive expected results (Sharpe, 1964; Fama and French, 1992; Lakonishok, Shleifer, and Vishny, 1994; Ang et al., 2006, 2009). The *Crisis Shock Factor*s are our proxies for firms' credit supply sensitivity, global demand sensitivity, and stock market selling pressure sensitivity. Following Tong and Wei (forthcoming) and Whited and Wu (2006), we incorporate the standard risk factors and the crisis shock factors by entering the relevant firm characteristics directly into

the regression rather than entering them indirectly first going through a factor model. μ_i and γ_c are industry and country fixed effects, respectively, and $\varepsilon_{f,i,c}$ is the firm level error term. We estimate our model with clustered standard errors to allow for within-country across-firms correlation of error terms.

We estimate equation (1) over two periods: the crisis period and a placebo (non-crisis) period. Crisis period returns are measured over the period August 2007 through December 2008. Most firm characteristics are measured at December 2006.[10] The placebo period encompasses returns from August 2005 through December 2006, with most firm characteristics measured at December 2004. Table 1 lists the countries along with the number of firms included in each sample. We only consider countries with at least 20 firms. The crisis period includes 17,127 firms operating in 44 countries, while during the placebo period our sample consists of 15,595 firms operating in 45 countries.

Table 2 presents descriptive statistics for returns, standard risk factors, and crisis shock factors during the crisis and placebo periods. Data on returns come from Datastream. Table 2 shows that firm returns average -47 percent over the crisis period. The standard deviation of returns over the crisis period is 32 percent. During the placebo period, returns average 29 percent and the standard deviation is 54 percent.

The independent variables used in our analysis come from Worldscope, a commercial database produced by Thomsom Reuters, which provides financial statement data for most listed firms around the world. *Standard Risk Factors* follow Tong and Wei (forthcoming) and include:

[10] The firms' beta vis-a-vis the global market portfolio is calculated over the period December 2001 through December 2006 for the crisis period regressions. For the placebo regressions beta is calculated over the period December 2000 through December 2005. Momentum (i.e., a measure of returns six month prior) is calculated over the period January 2005 through June 2005 for the placebo period and for January 2007 through June 2007 for the crisis period.

the *beta* of each firm vis-a-vis the global market, the *standard deviation of the beta residual* (i.e., the standard deviation of the error from the estimation of the beta vis-a-vis the global market), the *log of firm assets*, a measure of *momentum*, and the *market to book value ratio*. The beta of each firm vis-a-vis the global market is the coefficient from regressing each firm's stock return on the return from a global portfolio as captured by the FTSE World Index. The capital asset pricing model of Sharpe (1964) predicts that individual stock returns will be driven by the correlation of each firm with the market's return. Because stock markets around the world have become increasingly integrated, we consider the correlation or beta vis-a-vis a world portfolio as opposed to the local market. For the crisis period beta is measured over the period December 2001 and December 2006 and averages 0.72. For the placebo period beta is calculated over the period December 2000 through December 2005 and averages 0.79. The standard deviation of beta is 0.59 in both periods.

Following Ang et al. (2006, 2009), we also include the standard deviation of the error term from the regressions used to calculate beta. The average of this variable during the crisis period is 11.6, while it averages 11.9 during the placebo period.

Fama and French (1992) have shown that aside from beta, firms' expected returns are driven by firms' size and market to book value ratios. We measure firm size by the log of asset measured in dollars. The average for this variable during the crisis period is 11.6 (109,097 dollars) and the standard deviation is 2.1 (8.6 dollars). For the placebo, the log of assets averages 11.5 (98,715 dollars) and the standard deviation is 2.09 (8.1 dollars). The market to book value ratio is equivalent to the number of firms outstanding multiplied by the price of the shares, divided by the book value of equity. For the crisis period, the mean market to book value ratio is

2.51 and the standard deviation is 2.80. This variable averages 2.10 during the placebo period, with a standard deviation of 2.45.

Following Lakonishok, Shleifer, and Vishny (1994), we also include among the standard risk factors a measure of momentum, defined as each firm's return over the six month period prior. For the crisis period, this refers to January 2007 through June 2007. For the placebo period, momentum is measured over the period January 2005 through June 2005. The mean of momentum is 29 percent during the crisis, while it is 0 percent during the placebo period.

Among the crisis shock factors, we include a number of variables to measure firms' sensitivity to credit supply shocks, namely: the ratio of *dividends to sales*, the *leverage ratio*, *good coverage* – a dummy equal to 1 for firms with interest coverage ratios above 1- and the interaction between leverage and good coverage, which we label l*everage_good coverage*. The interest coverage ratio is defined as the ratio of earnings to interest expenses. It measures the ability of firms to meet their debt obligations. Hence, the dummy variable we use captures the share of firms for which their earnings exceed their debt obligations. Table 1 shows that 75.4 (75.3) percent of firms have interest coverage ratios above 1 during the crisis (placebo) period. The average leverage ratio is 0.21 during both the crisis and the placebo period, and the standard deviation in both periods is close to 0.20.

Our estimations include two variables to capture firms' sensitivity to stock selling pressures: the *volume traded* and the *share of stocks free floating.* The former is defined as the number of shares traded over the number of shares outstanding, while the *share of stocks free floating* is the number of shares free floating (not held by insiders) over the total number of shares outstanding. Both of these variables are indicators of the ease with which firms' stocks can be traded. The average for the volume traded is 0.11 during the crisis and 0.10 during the

placebo period. The mean ratio of free floating shares is 68 percent during the crisis and 64 percent during the placebo. We capture firms' sensitivity to global demand shocks by including the *share of foreign (overseas) sales* to total sales and the *ratio of foreign assets to total assets*. For the crisis and placebo periods, the share of foreign sales averages 0.31. The ratio of foreign assets to total assets averages 0.19 during the crisis period and 0.17 during the placebo period.

In some estimations, instead of including each of the individual variables that enter as indicators of firms' sensitivities to the three shock factors (demand sensitivity, credit supply sensitivity and selling pressure sensitivity), we compute the first principal component for each set of variables and use the standardized principal component of each set of variables to capture the effect of a particular shock factor. In particular, *Standardized Credit Supply Shock Factor* is the first principal component of the leverage ratio, good coverage, and the dividend to sales ratio. The *Standardized Selling Pressure Shock Factor* is the principal component of the ratio of shares traded over total shares and the ratio of free floating shares over total shares, while the *Standardized Global Demand Shock Factor* is the principal component of the share of foreign assets and the share of foreign sales. The principal components are standardized by subtracting the mean and dividing by the standard deviation. This facilitates the comparison of marginal effects across variables.

To verify the robustness of our findings, we also replace the individual credit supply, selling pressure, and global demand sensitivity ratios with a set of dummies that separate firms in different categories, depending on the values of the individual ratios. For each of the three categories of shocks we sort firms in three groups: Group A contains the firms that a priori are likely to be the most sensitive to the shock, Group B contains the firms that have middle degree

of sensitivity and Group C contains firms with least sensitivity to the shock (Group C is the omitted category in the regressions).

In the case of the credit supply sensitivity ratios, *Group A* contains firms that have low interest coverage (i.e. "good coverage" equals to zero). These are "distressed" firms that cannot meet their debt obligation with their cash flows. In addition, firms with good coverage but high debt levels (above 80th percentile) and zero dividends also belong to this group. These firms have the lowest debt capacity and are likely to be the most affected by the credit supply shock. *Group B* contains firms with good coverage and which either have high debt but pay dividends, or those that have moderate debt but do not pay dividends.[11] This group has some vulnerability to credit supply shock. *Group C* contains the rest of the firms. In our sample 29% of all firms are classified as Group A, 19% as Group B and about 52% as Group C.

In the case of the selling pressure sensitivity ratios, *Group A* contains firms with either high volume traded and/or high free float, *Group B* contains firms with medium levels of volume traded and free float and *Group C* contains all other firms.[12] In our sample 13% of firms are in group A, 32% are in group B and 54% in group C.

We also include the following dummies based on the global demand sensitivity ratios: *Group A* contains firms with either high foreign sales and/or high foreign assets, *Group B* contains firms with medium levels of foreign sales and assets and Group C contains all other

[11] Specifically, Group B contains firms that have moderate debt levels (i.e. fall between 60th and 80% percentile of debt distribution) and have no dividends, or firms that are high in debt (above 80th percentile) but have non-zero dividends.

[12] Specifically, we consider high volume traded or free float to be above 80th percentile and medium to be between 60th and 80th percentiles. If one of the two measures is high and the other is either high or medium, the firm is in Group A, if both are medium, or one is high and the other one is low, the firm is in Group B. The rest are in group C.

firms.[13] In our sample 23% of all firms are in Group A, 15 % are in Group B and 62% are in Group C. In all three categories of shocks Group C contains about half the firms, which helps us isolate the most sensitive firms into groups A and B.

IV. Empirical Results

In Table 3, we begin by reporting results for six regressions, estimated over the crisis period August 2007-December 2008, in which each of the eight variables that we use to capture the crisis shock factors enters separately in the regressions, and a seventh regression for the "placebo" period of August 2005-December 2006.

The first three columns in Table 3 consider regressions in which all three types of crisis shock factors are present (where we alternately omit one of the three leverage measures to demonstrate the effects of doing so). The fourth through sixth columns of Table 3 include the three sets of crisis shock factor variables one at a time. All regressions include controls for standard risk factors relating to expected returns, as discussed in Section III, which are not discussed here.[14] We focus our discussion on the crisis shock factors.

For the crisis period, the measured coefficients on variables associated with each of the three sets of shock factors do not change much as the result of including or excluding variables associated with the other two sets of crisis shock factors. We find statistically significant and economically important effects for all three categories of shock factors. With respect to selling pressure effects, both the share of free float and the share of stocks traded consistently enter

[13] Specifically, we consider high foreign assets or foreign sales to be above 80th percentile and medium to be between 60th and 80th percentiles. Similar to selling pressure groups, if one of the measures is high and the other is either high or medium, the firm is in Group A, if both are medium, or one is high and the other one is low, the firm is in Group B. The rest are in group C.

[14] All regressions also include country level and industry level fixed effects.

negatively and statistically significantly in the regressions. With respect to the global demand shock factor, the coefficient on the proportion of foreign sales is consistently negative and statistically significant, and the coefficient on the foreign assets share is consistently negative, but not statistically significant. This is not surprising since foreign assets, which captures the extent to which a firm's production is multinational, is not directly related to global trade, while foreign sales are.

The four corporate finance indicators used to measure the sensitivity to credit supply shocks (dividends to sales, leverage, good coverage, and the interaction between leverage and good coverage) generally enter with the predicted signs and are statistically significant. Dividends to sales enters positively, indicating that firms with higher pre-crisis payout tended to experience higher residual returns during the crisis. Leverage enters negatively and good coverage enters positively, and the interaction between the two also enters negatively and significantly.

During the placebo period, leverage effects are absent, with the exception of a positive coefficient on the good coverage-leverage interaction term, which is significant at 10% only. In other words, during non-crisis periods, firms that are highly leveraged and face a significant prospect of financial distress (those whose debt service commitments are extremely high relative to their income) experience negative expected returns. A similar finding has been noted in prior work by Campbell, Hilscher and Szilagyi (2006), who document that the probability of financial distress is associated with negative stock returns for U.S. firms for the past thirty years.

Clearly, the effect of the credit supply shock factor components is very different between the crisis and placebo periods. During non-crisis times only distressed firms have negative returns (i.e., those with interest coverage below one), while during crisis time we find that not

only firms in distress have negative returns, but even firms with high leverage that are not distressed also have negative returns. Also, firms with high dividend payout experience higher returns during the crisis, but not during the placebo period.

Similarly, with respect to the other two shock factors, we find that the variables capturing the global demand shock factor or the market liquidity shock factor are insignificant during the placebo period, confirming that these variables capture shocks that are crisis-specific.

In Table 4, we use the eight variables that collectively proxy for the three shock factors to construct first principal components for each of the three categories of shock factors and report those results, as well as the results based on the Group A, B, and C categorizations of the three shock factors, as described in Section III. We label those alternative ways to summarize the overall effects of each of the three crisis-related shock factors the "principal components" approach and the "group" approach. The first two columns of Table 4 report coefficients for the crisis period, and the second two columns report effects for the placebo period. The principal-components and group regressions in Table 4 confirm the results reported in Table 3.

During the crisis, for all three factors, using the group approach, the Group A effects are larger and more statistically significant than the Group B and Group C effects. In the case of the variables which capture sensitivity to credit-supply shocks, the Group B effect is also negative and statistically significant relative to the omitted Group C. Similarly, the principal-component approach finds negative and significant effects for all three shock factors during the crisis. In contrast, during the placebo period, under the principal-components approach, none of the shock factors is significant. Under the group approach, with the exception of the global demand sensitivity group A variable, which is marginally significant and positive while it was negative

during the crisis, none of the other group variables are significant during the placebo period. Overall, the results in Table 4 confirm those using individual indicators of crisis shock factors.

V. A Month-by-Month Analysis of the Cross-Section of Returns During the Crisis

Having shown that residual returns for the crisis period as a whole varied importantly as the result of each of the three shock factors, we now turn to a more detailed analysis of the crisis period on a month-by-month basis. To do so, we ran separate monthly regressions for each month from August 2007 through December 2008, using the same specifications as those in the first two columns of Table 4. Figures 1-3, Panel A plot the coefficients and two times their standard errors for each shock factor principal component in each month using regressions analogous to those in column (1) of Table 4. Panel B in each of the figures plots Group A coefficient values and standard errors from column (2) of Table 4.

We find that the effects of the crisis shock factors vary in intensity during the crisis in a manner that conforms to what one would expect. Time variation in the coefficients associated with the credit-supply sensitivity factor (Figure 1) are similar to those found in credit risk spreads that reflect the timing of credit-supply shocks. The first major change in both plots occurs in early 2008, followed by subsequent recovery in early 2008 and then a steep decline toward the end of 2008.

The time variation in the coefficients associated with the global demand shock factor vary with the timing of the declines in exports (see Figure 2). Both show a drop in August 2007, a subsequent recovery, then another drop in late 2007, followed by a rising trend through the

Spring of 2008, after which the trend is negative, culminating in a steep drop around November 2008.

The variation over time in the coefficients that measure the sensitivity to selling pressure closely tracks the variation in the returns to the stock market. Peaks and troughs of returns are closely related to peaks and troughs in the coefficients of the selling pressure indicators (see Figure 3). The time variation in these three sets of coefficients confirms our interpretation of the coefficients relating to the three shock factors as reflecting three unique, crisis-related influences on residual returns.

VI. Conclusion

Equity returns provide a uniquely comparable window to the performance of firms throughout the world, and their responses to financial crises. The global financial crisis of 2007-2008 posed exceptional challenges for firms, which implied unique determinants of equity returns. The collapse of global trade caused a major shock to demand for firms that had positioned themselves to benefit from participating in expanding global trade and production. Credit-supply contraction curtailed the access of firms to funding and reduced their effective debt capacity (which affected not only firms on the verge of financial distress, but also moderately levered firms). Firms whose equity was relatively liquid, and therefore, easier to trade, found their stock prices falling more than other firms, as investors who owned stock and were scrambling for cash chose to sell off relatively liquid stocks, in order to limit their losses from disposing of assets in an illiquid market.

All three of these crisis "shock factors" – exposure to the collapse in global trade demand, vulnerability to credit-supply shocks, sensitivity to stock market selling pressures – are reflected in the large and statistically significant observed patterns in residual equity returns (after controlling for normal risk factors that are associated with expected returns). We construct a vector of eight variables that measure the effects of the three crisis-related shock factors from August 2007-December 2008 – four variables that measure vulnerability to credit-supply shocks, two that measure exposure to global trade demand shocks, and two that measure sensitivity to stock market selling pressure. These eight variables enter with the expected sign and are significant statistically. The three sets of influences are unique to the crisis. Similar analysis for the placebo period of August 2005-December 2006 shows that the influences identified during the 2007-2008 sample period are not present in this non-crisis period.

Using the eight variables we identify as measures of firms' exposures to one of the three shock factors, we construct composite measures of each shock factor in two ways: using the first principal component of each of the variables included in the relevant set of variables, or by constructing indicator variables that group firms according to their combined values of the various indicators. The composite effect regressions confirm the unique importance of the shock factors during the crisis.

A month-by-month analysis of the magnitude of the influence of each of three factors shows that the time variation of the importance of each of the shock factors tracks related changes in the global economic environment. The time variation in the coefficients associated with the global trade demand shock factor vary with the timing of the declines in exports. Time variation in the coefficients associated with the credit-supply factor are similar to those found in credit risk spreads that reflect the timing of credit-supply shocks. The variation over time in the

coefficients that measure the market illiquidity shock factor closely tracks the variation in the returns to the stock market.

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Table 1: Sample of countries and firms

Countries	Number of firms	
	Crisis period	Placebo
Argentina	66	63
Australia	1388	1197
Austria	72	65
Belgium	108	95
Brazil	269	254
Canada	1369	1368
Chile	149	151
China	1649	1388
Colombia	0	26
Czech Republic	25	38
Denmark	105	103
Egypt, Arab Rep.	42	32
Finland	118	120
France	618	618
Germany	656	606
Greece	255	278
Hong Kong, China	759	754
Hungary	28	32
India	859	506
Indonesia	237	238
Ireland	64	61
Israel	153	149
Italy	231	202
Japan	1213	1145
Korea, Rep.	958	878
Luxembourg	28	31
Malaysia	874	833
Mexico	105	109
Netherlands	145	149
New Zealand	109	105
Norway	176	147
Pakistan	89	73
Peru	63	53
Philippines	134	119
Poland	212	145
Portugal	46	53
Russian Federation	148	89
Singapore	551	527
South Africa	254	246
Spain	99	104
Sweden	344	277
Switzerland	181	182
Thailand	408	369
Turkey	172	187
United Kingdom	1598	1430
Total	***17127***	***15595***

Table 2: Descriptive statistics

Variables	Crisis period			Placebo period		
	N	Mean	Std Dev.	N	Mean	Std Dev.
Return	17127	-0.47	0.32	14898	0.29	0.54
Beta	15829	0.72	0.59	14579	0.79	0.59
Momentum	16160	0.29	0.5	14096	0	0.27
Market to book value	16061	2.51	2.8	14001	2.1	2.45
Logarithm of total assets in USD	17127	11.59	2.09	14898	11.53	2.1
Standard error of residuals from beta	15907	11.6	3.91	14728	11.89	4.07
Good coverage	15082	0.75	0.43	13299	0.75	0.43
Leverage	16925	0.21	0.19	14721	0.21	0.2
Dividends over sales	14103	0.02	0.04	12745	0.02	0.04
Ratio of free floating shares to total shares	14073	68.17	27.81	11523	64.32	28.04
Ratio of shares traded to total shares	15928	0.11	0.18	13907	0.1	0.2
Foreign assets to total assets	17127	0.19	0.2	14898	0.17	0.19
Foreign sales to total sales	17127	0.31	0.26	14898	0.31	0.26
Construction firms	17127	0.09	0.29	14898	0.09	0.29
Mining firms	17127	0.15	0.35	14898	0.13	0.33
Retail trade firms	17127	0.05	0.21	14898	0.05	0.23
Services firms	17127	0.24	0.43	14898	0.25	0.43
Transport, communication, electricity, gas, and sanitary Firms	17127	0.12	0.32	14898	0.12	0.32

Table 3: Estimations using individual indicators of "crisis shocks"

Tables shows estimations for returns over the crisis (August 2007-December 2008) and placebo (August 2005-December 2006) periods. Robust standard errors are in parentheses. *, **, *** denote statistical significance at 10, 5 and 1 percent respectively.

	Crisis						Placebo
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Beta	-0.021***	-0.021***	-0.021***	-0.026***	-0.019***	-0.024***	0.025*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.013)
Momentum	-0.027**	-0.027**	-0.027**	-0.033***	-0.041***	-0.042***	0.125***
	(0.01)	(0.01)	(0.01)	(0.008)	(0.012)	(0.01)	(0.031)
Market to book value ratio	-0.002	-0.001	-0.001	-0.003***	-0.002*	-0.002***	-0.008*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)
Logarithm of total assets	0.002	0.002	0.001	-0.003	0.002	0.000	0.031***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.007)
Std dev. beta residuals	-0.015***	-0.015***	-0.015***	-0.017***	-0.017***	-0.017***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Dividends to sales	0.318***	0.311***	0.311***	0.339***			-0.168
	(0.07)	(0.07)	(0.07)	(0.066)			(0.209)
Good coverage dummy	0.025***	0.045***	0.056***	0.041***			0.019
	(0.007)	(0.007)	(0.009)	(0.008)			(0.029)
Leverage ratio	-0.097***	-0.044*		-0.03			-0.097
	(0.019)	(0.024)		(0.022)			(0.075)
Good coverage *leverage		-0.079***	-0.122***	-0.071***			0.135*
		(0.027)	(0.023)	(0.02)			(0.072)
Ratio of shares free float	-0.001***	-0.001***	-0.001***		-0.001***		-0.000
	(0.000)	(0.000)	(0.000)		(0.000)		(0.000)
Ratio of shares traded	-0.084***	-0.084***	-0.085***		-0.04		0.027
	(0.025)	(0.025)	(0.025)		(0.05)		(0.046)
Ratio of foreign to total assets	-0.028	-0.027	-0.028			-0.031*	0.086
	(0.021)	(0.021)	(0.021)			(0.018)	(0.072)
Ratio of foreign to total sales	-0.050**	-0.051**	-0.050**			-0.054**	-0.027
	(0.022)	(0.022)	(0.022)			(0.024)	(0.037)
Constant	-0.197***	-0.214***	-0.222***	-0.219***	-0.188**	-0.200**	-0.012
	(0.073)	(0.072)	(0.073)	(0.063)	(0.09)	(0.082)	(0.092)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,104	10,104	10,104	11,517	13,030	14,889	8926
R-squared	0.196	0.196	0.196	0.193	0.184	0.19	0.141
Number of countries	44	44	44	44	44	44	45

Table 4: Estimations using composite indicators of "crisis shocks"

Tables shows estimations for returns over the crisis (August 2007-December 2008) and placebo (August 2005-December 2006) periods. Robust standard errors are in parentheses. *, **, *** denote statistical significance at 10, 5 and 1 percent respectively.

	Crisis		Placebo	
Beta	-0.021***	-0.023***	0.025*	0.025**
	(0.007)	(0.007)	(0.013)	(0.012)
Momentum	-0.028**	-0.029***	0.128***	0.127***
	(0.01)	(0.01)	(0.031)	(0.03)
Market to book value ratio	-0.001	-0.001	-0.008*	-0.008*
	(0.001)	(0.001)	(0.004)	(0.004)
Logarithm of total assets	0.000	-0.001	0.033***	0.031***
	(0.004)	(0.004)	(0.007)	(0.007)
Standard deviation beta residuals	-0.015***	-0.017***	-0.012***	-0.012***
	(0.002)	(0.002)	(0.003)	(0.003)
Standarized principal component credit supply shock factor	-0.027***		-0.013	
	(0.004)		(0.01)	
Standardized principal component global demand shock factor	-0.015**		0.008	
	(0.006)		(0.01)	
Standardized principal component selling pressure shock factor	-0.026***		0.001	
	(0.005)		(0.007)	
Group A credit supply shock factor		-0.051***		-0.024
		(0.007)		(0.022)
Group B credit supply shock factor		-0.032***		0.019
		(0.008)		(0.014)
Group A global demand shock factor		-0.028*		0.028*
		(0.014)		(0.016)
Group B global demand shock factor		0.007		-0.018
		(0.021)		(0.017)
Group A selling pressure shock factor		-0.040**		0.016
		(0.015)		(0.027)
Group B selling pressure shock factor		-0.013		0.007
		(0.014)		(0.015)
Constant	-0.260***	-0.200***	-0.022	0.001
	(0.065)	(0.073)	(0.082)	(0.08)
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	10,104	10,104	8,926	8,926
R-squared	0.195	0.189	0.139	0.14
Number of countries	44	44	45	45

Figure 1. Panel A.

Principal Component Credit Supply Shock Factor Coefficients and Baa-Treasury spread

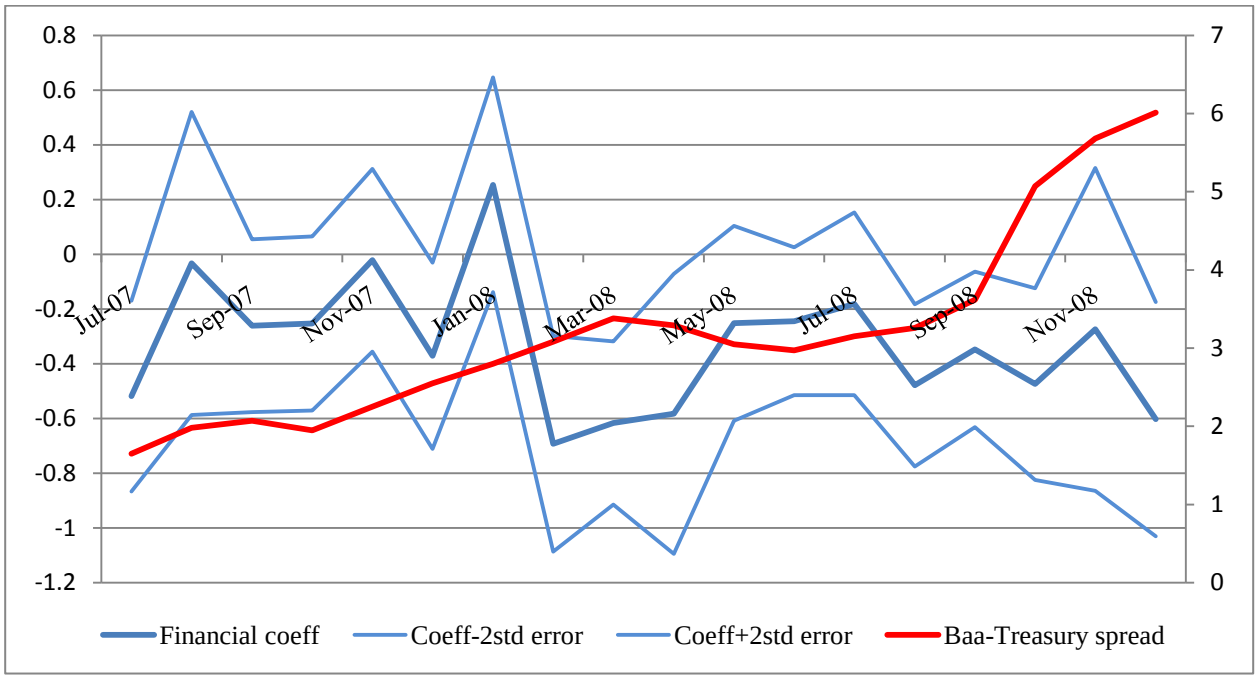

Figure 1. Panel B.

Group A Credit Supply Shock Factor Coefficients and Baa-Treasury spread

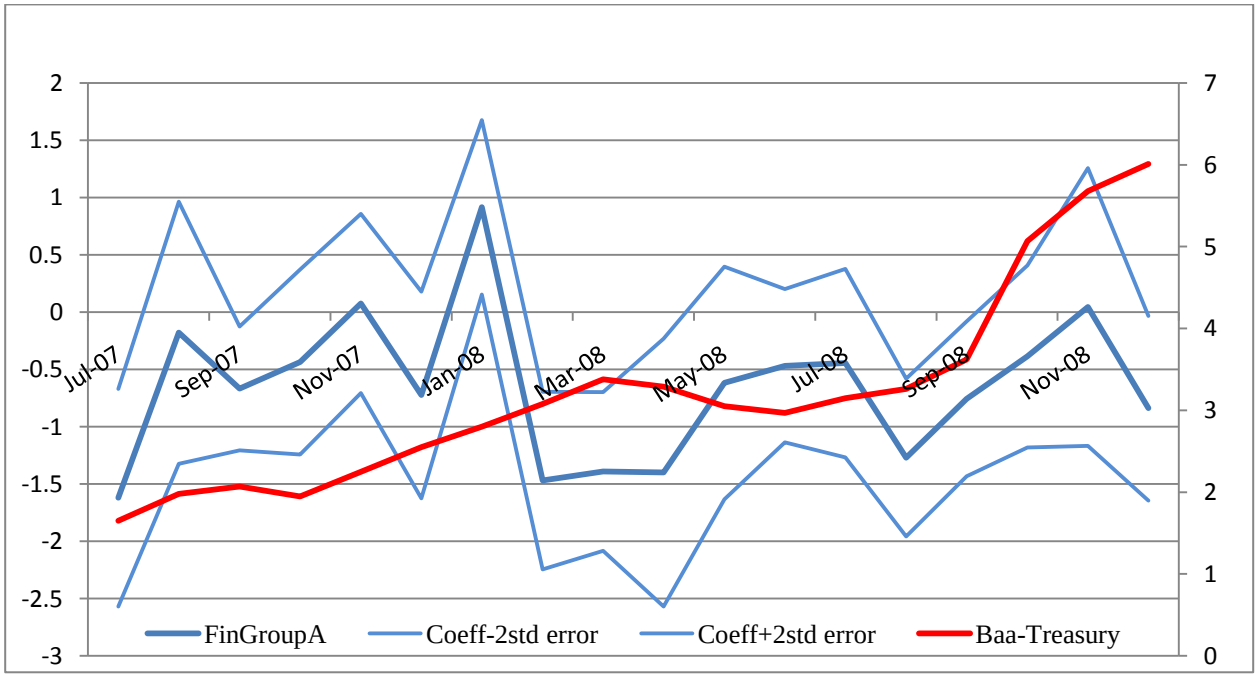

Figure 2. Panel A.

Principal Component Global Demand Shock Factor Coefficients and Exports

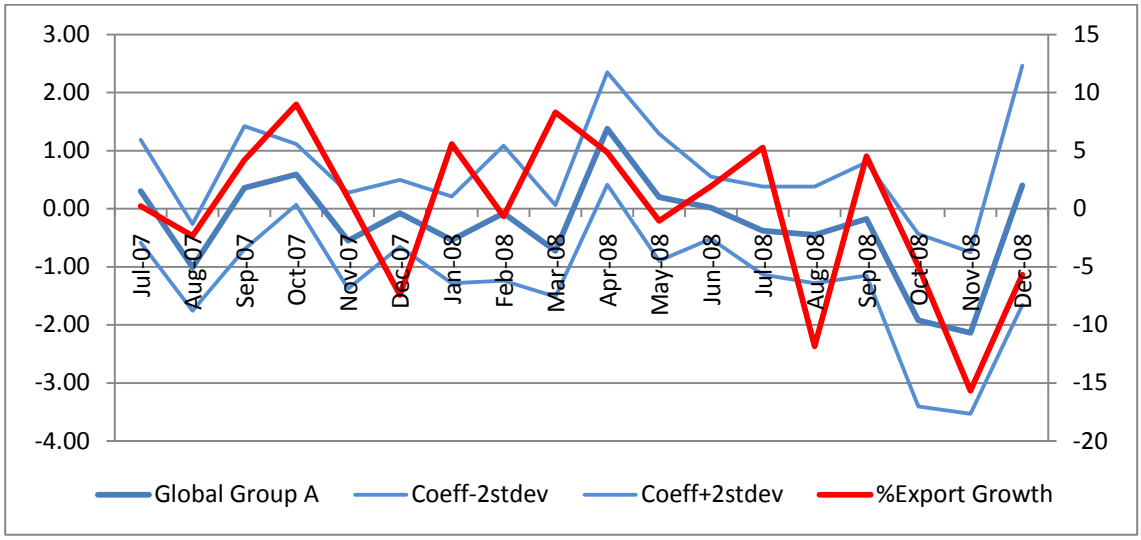

Figure 2. Panel B.

Group A Global Demand Shock Factor Coefficients and Exports

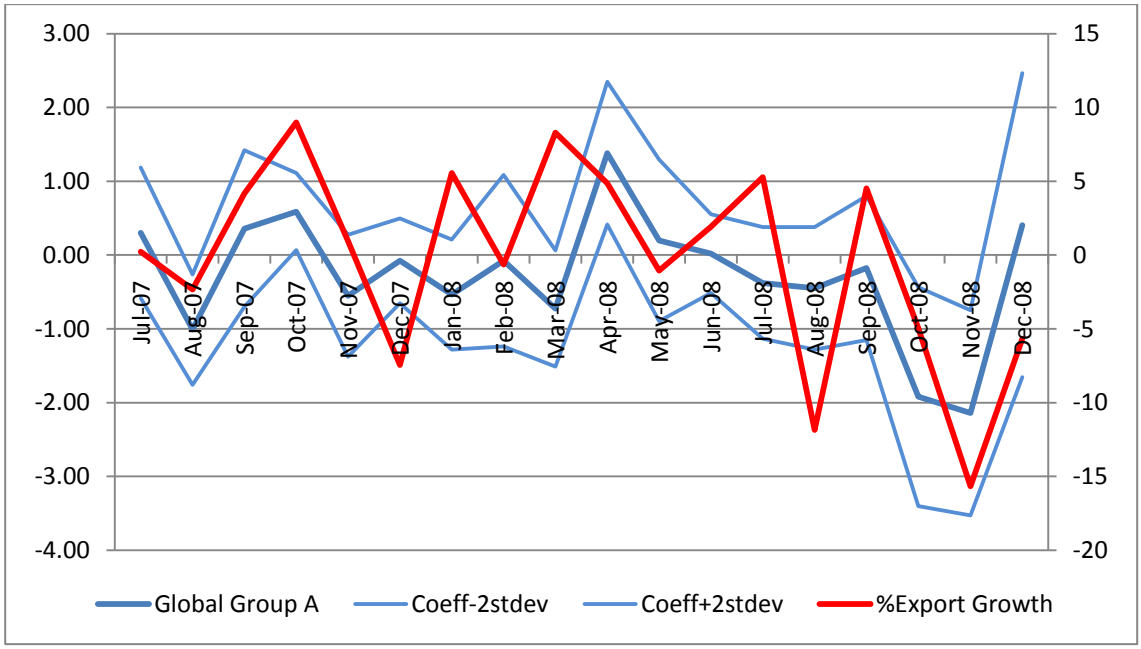

Figure 3. Panel A.

Principal Component Stock Market Selling Pressure Shock Factor Coefficients and S&P Returns

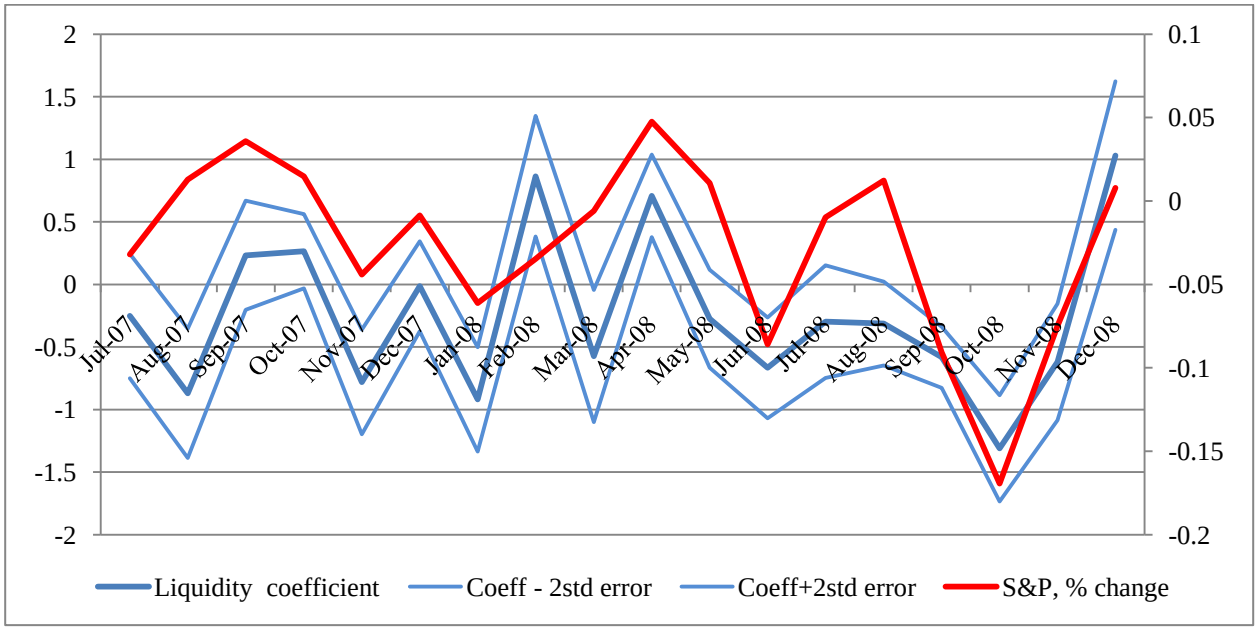

Figure 3. Panel B

Group A Stock Market Selling Pressure Shock Factor Coefficients and S&P Returns