How are Shocks Propagated Internationally? Firm-Level Evidence from the Russian and East Asian Crises*

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Comments Welcome

Abstract: This paper uses firm-level information to evaluate how shocks are propagated internationally. It reinterprets previous theoretical work as describing five mechanisms by which a country-specific shock can be transmitted to firms around the globe. These five transmission mechanisms are: product competitiveness; an income effect; a credit crunch; a forced-portfolio recomposition; and a wake-up call. The paper then constructs a new data set of financial statistics, product information, geographic data, and stock returns for over 14,000 companies in 46 countries. It uses this data and an event-study methodology to test what types of firms were more vulnerable to the East Asian and Russian crises.

Results suggest that an income effect, forced-portfolio recomposition, and wake-up call were all important propagation mechanisms during the Russian crisis. Each of these mechanisms, as well as product competitiveness, was significant during the East Asian crisis. A credit crunch appears to have played a relatively minor role in the international propagation of shocks during both crises. Moreover, results provide preliminary evidence of the relative importance of these propagation mechanisms. The wake-up call effect can have a larger impact than all of the other mechanisms combined. The product competitiveness effect during the Asian crisis, and the income effect during the Russian crisis, are also large in magnitude. An important implication is that the relative strength of the various transmission mechanisms varies across crises, so that it is unlikely that any single model can capture how shocks are propagated during all crises.

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1. Introduction

The 1990's has been punctuated by a series of currency crises. A striking characteristic of many of these crises is how an initial country-specific shock was rapidly propagated to markets of very different sizes and structures around the globe. A number of papers have developed theories attempting to explain these patterns, and several papers have used macroeconomic data to test their validity.

This paper, however, takes a very different approach to evaluating how shocks are propagated internationally. It utilizes firm-level information, instead of aggregate, macro-level data, to evaluate the impact of the East Asian and Russian crises on individual companies' stock market returns. It constructs a new data set of financial statistics, product information, geographic data, and stock returns for over 14,000 companies in 46 countries. It uses this information to test if firm vulnerability to the East Asian and Russian crises is affected by factors such as: sector of production; global pattern of sales and profitability; debt quantity and structure; trading liquidity and/or geographic location. Identifying which types of companies were (and were not) most vulnerable to these shocks is not only interesting in and of itself, but also helps assess how these financial crises were transmitted internationally.

The analysis presented in this paper has many useful implications (in addition to addressing the academic question of how shocks are propagated internationally.) For investors seeking to maintain a diversified portfolio, this paper shows what types of companies are more vulnerable to crises in other regions or markets. For management teams seeking to maximize company performance, this paper suggests what risks are involved from certain strategies and what practices could reduce exposure to financial crises. For a multilateral institution seeking to stop the spread of country-specific shocks, this paper will show how crises tend to spread and therefore indicate where multilateral institutions need to focus their efforts.

The remainder of this paper is divided into six sections. Section 2 surveys the theoretical literature on the international propagation of shocks and reinterprets much of this literature in the context of how individual firms could be affected by shocks to other countries. It also discusses the aggregate empirical work testing these theories and the limitations of this macroeconomic approach. Section 3 describes the extensive firm-level data set which was compiled for this paper. Next, Section 4 outlines the event-study methodology and presents a graphical analysis of stock returns for various portfolios after the East Asian and Russian crises. One problem with this

methodology, however, is that it is difficult to identify any simultaneous effects of a crisis. Therefore, section 5 attempts to isolate these various effects by estimating a number of multivariate regressions on cumulative abnormal stock returns. This section also reports an extensive set of robustness tests.

Section 6 concludes that an income effect, forced-portfolio recomposition, and wake-up call were all important propagation mechanisms during the Russian crisis. Each of these mechanisms, as well as product competitiveness, was significant during the East Asian crisis. A credit crunch appears to have played a relatively minor role in the international propagation of shocks during both crises. Moreover, although less conclusive, results also provide preliminary evidence of the relative importance of these various propagation mechanisms during each crisis. The wake-up call effect can have a larger impact than all of the other propagation mechanisms combined. The product competitiveness effect during the Asian crisis, and the income effect during the Russian crisis, are also large in magnitude. An important implication of this set of results is that the relative strength of the various transmission mechanisms varies across crises, so that it is unlikely that any single model can capture how shocks are propagated during all crises. This section concludes with a number of caveats.

2. Theory and Previous Evidence: How are Shocks Propagated Internationally?

Over the past few years, an extensive literature has explored how shocks are propagated internationally. Recent surveys of this literature have used a variety of different approaches toward coherently organizing this research and classifying potential transmission mechanisms.[1] This paper will draw on these approaches but use a slightly different framework and terminology in order to focus on the company-specific impact of shocks. More specifically, this section explains that a shock to one country could be transmitted to firms in other countries through five different channels: product competitiveness; an income effect; a credit crunch; a forced-portfolio recomposition; or a wake-up call. After discussing the theoretical underpinnings of each of these transmission mechanisms, this section will survey the macroeconomic empirical work testing

[1] For recent surveys of this literature, see Claessens, Dornbusch, and Park (1999) and Forbes and Rigobon (1999a).

each mechanism's relative importance. It will conclude by pointing out several limitations with this aggregate approach toward testing how shocks are propagated internationally.

2.1 Theory: How are Shocks Propagated Internationally?

The first channel through which a shock to one country could be transmitted to firms in other countries is through product competitiveness. Gerlach and Smets (1995) and Corsetti et al. (1998) formalize these ideas on the country level, but the general implications of their models can be extended to individual companies.[2] Basically, if one country devalues its currency, then that country's exports will be relatively cheaper in international markets. Similar products from firms in other countries which are sold in the same markets (including the country which initially devalued) will be relatively less competitive. Moreover, if exports from the initial country are a large enough share of global production in a given industry, then industry prices could fall worldwide. Therefore, even if a company does not directly compete with firms from the initial country in any specific markets, a product's competitiveness could be damaged by the country's currency crisis.[3]

A second mechanism by which a shock to one country could be propagated internationally is through an income effect that lowers demand for a firm's product. When a country undergoes a financial crisis or negative shock of any type, economic growth generally slows, often to the point of a severe economic contraction. Incomes in the country will fall, and any firm which exports to that country will face reduced demand (as long as the firm's product is not an inferior good.) This income effect will be magnified if the country's currency is devalued, since a devaluation would further reduce purchasing power and real income levels. Moreover, if the initial crisis spreads to other countries (for whatever reason), this income effect could reduce demand for a firm's product outside of the country initially subject to the shock.

A third channel by which firms can be affected by shocks in other countries is through a credit crunch. There are several different variants of this theory, but underlying them all is the idea that a crisis in one country leads to a sharp reduction in the supply of credit, reducing financial

[2] Gerlach and Smets (1995) was the first formal model of these effects. They focus on how the collapse of a currency affects the competitiveness of economies whose currencies remain pegged. Corsetti, Pesenti, Roubini and Tille (1998) provide a recent extension of these ideas based on micro-foundations.
[3] It is worth noting that there could be "secondary-product competitiveness" effects if exports from the country which devalued are used as inputs in the production of goods in other countries. In this case, the currency crisis could improve the competitiveness of these other products.

liquidity and generating an excess demand for credit at the prevailing interest rates. In one model of this mechanism, Goldfajn and Valdés (1997) focus on financial intermediaries which supply liquid assets to foreigners. A financial shock to one country causes investors in that country to withdraw their deposits, reducing the liquidity of financial intermediaries and forcing them to liquidate loans to firms in other countries and/or be unable to renew their financing in the future. Chang and Velasco (1998) develop another model that focuses on the maturity mismatch of a financial system's international assets and liabilities. Kaminsky and Reinhart (1998) show how commercial banks with lending concentrated in a crisis-stricken region could be forced to withdraw lending in other regions in order to maintain solvency. Although these models aim to explain macroeconomic phenomenon such as the spread of banking crises or speculative attacks, the implications for individual companies are straightforward. A shock to one country could lead to a credit crunch for firms in other countries, making it difficult for the firms to obtain new financing and/or renew old loans.

A fourth, and closely related, channel by which shocks could be transmitted internationally is through a forced-portfolio recomposition. More specifically, a shock to one country could reduce the liquidity of market participants and force them to sell assets in other markets in order to meet certain requirements. A number of papers model different variants of this forced-portfolio recomposition. For example, Frankel and Schmukler (1998) focus on closed-end country funds where a drop in the price of one market forces the funds to raise cash by selling assets in other markets. Valdés (1996) focuses on individual investors after a shock to one market. In order to continue operating in the market, to satisfy margin calls, or to meet regulatory requirements, the investors may be forced to sell assets in other countries. An implication of each of these theories is that stocks which are more liquid or more widely traded in global markets are more likely to be sold in this forced-portfolio recomposition.

A final channel by which country-specific shocks can be transmitted to firms in other countries is through a wake-up call effect (which is also called country reevaluation). This basic idea behind this set of theories is that a crisis in one country (or investor behavior in one country) can provide information about other countries (or how investors will behave in other countries.) One group of theories in this category focuses on the reassessment of macroeconomic fundamentals. If a country with certain macroeconomic characteristics (such as a weak banking sector) is discovered to be susceptible to a currency crisis, then investors will reassess the risk of other countries with

similar macroeconomic fundamentals.[4] A related group of theories focuses on investor behavior and information asymmetries, which can lead to herding or informational cascades.[5] These theories are often referred to as contagion and most predict multiple equilibria.[6] Tornell (1999) develops a model that combines both groups of wake-up call theories. In his model, a currency crisis in one emerging market will act as a coordinating device and cause money managers to expect attacks on "more vulnerable" countries. Country vulnerability is measured by the likelihood of a country depreciating its currency if it is attacked, which is directly related to macroeconomic fundamentals. Although each of these wake-up call theories focuses on how a shock to one country is transmitted to other countries, the impact on individual firms is straightforward. If a shock is transmitted to a second country through this channel, then all firms in the second market should be affected, and firm characteristics should not be significant.

This section discusses five potential transmission mechanisms-- product competitiveness, an income effect, a credit crunch, a forced portfolio recomposition, and a wake-up call. It is worth noting that these channels are not mutually exclusive and could overlap in important ways. For example, a crisis in one country could lead to a wake-up call and cause investors to withdraw from markets in a second country which has similar fundamentals. This attack could force the government in the second country to raise interest rates to defend its currency, which could in turn cause a credit crunch. It is also worth noting that this discussion of transmission mechanisms is somewhat limited and ignores several equally important, albeit related, topics. For example, this paper assumes that the initial country-specific shock is given, and does not explore the timing or cause of the initial crisis. It also ignores the possibility that a "monsoonal" or global shock occurred which affected several countries simultaneously.[7] In order to focus on how shocks are transmitted to firms around the world, this paper will leave these subjects for future work. It will take the initial shock as given and focus only on episodes where this initial shock is clearly country-specific.

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[4] For example, see Rigobon (1998).
[5] For examples, see Banerjee (1992), Shiller (1995), Masson (1997), Mullainathan (1998), Calvo and Mendoza (1998), and Chari and Kehoe (1999). This includes "political contagion" such as that modeled in Drazen (1998).
[6] Although the term "contagion" is widely used, there is little agreement on what exactly it means. See Forbes and Rigobon (1999a) for a lengthy discussion of how the term is misused and a proposition for how it should be defined.
[7] Masson (1997) introduces the term "monsoonal" to describe global shocks.

2.2 Previous Evidence: How Are Shocks Propagated Internationally?

Several papers have used macroeconomic statistics to attempt to measure the importance of one (or more) of these five propagation mechanisms. These papers have examined a variety of different crises periods, included an assortment of countries, and used a range of statistical techniques. Not surprisingly, the results have been mixed.

Tests of the first two transmission mechanisms--product competitiveness and income effects--are often lumped together as tests of "trade" as a propagation channel. Two papers find evidence supporting the role of trade. Eichengreen, Rose, and Wyplosz (1996) use a panel of quarterly data from 1959-93 to evaluate how speculative attacks on currencies spread across countries. They use two weighting mechanisms in order to compare the relative importance of trade and wake-up calls based on macro-similarities (which they call country reevaluation). In the first scheme, they weight crises in other countries by the importance of trade with those countries. In the second scheme, they weight crises by the similarity of macro-policies and outcomes. Results suggest that currency crises are spread across countries mainly through international trade linkages and not through a revision of expectations based on macroeconomic similarities. Glick and Rose (1998) also test for the relative importance of trade and country reevaluation in the international propagation of shocks. They examine five currency crises in the 1970's and 1990's and estimate the probability of a currency crisis occurring and the magnitude of currency market pressures. They measure trade linkages by the degree to which countries compete in third markets (i.e. product competitiveness effects) as well as by the extent of direct trade between two countries (i.e. income effects). Results suggest that currency crises spread through both types of trade linkages, while macroeconomic variables have no significant impact. Therefore, the results of both of these papers suggest that shocks are propagated through product competitiveness and income effects and not through wake-up calls based on macroeconomic fundamentals.

Several other papers, however, argue that trade linkages were not significant propagation mechanisms during recent crises. Masson (1997) claims that trade was not important during the East Asian and Mexican crises because linkages (both direct and in third markets) are small between Thailand and the other East Asian economies and between Mexico and the largest Latin American economies. Baig and Goldfajn (1998) analyze the trade matrix of East Asian countries and also conclude that trade linkages among these countries are weak and therefore not important in spreading the East Asian crisis.

Tests of the third propagation channel, a credit crunch, also yield mixed results. Peek and Rosengreen (1997) examine if Japanese bank lending within the U.S. decreased after the 1990 Japanese stock market crash. They find that risk-based capital requirements bound for many Japanese banks, which led to significant reductions in lending within the U.S. Several other papers focus on the East Asian crisis. Ding, Domac, and Ferri (1998) find a sharp increase in the spread between bank lending rates and corporate bond yields during this period. They conclude that this tightening of the bank loan market provides evidence of a credit crunch. Kim (1999) estimates a disequilibrium model of the bank loan market and finds that loan demand exceeds supply by a significant margin in Korea after the East Asian crisis. On the other hand, Ghosh and Ghosh (1999) estimate a similar disequilibrium model of bank loans, but fail to find an excess demand for credit during most of the Asian crisis period in either Indonesia, Korea, or Thailand. They therefore argue that there is little evidence of a quantity rationing causing a credit crunch.

Several papers have also attempted to test the importance of the fourth propagation mechanism--forced-portfolio recomposition. Kaminsky et al. (1999) use data on individual portfolios during the Mexican, East Asian and Russian crises. This data includes quarterly holdings of most of the market in Latin American mutual funds. They fund that these funds systematically sell assets from one country when a crisis hits another. Valdés (1996) examines the impact of the Mexican peso crisis on the secondary market prices of sovereign debt. After controlling for macroeconomic fundamentals and "big news" events, he finds strong cross-country correlations in prices for debt in developing-country markets but not in medium- and large-sized OECD markets. He interprets this as evidence that investors were forced to recompose their portfolios after the crisis. Frankel and Schmukler (1998) examine closed-end fund data during the Mexican debt crisis of 1982 as well as the peso crisis of 1994. They show that investors needed to raise cash during both crises, which forced them sell-off assets in other markets. They find a direct impact of these sell-offs on other Latin American countries and on the U.S., and an indirect effect (through the U.S.) on Asia. Other papers, however, argue that crises do not spread through this channel, since net redemptions and capital outflows by mutual fund investors tend to be small during the Mexican and East Asian crises.[8]

Most empirical tests of the fifth propagation mechanism, wake-up calls, have focused on the importance of country reevaluation based on macro-fundamentals rather than on "contagion" such

[8] For example, see Rea (1996) and Froot, O'Connell and Seasholes (1998). Note that Froot et al. examine all types of institutional investors (including mutual funds).

as herding and/or information cascades. Sachs, Tornell, and Velasco (1996) examine data for twenty developing countries in 1994 and 1995 and find that three country fundamentals (real exchange rate overvaluation, banking system fragility, and low international reserves) explain about one-half of the variation in their crisis index. Tornell (1998) examines both the Mexican and Asian crises and finds that the same three fundamentals explain a significant amount of the variation in the severity of the crises. Baig and Goldfajn (1998) use daily data from five Asian countries between 1995 and 1998 to test for changes in the correlations of currency markets, stock markets, interest rates, and sovereign spreads. They use dummies constructed from daily news and show that after controlling for own-country news and other fundamentals, cross-country correlations in currency and equity markets remain large and significant. They interpret this as evidence of country reevaluation and/or herding effects. While this set of papers suggests that wake-up calls are an important propagation mechanism, Eichengreen, Rose, and Wyplosz (1996) and Glick and Rose (1998) argue that macroeconomic similarities do not play a significant role. As discussed above, they argue that trade is far more important than country reevaluation in the international transmission of crises.

A final series of tests on how shocks are propagated internationally uses a very different approach and does not easily fit into the five classifications utilized in this paper. This approach categorizes transmission channels as crisis-contingent or non-crisis contingent, based on whether the propagation mechanism changes significantly after a shock. Crisis-contingent channels include credit crunches, portfolio recomposition, and some types of wake-up calls (such as herding), while non-crisis contingent channels include product competitiveness, income effects, and other types of wake-up calls (such as country reevaluation.) Papers based on this approach test if correlations in cross-market returns increase significantly after a crisis. Calvo and Reinhart (1996) examine weekly returns for equities and Brady bonds and find a significant increase in market co-movements after the Mexican peso crisis. Baig and Goldfajn (1998) use daily data for East Asian countries during that region's crisis and find a significant increase in cross-market correlations for currencies and sovereign spreads, but not for stock markets and interest rates. Therefore both of these papers find evidence for the transmission of shocks through a crisis-contingent channel--at least in some markets. Forbes and Rigobon (1999b), however, show that the correlation coefficient utilized in these papers is biased. When they adjust for this bias, they find that cross-market correlations in stock returns do not increase significantly for most countries after the 1987 U.S. stock market crash, Mexican peso crisis, or East Asian crisis. Rigobon (1999) extends this analysis to address the problem of endogeneity and reports similar results for the

Mexican, East Asian, and Brazilian crises. Therefore, both of these papers conclude that shocks are not transmitted through crisis-contingent theories. Instead, high cross-market correlations between many countries in all states of the world suggest that the financial shocks of the late 1980's and 1990's have been transmitted through non-crisis-contingent channels.

2.3 Limitations of Macro-tests of the International Propagation of Shocks

This literature review has shown that a range of samples, time periods, and econometric techniques have been used to test how shocks are propagated internationally. This series of macroeconomic tests has provided an extremely useful set of results evaluating the importance of the five transmission mechanisms discussed above. As this review has also shown, however, this strategy of using aggregate country-level data to test how shocks are propagated has several limitations.

One limitation of these aggregate empirical tests is that data availability makes it extremely difficult (if not impossible) to differentiate between many of the propagation channels. There are numerous examples of this problem. Most analyses of trade as a transmission mechanism focus on bilateral trade, but tests based on this statistic are not only unable to distinguish between product competitiveness and income effects, but they also ignore competitive effects in third markets. Glick and Rose (1998) create several more complicated measures of trade in order to differentiate between these various effects, but they even admit that due to the aggregate nature of their data, some of the calculated competitors during currency crises are "not intuitive" and "are probably not direct trade competitors."[9] Tests for the importance of wake-up call effects, and especially herding and/or informational cascades, are even more difficult to construct without investor-level data, and even with this data, it is difficult to differentiate between these sorts of wake-up calls and a forced-portfolio recomposition. In an overview of this empirical literature, Forbes and Rigobon (1999a) use a simple model to show that endogeneity and omitted variable bias make it virtually impossible to use aggregate tests to identify transmission mechanisms directly. This is why several empirical papers do not even try to differentiate between specific propagation mechanisms, and instead focus on broad categories of theories such as crisis- or non-crisis-contingent channels.

[9] Glick and Rose (1998), pg. 10.

A second limitation of this series of tests based on aggregate statistics is that the literature is far from reaching any sort of consensus. Granted, several transmission mechanisms may be important in the propagation of recent financial crises, and many of the papers only focus on one transmission channel, so that results from one paper do not necessarily contradict work on other channels. As the literature review above showed, however, several of the papers which do compare the relative importance of more than one channel are in sharp disagreement. For example, Eichengreen, Rose, and Wyplosz (1996) and Glick and Rose (1998) argue that trade has a significant impact while macroeconomic similarities are generally not significant. On the other hand, Sachs, Tornell, and Velasco (1996) argue that macroeconomic similarities have a large and significant effect while trade is not important. Tests of the credit crunch channel by Kim (1999) and Ghosh and Ghosh (1999) use the same strategy for estimating loan supply and demand during the East Asian crisis, but one paper concludes that a credit crunch existed while the other concludes the opposite. Several papers argue that mutual funds were important in transmitting recent financial crisis (through some sort of forced-portfolio recomposition or country reevaluation), while others argue that net redemptions and capital outflows by mutual fund investors were so small during recent crisis that they could not have had a major impact. Even the more general tests of crisis- versus non-crisis-contingent propagation mechanisms, such as those performed by Calvo and Reinhart (1996) and Forbes and Rigobon (1999b), reach opposite conclusions on whether some sort of "contagion" occurred after recent financial crises.

A final limitation of these tests based on macroeconomic data is that they ignore a tremendous wealth of information which is lost in the aggregation used to create the macroeconomic statistics. Within each country, there is a large variation in how different companies are affected by various shocks. For example, if a devaluation in one country increases the competitiveness of its exports, firms in other countries should only be directly affected by the devaluation if they sell products which compete with those exports. Companies which produce non-traded goods should be less affected by the devaluation. Similarly, if a crisis in one country leads to a global credit crunch, firms which are more dependent on short-term loans to finance current operations should be more affected by the increased cost of credit. Empirical studies which simply look at a country's aggregate trade statistics, balance of payments, or total market returns will ignore these important differential effects across firms. Utilizing firm-level information could be extremely useful in identifying how shocks are propagated internationally.

3. The Firm-Level Data Set

The obvious difficulty with utilizing firm-level information to identify how shocks are propagated internationally is that these micro-level tests require a larger data set composed of much less readily-available statistics. To construct this firm-level data set, I began by compiling balance sheet, income statement, cash flow, and general company information from the Worldscope database.[10] Worldscope contains information on approximately 16,000 companies from 51 countries, representing about 90% of global market capitalization (according to their literature). Records begin as early as 1980 for many companies, and include historical information on firms that became inactive due to a merger, bankruptcy, or any other reason. Worldscope reports both the original data as reported by each company, as well as templated figures which have been adjusted to account for cross-country variations in accounting practices. The templated figures are designed to be directly comparable across national boundaries. I compiled Worldscope information on all available companies for the one-year preceding the 1997 East Asian crisis and the 1998 Russian crisis. Then I matched this information with data on daily stock returns from Datastream [11] and excluded the five countries that had information on fewer than 10 firms.[12]

The resulting data set includes information from 46 countries for 14,154 companies before the East Asian crisis and 12,570 companies before the Russian crisis. Table 1 lists the number of companies in each country and region for each of the crisis periods. As the table shows, there is extensive coverage of companies in the Americas, Asia, Australasia, and Europe, although there is limited coverage of Africa and the Middle East. Table 2 lists median market capitalization, assets, and net income as well as the total number of companies by industry group.[13] Appendix A lists the statistics calculated for each firm and used throughout this paper and includes detailed information on how each variable is defined and/or calculated.

This firm-level data set has detailed information on a wide range of companies from around the world. There are, however, several limitations with this data. First, since Worldscope only reports information which is publicly available, virtually all of the sample consists of publicly-traded companies. Most private and government-owned companies are not included. As a result,

[10] The Worldscope data based is produced by Disclosure, which is part of the Primark Global Information Services Group. For further information, see the website: http://www.primark.com.
[11] Returns are calculated as the difference in logs and are not adjusted for inflation. Returns were also adjusted for weekends, with no significant impact on the results.
[12] Countries excluded are: Liechtenstein, Russian Federation, Slovakia, Sri Lanka, and Zimbabwe.

countries where many firms tend to be majority-owned by the state (such as China) tend to be underrepresented. Also, smaller firms, which are more likely to be privately owned, are underrepresented. A second problem is that although Worldscope attempts to correct for major differences in cross-country accounting standards, significant differences may still exist for certain variables. The analysis below addresses this problem by using a number of different statistics to test each hypothesis and by examining the impact of country-specific effects on the results. A third problem is that there are a number of extreme outliers which undoubtedly represent reporting errors. The analysis below addresses this problem by not only utilizing estimation techniques which minimize outliers, but also by performing an extensive set of sensitivity tests.

4. Methodology and Univariate Test Results

In order to test how a shock to one country is transmitted to firms in other countries, this paper uses an event study methodology. It closely follows the framework laid out in Chapter 4 of Campbell, Lo and MacKinlay (1997). The first part of this section explains the basic methodology and estimates a constant-mean-return model of normal stock returns before the East Asian and Russian crises. It then uses these estimated coefficients to calculate abnormal returns and cumulative abnormal returns for each stock after each crisis. The second part of this section aggregates these abnormal returns into different stock portfolios to test the strength of the various propagation mechanisms discussed above. Graphs of these various portfolios of cumulative abnormal returns provide preliminary evidence of which groups of companies were more vulnerable to the East Asian and Russian crisis, and therefore how these shocks were propagated internationally.

4.1 Methodology

To calculate normal returns for the sample of stocks discussed in Section 3, I utilize a constant-mean-return model. More specifically, for the pre-crisis period of length *P*, I estimate:

$$\mathbf{r}_i = \mu_i \mathbf{l} + \boldsymbol{\varepsilon}_i \qquad (1)$$

[13] I focus on median statistics since means tend to be skewed by several extreme outliers. These outliers undoubtedly represent reporting and/or measurement error and are adjusted for in the empirical analysis.

where $\mathbf{r}_i$ is the (P x 1) vector of daily returns for stock i over the pre-crisis period; μ_i is the estimated mean return for stock i; $\mathbf{\iota}$ is a (P x 1) vector of ones; and $\boldsymbol{\varepsilon}_i$ is the (P x 1) vector of disturbance terms. Campbell et al. show that under general assumptions, OLS estimates of equation 1 are consistent and efficient.[14]

Although this constant-mean-return model may appear simplistic, and including additional variables (such as market returns) could minimize the variance of the abnormal return, I focus on this model for two reasons. First, several of the tests performed below will estimate and examine the impact of financial crises on aggregate market and industry returns for different countries and sectors. If I utilize a model of normal returns which controls for these market or industry returns, then it would be impossible to perform these tests. Second, Campbell et al. report that this constant-mean-return model yields results similar to those of much more sophisticated models and that: "This lack of sensitivity to the model choice can be attributed to the fact that the variance of the abnormal return is frequently not reduced much by choosing a more sophisticated model."[15]

To estimate equation 1, I define the pre-crisis period (of length P) as the one-year before the "events" of the Russian and East Asian crises. I define the Russian crisis as starting on August 17, 1998 because this is the date that the government devalued the ruble and imposed a forced restructuring of its government debt.[16] I define the Asian crisis as starting on June 25 1997, because this is date that the Thai government removed support from a major finance company (implying that creditors could incur losses) and reported that the government's stock of international reserves was grossly overstated.[17] These events prompted a massive speculative attack on Thailand which forced the government to float the baht on July 2nd. Admittedly, the Asian crisis had several different phases and it is possible to define other event windows for the

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[14] Specifically, Campbell et al. (1997) show that it is necessary to assume the joint normality of asset returns. This states that if $\mathbf{r}_t$ is an (N x 1) vector of stock returns over the time period t, then $\mathbf{r}_t$ is independently multivariate normally distributed with mean μ and covariance matrix Ω for all t. Moreover, under the constant-mean return model, $\sigma^2_{\varepsilon_i}$ is the (i,i) element of Ω, $E[\varepsilon_{it}] = 0$, and $\mathrm{Var}[\varepsilon_{it}] = \sigma^2_{\varepsilon_i}$.

[15] Campbell, Lo and MacKinlay (1997), pg. 154.

[16] More specifically, on August 17th, the Russian government raised the band for the ruble exchange rate, defaulted on its treasury bills, and declared a ninety-day moratorium on foreign debt payments. The currency did not officially float until August 27th.

[17] As recently as May of 1997, the Thai government had pledged public commitment to support Finance One. Reneging on this promise threatened the extensive system of government backing (both implicit and

various phases of the crisis. Section 6 will test for the sensitivity of the results to different windows, such as defining the East Asian crisis as starting in October when the Hong Kong peg was attacked. The central analysis of this paper, however, will focus on an event window starting on June 25, 1997, since this is the earliest "phase" of the East Asian crisis and should therefore capture the full impact of the entire crisis on firms around the world.

Next, I utilize the parameter estimates from equation 1 during the pre-crisis period to calculate abnormal returns for each stock after the crisis. I define the Asian crisis as lasting for seven months (ending on January 24, 1998), in order to include the Korean debt restructuring of mid-January, which is generally considered the last major phase of the crisis. I define the Russian crisis as lasting for one month (ending on September 16, 1998), since the bailout of Long-Term Capital Management in the US was announced on September 23rd, and I do not want to include the impact of this announcement in the analysis. Once again, it is possible to define each of these crises as ending on different dates, and the sensitivity analysis tests for the impact of changing the length of the event window. The resulting vector of abnormal returns ($\hat{\varepsilon}_i^*$) for firm *i* during the defined crisis period (i.e. event window) of length *C* is therefore:

$$\hat{\boldsymbol{\varepsilon}}_i^* = \mathbf{r}_i^* - \hat{\mu}_i \mathbf{I} \tag{2}$$

where $\mathbf{r}_i^*$ is the (*C* x 1) vector of returns during the crisis, $\hat{\mu}_i$ is the estimated parameter from equation 1 for stock *i*, and $\mathbf{I}$ is a (*C* x 1) vector of ones. Then, I add the abnormal returns for each stock to calculate the cumulative abnormal returns (CAR's) over the full crisis period *C*:

$$CAR_{i,C} = \sum_{t=1}^{C} \hat{\varepsilon}_{i,t}^* \tag{3}$$

These CAR's are utilized in the graphs and regression analysis for the remainder of the paper.

4.2 Graphical Results

Once the CAR's have been calculated for each stock, it is possible to construct portfolios to test if different types of stocks were more vulnerable to the shocks of the East Asian and Russian crises.

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explicit). See Radelet and Sachs (1998) or Corsetti, Pesenti, and Roubini (1998) for a detailed accounting of key events in the Asian crisis.

As discussed in Section 2, there are five channels by which each crisis could have been transmitted to firms in other countries: product competitiveness; an income effect; a credit crunch; a forced portfolio recomposition; or a wake-up call. Although data limitations make it difficult to construct definitive tests of the strength of each of these channels, testing if certain types of companies are more vulnerable to these two shocks can provide strong evidence for or against each of these propagation mechanisms.

The first propagation channel, product competitiveness, argues that firms which produce the same goods as those exported by the crisis country will become less competitive (given that the crisis country's currency loses value.) Therefore, after the crisis, companies which produce in the same major industries as the crisis country should experience lower returns than companies which do not compete in those sectors. To test this channel, I define "major industries" for the crisis zone as the two-digit SIC groups for which net sales by companies from the crisis zone are 5% or more of net sales for the entire sample of companies.[18] I do not include industries which are "non-traded" and would not be expected to have competitive effects across countries.[19] Table 3 lists these SIC groups that are "major industries" for the crisis zone--i.e. industries which could experience a competitiveness effect from the Asian and Russian crises. Granted, this classification procedure is not a precise measure of competitiveness and has a number of problems[20], but it does provide a rough approximation of what industries are most likely to be affected by the two crises. Moreover, the sensitivity analysis in Section 5 shows that modifications to this competitiveness indicator have no significant impact on results.

Next, I use the two-digit SIC codes listed in Table 3 to divide the firms in the data set into two portfolios for each crisis: companies whose primary output competes with output from the crisis zone (i.e. is in the same 2-digit SIC group) and companies whose primary output does not compete.[21] Figures 1.1 and 1.2 graph the CAR's of each portfolio over time for the Asian and

[18] The Asian-crisis zone is defined as: Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand. The Russian-crisis zone is simply Russia. Total sales are measured in US$ and are taken from the companies annual report from the one-year preceding the crisis.
[19] More specifically, the excluded industries are: utilities; services; leisure; finance/real estate; and public administration. SIC codes for the excluded industries are defined in Table 1.
[20] One problem is that different countries could produce goods of varying quality within the same SIC category and therefore not compete directly. Another problem is that all firm sales are included under the firm's primary SIC code although firms could have branches which produce in other sectors.
[21] Throughout this section, reported results are based on equally-weighted portfolios. Estimates based on market-weighted portfolios are not significantly different and are reported in the sensitivity analysis. Also, I do not include firms from the relevant crisis area in either portfolio for two reasons. First, these firms are not relevant to this paper's investigation of how shocks to one country affect firms in other countries.

Russian crisis periods, as well as one-month before each crisis. The horizontal axes are labeled in event time, with zero equal to the date of the relevant crisis. Figure 1.1 shows that for the first two months of the Asian crisis, CAR's were virtually identical for firms producing in the "major industries" of the Asian crisis countries and not producing in these SIC groups. After about two months, however, firms whose primary output was in the "major industries" group experienced significantly lower returns. This difference increases over time, suggesting not only that there was a product competitiveness effect during the Asian crisis, but that this effect was more important in the later phases of the crisis. This is not surprising because the countries which devalued in the earlier stages of the crisis (i.e. Thailand and Indonesia) produced smaller shares of global output than countries which devalued in the later stages of the crisis (i.e. Korea.)

On the other hand, Figure 1.2 shows that the product-competitiveness effect during the Russian crisis was significantly different than that during the Asian crisis. During the first two weeks of the Russian crisis, CAR's were virtually identical for firms producing in Russia's "major industry" and not producing in this SIC group. After about two weeks, however, firms which produced in this "major industry" group experienced significantly higher, instead of lower, returns. It appears that companies which competed with Russia's products actually gained from Russia's crisis. This may be due to the fact that the measure of Russia's "major industries" is imprecise. Russia's one "major industry" (metal mining) could incorporate a number of specialized sectors which do not compete directly and of which Russia only produces a few. This result could also be due to the fear that the Russian crisis would lead to such domestic turmoil that production levels would drop and costs rise, potentially counteracting the devaluation of the ruble (and even causing non-Russian firms to have a cost advantage, instead of a disadvantage.) Finally, given that Asian output is a much larger share of global production than Russian output, it is not surprising that there was a strong product competitiveness effect during the Asian crisis and not the Russian crisis.

The second channel through which shocks could be propagated internationally is an income effect. A country (or region) suffering from a crisis generally experiences lower growth rates and a contraction of aggregate demand, which reduces the profitability of firms which sell in that country (or region.) To test this channel, I calculate the percent of sales, operating income, and assets in Russia and the Asian-crisis countries for each firm during the one year preceding the

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Second, crises could affect local firms differently, such as increasing the competitiveness of their exports instead of decreasing it.

relevant crisis. This classification procedure is not precise, since many companies report sales, income and assets by region instead of by country, but it does provide a useful proxy of a firm's direct exposure to the crisis zone.[22] Then, for each variable, I divide the sample into two portfolios: firms which have direct exposure to the crisis zone (defined as at least 5% of assets, sales, or net income in the region) and firms which do not have direct exposure. I continue to exclude firms that are based within the relevant crisis zone.

The CAR's for each portfolio are graphed in Figures 1.3 and 1.4. Figure 1.4 shows evidence of a strong income effect during the Russian crisis. Although the sample of companies with direct exposure to Russia is small, these firms experienced significantly lower CAR's than firms in the rest of the sample. On the other hand, Figure 1.3 shows that in the early stages of the Asian crisis, companies with direct exposure to the Asian-crisis countries actually outperform companies with no direct exposure. This could indicate that firms with direct exposure to Asia share other characteristics that generate higher CAR's during this period (such as being larger or more internationally diversified). This could also indicate that the Asian countries affected during the early phases of the crisis were relatively small markets. This interpretation is supported by the fact that mid-way through the Asian crisis, firms with direct exposure to Asia experienced a significant drop in their CAR's. This later phase is when the largest Asian-crisis markets experienced the most severe phases of their country-specific crises. It is therefore not surprising that any income effect from reduced demand in the entire Asian-crisis region is larger during the later phase of the crisis.

The third channel by which a shock to one country could be transmitted to firms in other countries is a credit crunch. As discussed in Section 2, there are several different variants of this theory, but underlying them all is the idea that a crisis in one country leads to a sharp reduction in the international supply of credit, raising the cost of credit to firms in other countries. A direct implication of this theory is that companies which rely more heavily on short-term debt to finance inventories and provide working capital would be more affected by a crisis (and experience

[22] Russia is often grouped with Europe and individual Asian countries are often grouped together as Asia. In order to be consistent, I only include exposure that is specifically linked to the relevant country. For example, for the Russian crisis, I only include sales, income, or assets in Russia or the Former USSR. For the Asian crisis, I only included sales, income, or assets in Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, or Thailand. The sensitivity analysis tests for the impact of using broader definitions of these variables (i.e. including sales to all of Asia).

relatively lower abnormal stock returns.)[23] To test this theory, I use each firm's ratio of net short-term debt to equity to divide the sample of firms into two portfolios: those more highly dependent on short-term financing and those less dependent.[24]

Figures 1.5 and 1.6 graph the CAR's for the two crises. Figure 1.5 shows that during the entire Asian-crisis period (except the first week), firms more dependent on short-term debt experienced lower CAR's. This supports the hypothesis that there was some type of "credit-crunch" during the Asian crisis period. It is worth noting, however, that this test is not definitive since firms more reliant on short-term debt could experience lower returns during the crisis for other reasons. For example, firms more dependent on short-term debt financing could be smaller or riskier companies. During the Russian crisis, however, firms which are more reliant on short-term debt financing do not have significantly lower CAR's than the rest of the sample. In fact, as shown in Figure 1.6, mid-way through the crisis these more-dependent firms experience slightly higher, instead of lower, CAR's. Therefore, these graphs provide support for some sort of credit crunch during the Asian crisis, but not during the Russian crisis.

A forced-portfolio recomposition, the fourth propagation channel, suggests that after a crisis, investors may need to sell assets in markets not directly affected by a crisis in order to meet certain requirements. An implication of this set of theories is that stocks which are more liquid or more widely traded in global markets are more likely to be exchanged in this rapid, forced sell-off. To test this channel, I calculate each firm's stock liquidity as the percent of trading days for which stock returns are non-zero (in the pre-crisis period). Then, I define high-liquidity stocks as those for which returns are non-zero in at least 75% of the pre-crisis trading days.[25] All other stocks are classified as low-liquidity.

Figures 1.7 and 1.8 graph the CAR's for portfolios of high-liquidity and low-liquidity stocks for the Asian and Russian crises. During the first half of the Asian crisis, high-liquidity stocks slightly outperform low-liquidity stocks, while during the second half of the crisis, high-liquidity stocks underperform low-liquidity stocks. This suggests that any forced portfolio recomposition

[23] For theoretical and empirical information on this balance sheet channel see Bernanke and Gertler (1995) or Bernanke and Lown (1991).

[24] The sensitivity analysis uses a number of other measures of short-term debt dependence to construct these portfolios. Results do not change significantly. For each crisis, I use the sample median as the division between more-dependent and less-dependent firms. The sample median of net short-term debt to equity is 1.31% during the East Asian crisis and 0.97% during the Russian crisis.

caused by the Asian crisis occurred during the later stages of the crisis. As discussed above, this is not surprising, given that the largest Asian countries experienced the most severe phases of their country-specific crises during this later stage. On the other hand, Figure 1.8 shows that during the entire Russian crisis (excluding the first five days), high-liquidity stocks experienced lower CAR's than low-liquidity stocks. Therefore, these graphs support some type of forced-portfolio recomposition during the Russian crisis and the later half of the Asian crisis.

The final channel by which a shock to one country could be transmitted to firms in other countries is a wake-up call or country reevaluation. This transmission channel incorporates a number of different theories, but each variant has one important implication: a crisis in one country causes investors to pull out of all firms in another country or region. As a result, most of the movement in individual stock prices should be driven by movement in the aggregate country index. Firm characteristics should have no significant effect.[26] To test this transmission channel, I divide the sample into different portfolios based on the country and region where each firm is based.

Figures 1.9 though 1.18 show a sample of the CAR's for these different portfolios. The differences between the Asian and Russian crises are striking. During the Asian crisis, OECD and North American firms perform significantly better than those in the rest of the world, while during the Russian crisis OECD and North American firms perform significantly worse. During the Asian crisis, Asian firms (excluding those in the crisis countries) perform significantly worse than those in the rest of the world, while during the Russian crisis, Asian firms perform significantly better.[27] Latin American performance is similar to that of the rest of the world during the Asian crisis (although it diverges at the end of the period), but significantly worse during the Russian crisis. Finally, the odd group of firms from Israel, South Africa and Turkey (labeled the "other region") significantly outperform the rest of the world during the Asian crisis, but under-perform during the Russian crisis. These graphs clearly show that regional and country effects are important during both crises. They also suggest that the Asian crisis did not cause investors to "wake-up" and pull out of the Americas or small emerging markets (such as South Africa). On

[25] The sensitivity analysis uses a number of other measures of stock liquidity. Results do not change significantly.
[26] One caveat, however, is that if this wake-up call and the resultant sell-off occurs quickly, more liquid stocks would be more affected. In this case, it would be difficult to differentiate a "wake-up call" effect from the "forced-portfolio recomposition" discussed above.
[27] This is undoubtedly due to the fact that the "normal" returns for Asian countries are calculated during late 1997 and early 1998.

the other hand, the Russian crisis did appear to cause a significant reevaluation of both North and South America, as well as small (non-Asian) emerging markets.

To summarize, the graphical results presented in this section provide mixed support for the five international propagation mechanisms. There is strong support for a product competitiveness effect during the later stages of the Asian crisis, but none during the Russian crisis. There is strong evidence of an income effect during the Russian crisis, some evidence during the later phases of the Asian crisis, but no evidence during the initial phases of the Asian crisis (and actually evidence of the opposite). There is support for a credit crunch during the Asian crisis, but not during the Russian crisis. There is evidence of a forced-portfolio recomposition during the Russian crisis and later half of the Asian crisis, but not during the early phases. Evidence for the last channel is the most conclusive. During each crisis, there are strong country and regional effects, suggesting some sort of wake-up call effect. This wake-up call causes the reevaluation of a broader range of countries during the Russian crisis. Finally, and perhaps most important, these graphs suggest that different transmission mechanisms played relatively different roles in the international propagation of shocks during the Asian and Russian crises.

5. Multivariate Tests

Although this graphical analysis is suggestive, it is difficult to draw strong conclusions from this type of univariate approach. If two (or more) firm characteristics are highly correlated, then it may be difficult to isolate the impact of a specific characteristic on stock returns. For example, as mentioned above, larger firms are more likely to have direct sales exposure to the Asian crisis region, and larger firms may be less vulnerable to global crises (if investors switch to larger, more stable companies after a shock). In this case, a portfolio of firms with direct exposure to the Asian crisis region may outperform firms with no exposure to the region, although this difference in performance has no direct relationship to the variable under consideration (exposure to Asia.) In other words, an international shock could simultaneously have several different effects on a firm and it is difficult to identify the strength of these effects by focusing on only one variable. This section will address this problem by estimating a number of cross-section, multivariate regressions and attempt to isolate and quantify the relative importance of the five propagation mechanisms during the Asian and Russian crises. The section begins by explaining the basic methodology and presenting one set of base results. The section ends with a number of sensitivity tests and extensions of the base model.

5.1 Methodology and Central Results

To begin, define $\mathbf{y}$ as the (*N x 1)* vector of cumulative returns during the full crisis period (of length *C* as defined above) for the entire sample of *N* stocks.[28] Then if $\boldsymbol{X}$ is a (*N x K*) matrix of firm characteristics (with the first column a vector of ones), it is possible to estimate:

$$\mathbf{y} = \mathbf{X}\theta + \boldsymbol{\eta} \qquad (4)$$

where θ is the (*K x 1*) vector of coefficients and η is (*N x 1*) vector of disturbances. More specifically, for consistency with the graphical analysis, I include five firm characteristics in $\boldsymbol{X}$, each of which is designed to test one of the propagation mechanisms discussed above*:*

Independent Variable	**Propagation Channel**	**Relevant Statistic**[29]
Sector competition	Product competitiveness	Dummy =1 if firm produces in the same SIC group as a "major industry" of the crisis zone (see Table 3)
Direct exposure	Income effect	Dummy = 1 if firm has over 5% of sales, assets, or net income from the crisis zone
Debt liquidity	Credit crunch	Percent of net short-term debt to equity
Trading liquidity	Forced-portfolio recomposition	Dummy=1 if stock return<>0 in at least 3/4 of the trading days in the 1-year pre-crisis period
Country dummies	Wake-up call	Dummy variable equal to one if firm is based in a given country; US is excluded country

Table 4 presents the base estimates of equation (4) for the Asian and Russian crises, using the set of independent variables and statistics listed above. Countries from the crisis zone continue to be

[28] Once again, specification is based on Campbell et al. (1997).
[29] For more information, see Section 4 and/or Appendix A.

excluded from the relevant analysis. Columns (1) and (3) present OLS estimates with standard errors White-adjusted for heteroscedasticity.

As discussed above, however, one problem with the Worldscope data is that there are a number of extreme outliers. Many are undoubtedly reporting errors, but it is difficult to judge which outliers are "mistakes" and which represent unusual corporate practices (such as the extremely high debt/equity ratios of several Asian firms.) Therefore, instead of trying to evaluate which outliers should be dropped, I use an estimation technique which reduces the weight given to outliers. First, I calculate Cook's distance statistic for each firm and eliminate gross outliers. Then, I use an iterative estimation technique which places less weight on observations with larger residuals.[30] Columns (2) and (4) present these results and show that several coefficient estimates change significantly when outliers are given less weight. Moreover, results in columns (2) and (4) are virtually identical to those obtained by simply dropping extreme outliers (based on a graphical analysis.) Therefore, outliers appear to be a problem, and in the discussion which follows, I focus on the estimates in columns (2) and (4).

Most of the estimates reported in Table 4 support the results and discussion from the graphical analysis. The coefficient on sector competition is negative and highly significant during the Asian crisis, but positive and significant in the Russian period. This supports the claim that product competitiveness was an important propagation mechanism during the former period, but not the later. Moreover, the coefficient on sector competition in column (2) suggests that the magnitude of this impact could be large. Firms which competed in the same sectors as "major industries" from Asia had CAR's 6.3% lower than non-competitive firms (over the entire seven-month Asian crisis period.)

The coefficient on the second variable, direct exposure, is negative and just significant (at the 5% level but not the 1% level) during the Asian period, and negative and highly significant during the Russian crisis. This borderline significance during the Asian crisis is not surprising given the graphical result that there was no income effect during the first half of the period. Overall, however, these two graphs suggest that an income effect was important during the Russian crisis

[30] More specifically, in the first stage, I eliminate gross outliers for which Cook's distance is greater than one. This criteria leads to the elimination of only one outlier (during the Asian crisis.) Then I estimate the base regression and calculate Huber weights based on the absolute value of these residuals. I use these weights to reestimate the regression, reiterating until convergence, and then use this result and biweights to further reiterate until convergence. For further information on this procedure, see Hamilton (1998).

and entire Asian crisis period. Once again, the coefficients on the direct exposure variable suggest that the magnitude of this effect was significant. Firms with direct exposure to the Asian crisis countries had CAR's 8.2% lower than the rest of the sample, and firms with direct exposure to Russia had returns 13.3% lower.

The coefficient on debt liquidity is negative (although insignificant) during both crisis periods. This weak evidence of a credit crunch agrees with the graphical evidence during the Asian crisis, and suggests that the graphical evidence against a credit crunch during the Russian period is spurious. Finally, the coefficient on trading liquidity is negative and highly significant during both crises. This agrees with the graphical evidence that there may have been a large forced-portfolio recomposition effect during both crises (even though this effect did not begin during the Asian crisis until mid-way through the event horizon.) The coefficient values, however, suggest that the magnitude of this effect may have been smaller than for the product competitiveness or income effects. More-liquid stocks had CAR's 2.3% lower than the rest of the sample during the Asian crisis period and 3.1% lower than the rest of the sample during the Russian crisis period.

Coefficient estimates for the country dummy variables included in these regressions are reported in Table 5.[31] For each crisis, a majority of the coefficients are individually significant (with the U.S. as the omitted country), and an F-test indicates that the coefficients are jointly, highly significant. Once again, many of the results support the graphical analysis presented above. For example, non-crisis Asian countries have significant negative coefficients during the Asian crisis, but many have significant positive coefficients during the Russian crisis. This undoubtedly results from the fact that the "normal" returns for the Asian countries during the Russian crisis were based on the preceding one-year period that included the Asian crisis. Most other emerging markets also have negative (and usually significant) coefficients during both crisis periods. Moreover, the magnitude of these country-specific coefficients can be large, ranging from -0.456 for Venezuela to 0.527 for Turkey (both during the Asian crisis.) Granted, these coefficients only capture returns relative to the US average (the omitted country), but the magnitude of the coefficients suggests that country-specific effects can overshadow the effects of the other transmission mechanisms.

[31] Due to space constraints, I only report coefficient estimates based on columns (2) and (4) of Table 4. Estimates based on columns (1) and (3) are not significantly different.

To summarize, this set of results suggests that that an income effect, forced-portfolio recomposition, and wake-up call were all important propagation mechanisms during the Russian crisis. Each of these mechanisms, as well as product competitiveness, was significant during the East Asian crisis. A credit crunch appears to have played a relatively minor role in the propagation of shocks during both crises. Moreover, the magnitude of these propagation channels varies significantly. The wake-up call effect, as proxied by the country-specific dummy variables, has the largest impact on CAR's over the two crisis periods. Product competitiveness and income effects are smaller, although still large in terms of the relative influence on firm performance. The forced-portfolio recomposition effect is significantly smaller.

5.2 Sensitivity Tests and Model Extensions

The estimates reported above are based on a number of strong assumptions and simplifications. Therefore, this section will perform a number of sensitivity tests. More specifically, it will test for the impact of: redefining key variables; including additional explanatory variables; utilizing stricter inclusion criteria and sample selection; and reclassifying period definitions. Due to space constraints, I do not show the univariate graphs or report all of the multivariate regression results. Any results which differ significantly from the base estimates reported above, however, are discussed in detail.[32]

5.2.1 Sensitivity Tests I: Redefining Key Variables

As a first set of sensitivity tests, I test for the impact of redefining each of the variables used in the base analysis. The first variable, sector competition, was measured by a dummy variable equal to one if a firm produced in the same sector as a "major industry" from the crisis zone. "Major industry" was defined as any two-digit SIC group for which sales by firms in the crisis zone were at least 5% of global sales (and non-traded sectors were excluded). I begin by slightly tweaking this definition, such as raising the criteria to be a "major industry" to 10% of global sales and/or including the "non-traded" goods. Results do not change significantly for the Asian crisis, although when the 10% division is utilized, Russia no longer has any "major industry." Moreover, including firms in oil and gas extraction (SIC code 13) as a "major industry" for Russia (since Russia has almost 5% of global production) does not change the significant, positive coefficient on sector competition for this period.

[32] Full results are obviously available from the author.

Next, I make a more significant adjustment to the definition of sector competition. Instead of using sample information to calculate "major industries" for each crisis zone, I use the *Country Profile* published by the Economist Intelligence Unit to construct a list of major exports (ranked by f.o.b. price) for Russia and the Asian-crisis countries.[33] Table 6 lists these general export categories and their closest relevant two-digit SIC codes. Granted, this classification procedure is imprecise and does not adjust for the relative share of each export industry in global production, but it is a useful complement to the measure utilized above. Column 2 of Table 7 shows the results for the Asian crisis. The coefficient on product competitiveness is still negative and significant. The slight reduction in magnitude is not surprising given the greater imprecision in this new definition of sector competition. Column 2 of Table 8 shows the results for the Russian crisis. The coefficient on sector competition is now equal to zero and insignificant (which is more intuitive given the previous positive and significant coefficient). This is not surprising given that Russian exports in the stated industries are a small share of global production.

The second variable in the base specification, direct exposure, is a dummy variable equal to one if a company has over 5% of sales, assets, or income in the crisis region. Once again, I begin by tweaking this definition, and utilize 10% or 20% as the cutoff for "direct exposure". The number of companies with "direct exposure" falls significantly, and the coefficient on "direct exposure" remains significant and increases. Next, I make a more significant adjustment to the variable definition. As discussed above, this measure is imprecise since many of the companies only list sales by broad geographic region (i.e. Asia or Europe) and not by specific country. Now I broaden the definition of "direct exposure" to include sales, assets, or income, in all of Asia (for the Asian crisis) and all of Europe (for the Russian crisis.) This is clearly a rough measure, since a majority of the "direct exposure" is now with non-crisis countries (such as Japan, for the Asian crisis, or Germany, for the Russian crisis.) Not surprisingly, the coefficient on direct exposure is insignificant in each case. The other coefficient values, however, do not change significantly.

The third variable in the base specification, debt liquidity, is measured by the ratio of net short-term debt to equity. There are a number of different ratios which could also capture a firm's dependence on short-term financing and its vulnerability to a credit crunch. Therefore, I try eight different definitions of this variable: net short-term debt to working capital; net short-term debt to total assets; net short-term debt to total capital; coverage ratio; current ratio; quick ratio; share of

[33] I define "major" exports as the five largest exports (ranked by f.o.b. price) for each country. Exports for the Asian countries are taken from 1996 and for Russia from 1997. Specific exports are generally

short-term debt to total debt, and the ratio of working capital to assets. Each of these variables is defined in detail in Appendix A. Then I re-estimate the base regression using each of these definitions. Column 3 of Tables 7 and 8 report the results using current ratio, and is typical of the results based on the other measures. The coefficient on debt liquidity is generally not only insignificant at the 5% level (in 7 of the 8 cases during the Asian crisis and 6 cases during the Russian crisis), but often has the wrong sign. Other coefficients and signs, however, are surprisingly robust. The only noteworthy change is that the coefficient on direct exposure during the Asian crisis occasionally becomes insignificant (although it always remains negative.)

The fourth variable in the base regression, trading liquidity, is measured by a dummy variable equal to one if the stock had non-zero returns in at least 75% of the pre-crisis trading days. Once again, I tweak the definition and use the less stringent criteria that stocks are "high-liquidity" if they have non-zero returns in at least 50% of the pre-crisis trading days. Results do not change significantly, although the magnitude of the share liquidity coefficient decreases during the Asian crisis and increases during the Russian crisis. Next, I make a more substantial change to this variable definition. I redefine share liquidity as the percent of shares traded to shares outstanding. Since this measure is not available for a majority of firms, the sample size shrinks significantly, but column 4 in Tables 7 and 8 shows that the central results are unchanged. Moreover, in both cases the coefficient on share liquidity remains negative and significant.

Finally, the last set of variables included in the base regression are the country dummy variables which are designed to capture any sort of wake-up call effect. Since any reevaluation or wake-up call is just as likely to take place along regional as well country-specific borders, I replace the country dummy variables with regional dummy variables (using the regions defined in Table 1.) Results are reported in column 5 of Tables 7 and 8 and do not change significantly from the base results. In each case, the regional dummies are jointly significant, and each is even individually significant. Moreover, when I repeat the analysis with both country and regional dummies, both sets of dummy variables are jointly significant (and the other coefficient estimates do not change significantly.)

5.2.2 Sensitivity Tests II: Including Additional Explanatory Variables

As a second set of sensitivity tests, I add a number of different explanatory variables to the base specification. First, as mentioned above, company size could interact with the propagation of

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reclassified by broader industry group. (For example, rice is listed as food.)

shocks if, for example, small firms have more difficulty raising capital and are therefore more vulnerable to a credit crunch. To control for the impact of firm size, I add several variables to the base regression: total market capitalization; total equity; total assets; total sales; or net income (all expressed in US$). Column 6 of Tables 7 and 8 report the results based on total market capitalization and are virtually identical to those based on the other measures, as well as virtually identical to the base results in Column 1. In each case, the coefficient on the measure of firm size is positive and highly significant.

Next, several analyses of the Asian crisis have focused on the importance of over-borrowing (and crony capitalism) in causing this crisis and/or making firms in this region more vulnerable to an initial shock. Although this paper does not address the initial cause of either crisis, it is possible that these concerns led to a "reevaluation" of firms which were highly-leveraged and/or had unusually low levels of profitability. To test for this effect, I add a number of controls for leverage and profitability to the base regression: total debt to equity; net long-term debt to equity; total debt to total capital; total debt to assets; return on equity; return on assets; and return on invested capital. Column 7 of Tables 7 and 8 report the results based on the ratio of total debt to total capital (and is typical of the other results.) The coefficients on the leverage statistics are usually negative and significant, even if the measure of debt liquidity is dropped from the regression. The coefficients on the profitability measures are always positive and significant during the Asian crisis, but negative and significant during the Russian crisis (except for return on equity which is insignificant). None of the other coefficient estimates change significantly.

As a final addition to the base model, I include a set of dummy variables for the industry groups specified in Table 2. The results are reported in column 8 of Tables 7 and 8 and an F-test indicates that the industry dummy variables are jointly significant. Most coefficient estimates do not change significantly, except during the Asian crisis when the coefficient on debt liquidity becomes significant while the coefficient on direct exposure becomes insignificant. It is worth noting that the coefficient on sector competition remains negative and significant during the Asian crisis, despite the fact that the industry dummy variables undoubtedly capture some of the product competitiveness effect.

5.2.3 Sensitivity Tests III: Stricter Inclusion Criteria and Sample Selection

As a third set of sensitivity tests, I use stricter criteria for inclusion in the sample and examine the impact of dropping various countries and groups of stocks from the analysis. First, since some

stocks in the sample are not heavily traded, I exclude stocks that have non-zero returns in over half of the pre-crisis trading days. The sample for the Asian crisis period shrinks by 1960 companies, and the sample for the Russian crisis shrinks by 194. Results are reported in column 2 of Tables 9 and 10. Coefficient estimates do not changes significantly, and in fact, the magnitude of most estimates increases. This suggests that all of the results reported above would actually be strengthened by excluding less-liquid stocks from the sample. It is also worth nothing that the coefficient on stock liquidity remains negative and significant, despite the fact that many of the "less-liquid" stocks have been dropped from the sample

Next, since different industries may have different reporting standards (such as financial companies or public-sector institutions), I repeat the base analysis but exclude one industry group at a time (using the industry groups specified in Table 2.) Column 3 in Tables 9 and 10 reports the estimates from dropping the "Finance/Real Estate" sector--which is the only test that yields results significantly different than the base analysis. During the Russian crisis, coefficient estimates are unchanged, but during the Asian crisis, the coefficient on direct exposure becomes (barely) insignificant, while the coefficient on debt liquidity becomes (barely) significant.

Finally, as mentioned above, different countries have different reporting standards, and the templated statistics reported in the Worldscope database may not sufficiently correct for these differences. Therefore, to ensure that any remaining differences in reporting standards do not have a significant impact on results, I exclude one country at a time from the base analysis. In each case, the central results do not change significantly (except during the Asian crisis, the coefficient on direct exposure occasionally becomes insignificant).

5.2.4 Sensitivity Tests IV: Reclassifying Period Definitions

As a final set of sensitivity tests, I reclassify the period definitions used in the base analysis. I begin with the Asian crisis. First, I extend the length of the crisis period by two months (ending on March 24, 1998) in order to capture some of the continuing pressure in the Asian markets during late February and early March. Results are reported in column 4 of Table 9 and show several significant differences from the base analysis. The coefficient on direct exposure has increased in magnitude and is now highly significant. This could indicate that the full income effect from the Asian crisis took several months to be fully reflected in stock prices. The other significant change is that (for the first time in all the results reported above) the coefficient on

trading liquidity is insignificant. This could indicate that over longer time periods, liquidity becomes less important in a forced-portfolio recomposition.

Next, since the graphical results in Section 3 showed several differences between the early and later phases of the Asian crisis, I analyze these two sub-sections separately. I shorten the crisis period to only 3 months (ending on September 24th) so as to focus on the initial phase of the crisis when only the lower-income Asian countries (Thailand, Indonesia, and the Philippines) were under speculative attack. Then I focus on only the later part of the crisis, when the higher-income Asian economies began to be attacked. I define this "crisis" as starting on October 1, 1997 (so as to include the mid-October massive speculative attack on Hong Kong and crash of that country's stock market) and continue to the previous end date of January 24, 1998.[34] Results of these two tests are reported in columns 5 and 6 of Table 9 and support the graphical analysis reported above. Most of the coefficients are not significant during the early phase of the Asian crisis, but all are highly significant (except debt liquidity) during the later phase of the crisis. As discussed above, given the larger market size of the countries attacked during the later phase of the crisis, it is not surprising that any product competitiveness effect, income effect, or forced-portfolio recomposition effect is larger during this later stage.

Finally, although the period classifications for the Russian crisis are more straightforward than for the Asian crisis, I repeat the base tests for the Russian period, but end the crisis after one week, two weeks, or three weeks, instead of after one month. (I do not extend the length of the crisis window since I do not want to include the collapse of Long-Term Capital Management.) Results for the two-week crisis period are reported in column 4 of Table 10 and are similar to those based on the other periods. One significant change from the base analysis is that the coefficient on product competitiveness is now negative (and insignificant) instead of positive and significant.

6. Caveats and Conclusions

This paper began by reinterpreting previous theoretical work on the transmission of crises as describing five mechanisms by which a country-specific shock could be propagated to firms around the globe. These five transmission mechanisms are: product competitiveness; an income effect; a credit crunch; a forced-portfolio recomposition; and a wake-up call. After briefly

reviewing the macroeconomic empirical work testing these various channels, the paper constructs a new firm-level data set of financial statistics, product information, geographic data, and stock returns for over 14,000 companies in 46 countries.

The remainder of the paper uses this firm-level data and an event-study methodology to test if firm vulnerability to the Asian and Russian crises is affected by factors such as: sector competitiveness; direct exposure to the crisis zone; debt liquidity; trading liquidity and geographic location. These tests suggest that an income effect, forced-portfolio recomposition, and a wake-up call were all important propagation mechanisms during the Russian crisis. Each of these mechanisms, as well as product competitiveness, was significant during the East Asian crisis. A credit crunch appears to have played a relatively minor role in the international propagation of shocks during both crises. An extensive set of robustness tests examines the impact of redefining variable definitions, including additional explanatory variables, using different sample selection criteria, and reclassifying period definitions. Results are highly robust (except that the income effect occasionally becomes insignificant during the Asian crisis.)

Although less conclusive, results also provide preliminary evidence of the relative importance of these various propagation channels during each crisis. The wake-up call effect, as proxied by country-specific or regional terms, can have a larger impact than all of the other propagation mechanisms combined. The product competitiveness effect during the Asian crisis, and the income effect during the Russian crisis, are also large in magnitude. The income effect during the Asian crisis can be large, although this estimate fluctuates significantly based on the specification utilized. Finally, although the forced-portfolio recomposition effect is consistently significant during both crises, the magnitude of this channel appears to be relatively small. An important implication of this set of results is that the relative strength of the various transmission mechanisms varies across crises. As a result, it is unlikely that a single model can capture how shocks are propagated during all crises.

Taken as a whole, these results are extremely suggestive. They are, however, only a first step. Several statistics are imprecisely measured (such as sector competition and direct exposure.) Other variables are only rough proxies for the propagation mechanism being tested (such as using trading liquidity to capture the impact of a forced-portfolio recomposition.) Reporting errors in

[34] Even though the period from June 25-October 18 is no longer technically part of the "event window", I continue to exclude it from the pre-crisis calculation of normal returns.

the Worldscope database could still affect results (despite the use of an estimation technique which minimizes outliers.) Therefore, this paper's results should be interpreted as a useful (and hopefully edifying) complement to the macroeconomic, empirical evidence on how shocks are propagated internationally.

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Table 1: Number of Companies by Country and Region

	Asian Crisis	Russian Crisis
Asia	**4656**	**3954**
China	93	18
Hong Kong	390	344
India	209	167
Indonesia	133	95
Japan	2308	2240
Korea	257	225
Malaysia	424	304
Pakistan	44	19
Philippines	111	91
Singapore	219	191
Taiwan	204	64
Thailand	264	196
Australasia	**263**	**205**
Australia	216	159
New Zealand	47	46
Europe	**4232**	**3840**
Austria	77	74
Belgium	111	96
Czech Rep.	50	48
Denmark	162	154
Finland	86	85
France	506	465
Germany	476	456
Greece	112	68
Hungary	26	24
Ireland	59	53
Italy	171	155
Luxembourg	16	16
Netherlands	162	159
Norway	112	110
Poland	46	20
Portugal	62	52
Spain	130	124
Sweden	157	147
Switzerland	153	147
U.K.	1558	1387
Latin America	**357**	**325**
Argentina	32	31
Brazil	135	118
Chile	69	67
Columbia	25	20
Mexico	66	62
Peru	18	16
Venezuela	12	11
North America	**4400**	**4036**
Canada	460	415
U.S.	3940	3621
Other	**246**	**210**
Israel	20	19
South Africa	165	137
Turkey	61	54
Total Sample	**14154**	**12570**

Table 2: Sample Statistics

	Asian Crisis[a]	Russian Crisis[a]
Median Firm Market Cap. (in $000)		
Asia	$216,154	$118,104
Austral-Asia	306,295	291,104
Europe	154,399	184,213
Latin America	292,901	336,381
North America	385,628	480,730
Other	267,581	295,645
Whole Sample	***$245,963***	***$234,116***
Median Firm Assets (in $000)		
Asia	$372,440	$377,506
Austral-Asia	388,881	405,763
Europe	233,470	258,020
Latin America	606,854	726,708
North America	372,929	464,204
Other	281,328	318,449
Whole Sample	***$335,532***	***$367,885***
Median Firm Net Income (in $000)		
Asia	$7,458	$3,938
Austral-Asia	17,124	18,286
Europe	7,756	9,950
Latin America	22,064	26,843
North America	14,692	17,230
Other	19,095	20,571
Whole Sample	***$9,845***	***$9,472***
Percent of Firms by Industry[b]		
Petroleum	2.3%	2.2%
Finance/Real Estate	18.6	18.6
Consumer Durables	15.6	15.8
Basic Industry	12.2	12.0
Food/Tobacco	6.2	6.1
Construction	6.7	6.6
Capital Goods	9.9	10.1
Transportation	3.4	3.3
Utilities	4.8	4.9
Textiles/Trade	8.3	8.1
Services	7.6	7.7
Leisure	4.4	4.4
Public Administration	0.1	0.1

NOTES:

(a) Data from annual report in the one year preceding relevant crisis. Asian crisis defined as starting on 6/25/97. Russian crisis defined as starting on 8/17/98.

(b) Based on firm's primary SIC code. Industry definitions largely based on two-digit SIC code groups defined in Campbell (1996). The only changes are: the addition of a group for Public administration, and the addition of several two-digit codes (which were not included anywhere by Campbell) to pre-specified groups. More specifically, SIC codes for each group are: Petroleum (13, 29); Finance/real Estate (60-69); Consumer durables (25, 30, 36-37, 39, 50, 55, 57); Basic industry (8, 10, 12, 14, 24, 26, 28, 33); Food/tobacco (1, 2, 7, 9 20, 21, 54); Construction (15-17, 32, 52); Capital goods (34, 35, 38); Transportation (40-42, 44, 45, 47); Utilities (46, 48, 49); Textiles/trade (22, 23, 31, 51, 53, 56, 59); Services (72, 73, 75, 76, 80-82, 87, 89); Leisure (27, 58, 70, 78, 79, 83-86, 88), Public administration (43, 91-97)

Table 3
Major Industries in Crisis Zone[a]
(Two-digit SIC Codes in parentheses)

Asian Crisis[b]	Russian Crisis
(8)Forestry	(10) Metal Mining
(16) Heavy Construction, ex. building	
(22)Textile Mill Products	
(23) Apparel and other Textile Products	
(31) Leather and leather products	
(32) Stone, clay, and glass products	
(33) Primary metal industries	
(36) Electronic & other electric equipment	
(44) Water Transportation	
(45) Transportation by Air	
(50)Wholesale trade-durable goods	
(55)Automotive dealers & service stations	
(56) Apparel and accessory stores	

NOTES:

(a) "Major industries" defined as two-digit SIC groups for which net sales from companies based in the crisis zone are 5% or more of net sales for the entire sample. Sales are measured in US$ and taken from annual reports in the one year prior to the defined start of the crisis. Industries which are "non-traded" and are not directly competitive across countries are excluded. More specifically, the excluded industries are: utilities; services; leisure; finance/real estate; and public administration. SIC codes for the excluded industries are defined in Table 1.

(b) Asian-crisis countries defined as: Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand.

Table 4
Regression Results[a]

	Asian Crisis[b]		Russian Crisis[c]	
	Base Results (1)	**Outliers Underweight[d]** (2)	**Base Results** (3)	**Outliers Underweight[d]** (4)
Constant	0.073**	0.089**	-0.064**	-0.042**
	(0.008)	(0.006)	(0.005)	(0.003)
Sector Competition[e]	-0.063**	-0.063**	0.139**	0.105**
	(0.007)	(0.006)	(0.024)	0.014
Direct Exposure[f]	-0.061	-0.082*	-0.134**	-0.133**
	(0.045)	(0.040)	(0.054)	(0.035)
Debt Liquidity[g]	-0.004**	-0.046	-0.025	-0.018
	(0.000)	(0.057)	(0.015)	(0.014)
Trading Liquidity[h]	-0.027**	-0.023**	-0.023**	-0.031**
	(0.007)	(0.006)	(0.004)	(0.003)
Country Dummies[i]	Yes**	Yes**	Yes**	Yes**
# Observations	***9692***	***9691***	***10464***	***10464***
R^2	***0.30***		***0.27***	
F-statistic	***209.7***	***153.9***	***46.1***	***117.0***

NOTES:
(a) Standard errors in parentheses. All errors are White-adjusted for heteroscedasticity.
* is significant at the 5% level; ** is significant at the 1% level
(b) Dependent variable is CARs from 6/25/97 through 1/24/98. Asian crisis firms excluded from the regression.
(c) Dependent variable is CARs from 8/17/98 through 9/16/98. Russian firms excluded from the regression.
(d) Estimated following Hamilton (1998). See text for details.
(e) Dummy variable equal to 1 if firm's main output is in the same two-digit SIC group as a "major industry" from the crisis zone. (See Table 3 for definitions of "major industry".)
(f) Dummy variable equal to 1 if firm has over 5% of sales, assets or net income in the crisis zone.
(g) Net short-term debt as a percent of common equity.
(h) Dummy variable equal to 1 if stock had non-zero returns in at least 3/4 of trading days in one year prior to crisis.
(i) Country dummies reported in Table 5. Stars indicate joint significance of dummy variables. US is excluded country.

Table 5: Country Dummy Variables[a]

		Asian Crisis		Russian Crisis	
		Coefficient	**Std. Errors**	**Coefficient**	**Std. Errors**
Asia	China	-0.405**	(0.027)	0.227**	(0.031)
	Hong Kong	---	---	0.135**	(0.007)
	India	-0.345**	(0.019)	0.120**	(0.010)
	Indonesia	---	---	-0.114**	(0.014)
	Japan	-0.455**	(0.007)	-0.010**	(0.004)
	Korea	---	---	0.147**	(0.009)
	Malaysia	---	---	0.384**	(0.008)
	Pakistan	-0.161**	(0.039)	0.106**	(0.031)
	Philippines	---	---	0.038**	(0.014)
	Singapore	---	---	0.139**	(0.010)
	Taiwan	---	---	0.055**	(0.016)
	Thailand	---	---	-0.015	(0.010)
Aust-Asia	Australia	-0.118**	(0.020)	0.053**	(0.012)
	New Zealand	-0.143**	(0.040)	0.049*	(0.021)
Europe	Austria	-0.068*	(0.032)	-0.011	(0.016)
	Belgium	-0.008	(0.026)	-0.004	(0.013)
	Czech Rep.	-0.113**	(0.041)	-0.069**	(0.019)
	Denmark	-0.052**	(0.021)	0.009	(0.011)
	Finland	0.002	(0.028)	-0.092**	(0.014)
	France	-0.031**	(0.013)	-0.030**	(0.006)
	Germany	-0.108**	(0.014)	-0.008	(0.007)
	Greece	-0.067**	(0.027)	-0.093**	(0.016)
	Hungary	0.030	(0.052)	-0.433**	(0.026)
	Ireland	0.099**	(0.035)	-0.098**	(0.018)
	Italy	0.218**	(0.021)	-0.125**	(0.011)
	Luxembourg	-0.027	(0.075)	0.017	(0.037)
	Netherlands	-0.072**	(0.021)	-0.043**	(0.011)
	Norway	-0.035	(0.027)	-0.075**	(0.014)
	Poland	-0.287**	(0.054)	-0.127**	(0.039)
	Portugal	0.005	(0.034)	-0.039*	(0.019)
	Spain	0.061**	(0.024)	-0.093**	(0.012)
	Sweden	-0.043	(0.025)	-0.083**	(0.011)
	Switzerland	-0.030	(0.022)	-0.089**	(0.011)
	UK	-0.038**	(0.009)	-0.047**	(0.005)
Latin Am	Argentina	-0.279**	(0.046)	-0.243**	(0.023)
	Brazil	-0.347**	(0.025)	-0.080**	(0.013)
	Chile	-0.289**	(0.032)	-0.088**	(0.016)
	Columbia	-0.100*	(0.050)	-0.065*	(0.028)
	Mexico	-0.046	(0.034)	-0.012	(0.017)
	Peru	-0.346**	(0.062)	-0.137**	(0.033)
	Venezuela	-0.456**	(0.072)	-0.028	(0.037)
North Am	Canada	-0.040**	(0.015)	0.006	(0.008)
	US	Omitted	Omitted	Omitted	Omitted
Other	Israel	-0.173*	(0.083)	-0.054	(0.041)
	South Africa	-0.245**	(0.024)	-0.047**	(0.012)
	Turkey	0.527**	(0.037)	-0.400**	(0.019)
F-Test[b]		***164.1*** **		***124.11*** **	

NOTES:(a) All standard errors are White-adjusted for heteroscedasticity. Results based on regressions reported in columns (2) and (4) of Table 4. See Table 4 for variable definitions and regression statistics.
* is significant at the 5% level; ** is significant at the 1% level
(b) Statistic is an F-test for joint significance of the country dummy variables.

Table 6
Primary Exports From Crisis Zone
(Two-digit SIC Codes in parentheses[a])

Asian Crisis[b]	Russian Crisis[c]
Food (01, 02)	Timber, Cellulose & Paper (08,26)
Crude Materials & Crude Petroleum (13)	Fuel, Minerals, Metals & Precious Stones (10, 12, 13, 14)
Manufactured Goods & Miscellaneous Manufacturers Includes: Textiles, Apparel, Processed Food Products; Chemicals, Petroleum & Coal Products; Metal Industries & Products; Machinery; Electronic & other Electric Equipment; Transportation Equipment (20-39)	Chemicals and Rubber (28, 30)
	Machinery and Equipment (35)
Transportation, Travel and Trade Related Services (37, 44, 47)	
Communications Products (48)	

NOTES:
(1) SIC Codes are an approximation given the information available for exports.
(2) Data for 1996.
(3) Data for 1997.

SOURCE:
Compiled based on the Economist Intelligence Unit, *Country Profile*. 1999 edition for each country. Exports taken from Reference Tables in the Appendix. The five most important exports for each country (ranked by fob price) are included. Specific exports are generally reclassified by broader industry group. (For example, rice is categorized as food.)

Table 7
Sensitivity Tests I & II: Asian Crisis[a]

	Base Results (1)	Redefine Sector Compet.[b] (2)	Redefine Debt Liquidity[c] (3)	Redefine Trading Liquidity[d] (4)	Add Regional Dummies (5)	Add control for Firm Size[e] (6)	Add control for Leverage[f] (7)	Add Industry Dummies[g] (8)
Constant	0.089**	0.098**	0.073**	0.111**	0.085**	0.087**	0.084**	-0.160
	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.172)
Sector Competition	-0.063**	-0.048**	-0.040**	-0.057**	-0.060**	-0.062**	-0.060**	-0.037**
	(0.006)	(0.005)	(0.006)	(0.011)	(0.006)	(0.006)	(0.006)	(0.007)
Direct Exposure	-0.082*	-0.073	-0.069	-0.037	-0.081*	-0.083*	-0.085*	-0.065
	(0.040)	(0.040)	(0.042)	(0.067)	(0.041)	(0.040)	(0.039)	(0.040)
Debt Liquidity	-0.046	-0.073	-0.129	-0.088	-0.084	-0.047		-0.110*
	(0.057)	(0.057)	(0.094)	(0.184)	(0.058)	(0.057)		(0.056)
Trading Liquidity	-0.023**	-0.019**	-0.024**	-0.041**	-0.026**	-0.026**	-0.019**	-0.019**
	(0.006)	(0.006)	(0.006)	(0.003)	(0.005)	(0.006)	(0.005)	(0.005)
Country Dummies	Yes**	Yes**	Yes**	Yes**	No	Yes**	Yes**	Yes**
# Observations	***9691***	***9691***	***9424***	***3143***	***9691***	***9691***	***10427***	***9691***
F-statistic	***153.9***	***154.8***	***130.5***	***24.54***	***577.7***	***150.0***	***161.8***	***125.4***

NOTES:

(a) Standard errors in parentheses. All errors are White-adjusted for heteroscedasticity. Estimated using the technique outlined in Hamilton (1998) and described in the text. Dependent variable is CARs from 6/25/97 through 1/24/98. Asian crisis firms excluded from the regression. All variables defined in Table 4 except as noted. * is significant at the 5% level; ** is significant at the 1% level

(b) Sector competition is redefined as major exports as listed in the EIU *Country Profile*. See Table 6 for details.

(c) Debt liquidity defined by the current ratio (ratio of current assets to current liabilities).

(d) Trading Liquidity defined as the percent of shares traded to shares outstanding.

(e) Firm size measured by total market capitalization (in US$).

(f) Leverage measured by ratio of total debt to total capital.

(g) Industry dummies based on divisions specified in Table 2.

Table 8
Sensitivity Tests I & II: Russian Crisis[a]

	Base Results (1)	Redefine Sector Compet.[b] (2)	Redefine Debt Liquidity[c] (3)	Redefine Trading Liquidity[d] (4)	Add Regional Dummies (5)	Add control for Firm Size[e] (6)	Add control for Leverage[f] (7)	Add Industry Dummies[g] (8)
Constant	-0.042**	-0.043**	-0.050**	-0.062**	-0.039**	-0.043**	-0.042**	-0.139
	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.121)
Sector Competition	0.105**	0.000	0.108**	0.252**	0.119**	0.105**	0.111**	0.110**
	0.014	0.003	0.012	0.023	0.014	0.014	0.013	0.014
Direct Exposure	-0.133**	-0.134**	-0.144**	-0.200**	-0.158**	-0.133**	-0.131**	-0.132**
	(0.035)	(0.035)	(0.035)	(0.053)	(0.037)	(0.035)	(0.035)	(0.034)
Debt Liquidity	-0.018	-0.018	-0.003	-0.124	-0.023	-0.018		-0.020
	(0.014)	(0.014)	(0.004)	(0.087)	(0.015)	(0.013)		(0.013)
Trading Liquidity	-0.031**	-0.030**	-0.028**	-0.010**	-0.035**	-0.033**	-0.031**	-0.032**
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Country Dummies	Yes**	Yes**	Yes**	Yes**	No	Yes**	Yes**	Yes**
# Observations	***10464***	***10464***	***9925***	***3137***	***10464***	***10422***	***11153***	***10464***
F-statistic	***117.0***	***115.3***	***83.4***	***20.8***	***116.4***	***115.2***	***118.9***	***97.7***

NOTES:

(a) Standard errors in parentheses. All errors are White-adjusted for heteroscedasticity. Estimated using the technique outlined in Hamilton (1998) and described in the text. Dependent variable is CARs from 8/17/98 through 9/16/98. All variables defined in Table 4 except as noted.
* is significant at the 5% level; ** is significant at the 1% level

(b) Sector competition is redefined as major exports as listed in the EIU *Country Profile*. See Table 6 for details.

(c) Debt liquidity defined by the current ratio (ratio of current assets to current liabilities).

(d) Trading Liquidity defined as the percent of shares traded to shares outstanding.

(e) Firm size measured by total market capitalization (in US$).

(f) Leverage measured by ratio of total debt to total capital.

(g) Industry dummies based on divisions specified in Table 2.

Table 9
Sensitivity Tests III & IV: Asian Crisis[a]

	Base Results (1)	Exclude Illiquid Stocks[b] (2)	Exclude Finance Sector[c] (3)	Crisis ends on 3/24/98 (4)	Crisis ends on 9/24/97 (5)	Crisis starts on 10/17/97 (6)
Constant	0.089**	0.089**	0.073**	0.161**	0.105**	-0.032**
	(0.006)	(0.007)	(0.007)	(0.007)	(0.004)	(0.005)
Sector Competition	-0.063**	-0.069**	-0.045**	-0.060**	-0.006	-0.045**
	(0.006)	(0.007)	(0.006)	(0.007)	(0.004)	(0.004)
Direct Exposure	-0.082*	-0.094*	-0.070	-0.111**	0.050*	-0.122**
	(0.040)	(0.046)	(0.044)	(0.044)	(0.025)	(0.030)
Debt Liquidity	-0.046	-0.163	-0.192**	-0.075	-0.018	-0.044
	(0.057)	(0.087)	(0.039)	(0.062)	(0.030)	(0.041)
Trading Liquidity	-0.023**	-0.024**	-0.029**	0.005	-0.001	-0.012**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.003)	(0.004)
Country Dummies	Yes**	Yes**	Yes**	Yes**	Yes**	Yes**
# Observations	***9691***	***7731***	***8233***	***9629***	***9846***	***9691***
F-statistic	***153.9***	***131.4***	***124.8***	***156.4***	***131.3***	***39.7***

NOTES:

(a) Standard errors in parentheses. All errors are White-adjusted for heteroscedasticity. Estimated using the technique outlined in Hamilton (1998) and described in the text. Dependent variable is CARs from 6/25/97 through 1/24/98. Asian crisis firms excluded from the regression. All variables defined in Table 4 except as noted. * is significant at the 5% level; ** is significant at the 1% level

(b) Illiquid stocks defined as stocks for which returns are non-zero in over 50% of the pre-crisis trading days.

(c) Finance (and real estate) sector defined as firms whose main sector of production is two-digit SIC code 60-69.

Table 10
Sensitivity Tests III & IV: Russian Crisis[a]

	Base Results (1)	Exclude Illiquid Stocks[b] (2)	Exclude Finance Sector[c] (3)	Crisis ends on 8/31/98 (4)
Constant	-0.042**	-0.044**	-0.047**	-0.084**
	(0.003)	(0.004)	(0.004)	(0.002)
Sector Competition	0.105**	0.108**	0.110**	-0.001
	0.014	0.014	0.014	0.009
Direct Exposure	-0.133**	-0.148**	-0.146**	-0.054**
	(0.035)	(0.038)	(0.037)	(0.023)
Debt Liquidity	-0.018	-0.019	-0.009	0.000
	(0.014)	(0.013)	(0.014)	(0.000)
Trading Liquidity	-0.031**	-0.031**	-0.029**	-0.029**
	(0.003)	(0.003)	(0.003)	(0.002)
Country Dummies	Yes**	Yes**	Yes**	Yes**
# Observations	***10464***	***10270***	***8746***	***10477***
F-statistic	***117.0***	***117.3***	***83.4***	***82.5***

NOTES:

(a) Standard errors in parentheses. All errors are White-adjusted for heteroscedasticity. Estimated using the technique outlined in Hamilton (1998) and described in the text. Dependent variable is CARs from 8/17/98 through 9/16/98. All variables defined in Table 4 except as noted.
* is significant at the 5% level; ** is significant at the 1% level

(b) Illiquid stocks defined as stocks for which returns are non-zero in over 50% of the pre-crisis trading days.

(c) Finance (and real estate) sector defined as firms whose main sector of production is two-digit SIC code 60-69.

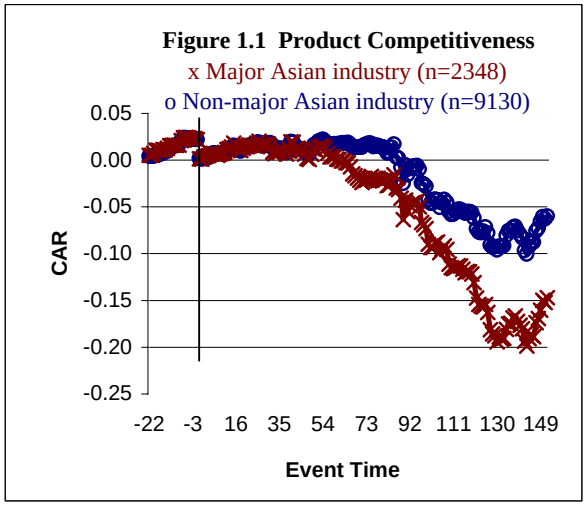
Appendix A: Variable Definitions[1]

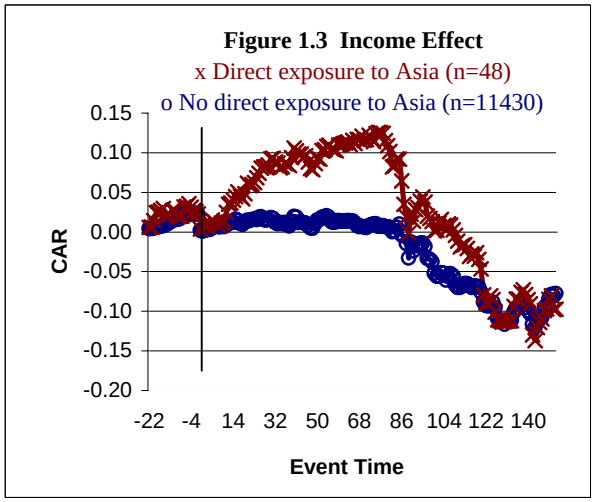
Common Equity	Common shareholder's investment in a company. Includes common stock value, retained earnings, capital surplus, capital stock premium, cumulative gain or loss of foreign currency translations, discretionary reserves, and negative goodwill.
Coverage Ratio*	The ratio of earnings before interest and taxes to interest expense on debt.
Common Shares Traded to Common Shares Outstanding*	Common shares outstanding are the number of shares outstanding at the company's year end and is the difference between issued shares and treasury shares. For companies with more than one type of common/ordinary shares, common shares outstanding represents the combined shares adjusted to reflect the par value of the share type. Common shares traded is the number of shares of the company traded during the year.
Current Assets	Cash and other assets that are reasonably expected to be realized in cash, sold or consumer within one year or one operating cycle.
Current Liabilities	Debt or other obligations that the company expects to satisfy within one year.
Current Ratio	The percent of current assets to current liabilities.
Days Return is Non-Zero*	Dummy variable equal to one if the stock return is not equal to zero in at least three-quarters of the non-weekend days in the pre-crisis period.
Market Capitalization	Product of shares outstanding and market price at fiscal year end. For companies with more than one type of common/ordinary shares, market capitalization represents total market value of the company.
Net Income	Income after all operating and non-operating income, expenses, reserves, income taxes, minority interest, and extraordinary items. Represents income before preferred dividends.
Net Long-Term Debt*	Any interest bearing financial obligations (excluding amounts due within one year and net of premium or discount) minus cash and cash equivalents.
Net Sales	Gross sales and other operating revenue less discounts, returns and allowances. For financial companies, sales represents total operating revenue.
Net Short-Term Debt*	Any debt payable within one-year (including the current portion of long-term debt and sinking fund requirements of preferred stock or debentures) minus cash and cash equivalents.
Percent Assets by Region*	Ratio of assets in a given region to total assets.
Percent Operating Income by Region*	Ratio of operating income in a given region to total operating income, where operating income is the difference between sales and total operating expenses.
Percent Sales by Region*	Ratio of sales in a region to net sales.
Quick Ratio	The ratio of (cash and equivalents + net receivables) to current liabilities.
Return on Assets	100* (Net income before preferred dividends + ((interest expense on debt - interest capitalized) * (1 - Tax Rate))) / Last year's total assets. Calculated differently for financial companies.
Return on Equity	100* (Net income before preferred dividends - preferred dividend requirements) / Last year's common equity
Return on Invested Capital	100*Net income before preferred dividends + ((Interest expense on debt - interest capitalized) * (1 - Tax Rate))) / (Last year's total capital + last year's short-term debt & current portion of long-term debt)
Share of Short-term Debt in Total Debt*	The ratio of net short-term debt to total debt.
Total Assets	For industrials: the sum of total current assets, long-term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets. For banks: the sum of cash and due from banks, total investments, net loans, customer liability on acceptances, investment in unconsolidated subsidiaries, real estate assets, net property, plant and equipment and other assets. For insurance companies: sum of cash, total investments, premium balance receivables, investments in unconsolidated subsidiaries, net property, plant, and equipment and other assets.
Total Capital	The total investment in the company. The sum of common equity, preferred stock, minority interest, long-term debt, non-equity reserves and deferred tax liability in untaxed reserves.
Working Capital	The difference between current assets and current liabilities.

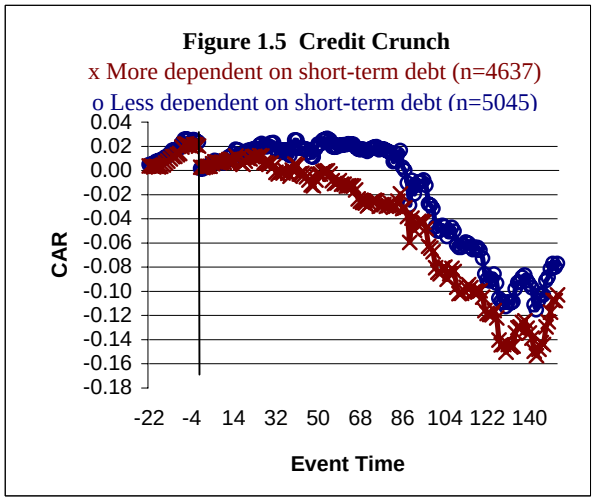
(1) Variables are either taken directly from the Worldscope database or calculated based on information provided by Worldscope and/or price information from Datastream. Statistics marked with a * are not directly available from Worldscope and are calculated as stated. For more information on specific statistics, see Worldscope database.

Figures 1.1 through 1.6

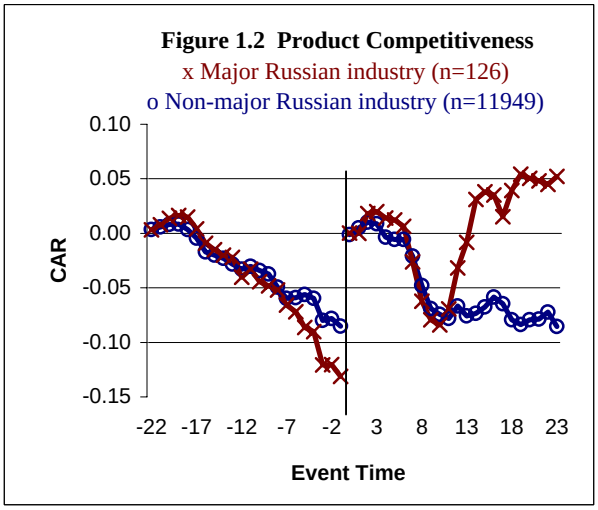
Asian Crisis CAR's

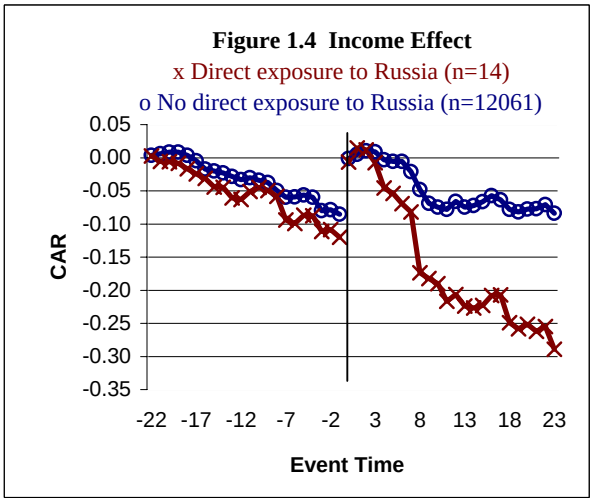


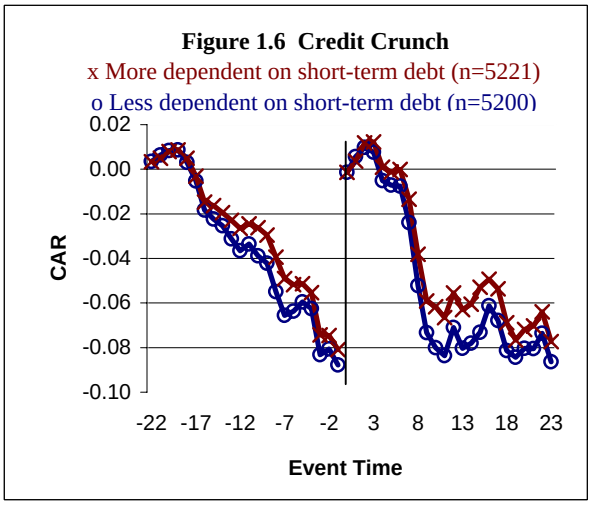




Russian Crisis CAR's

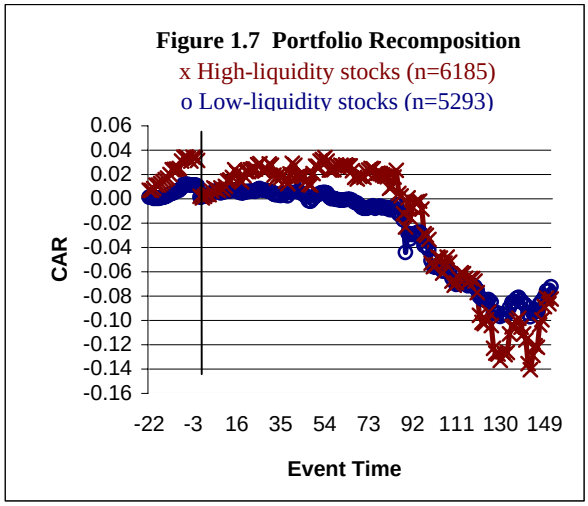


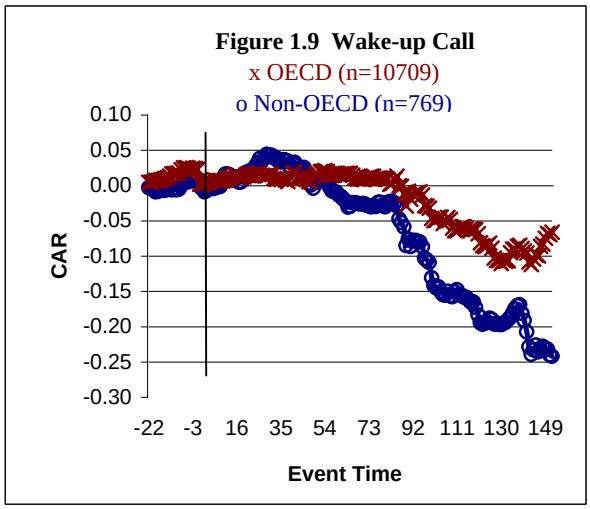


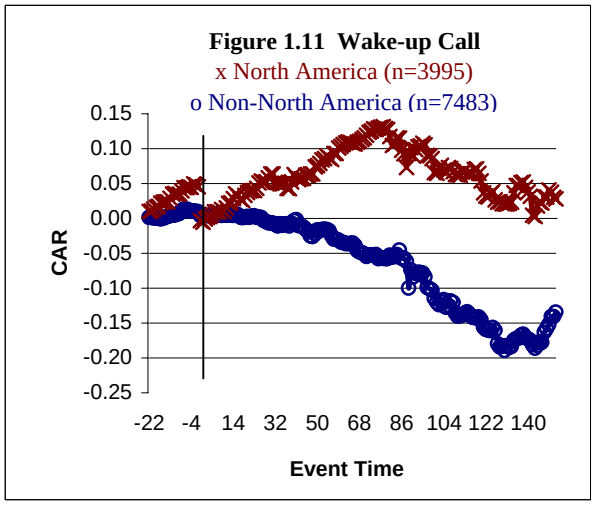


Figures 1.7 through 1.12

Asian Crisis CAR's







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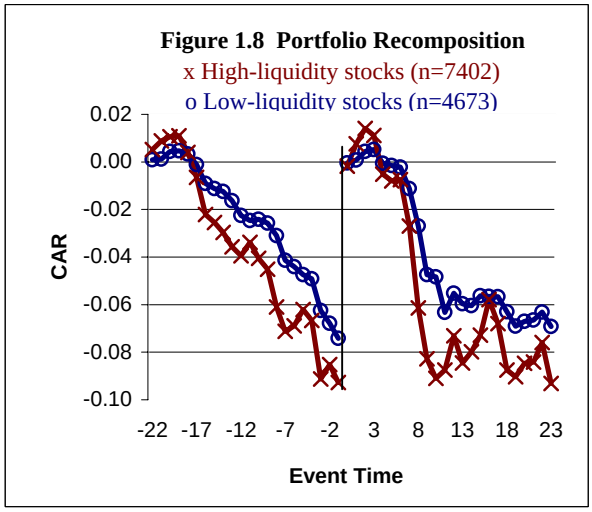
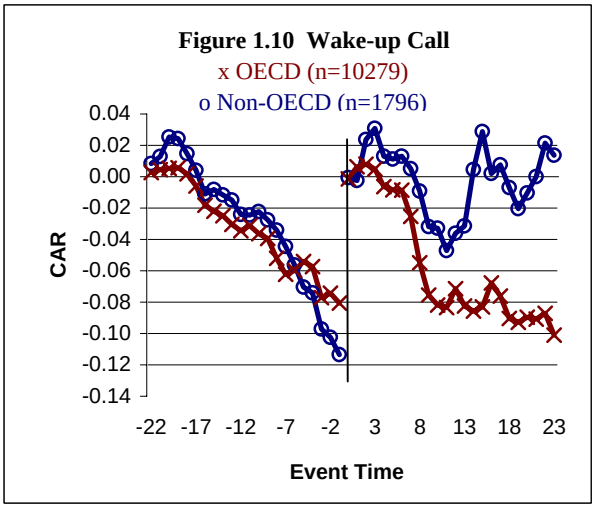
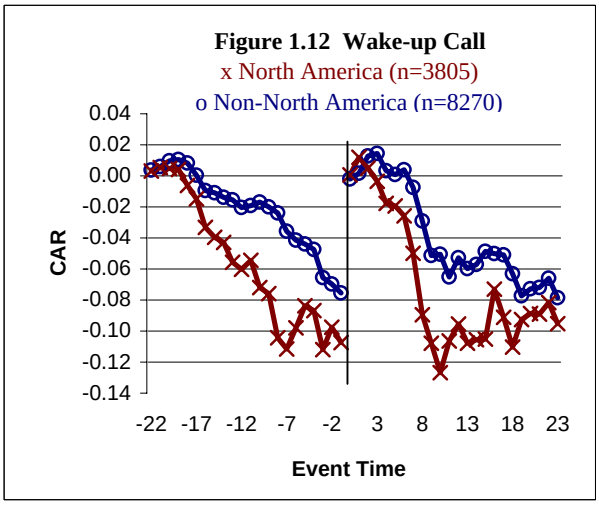
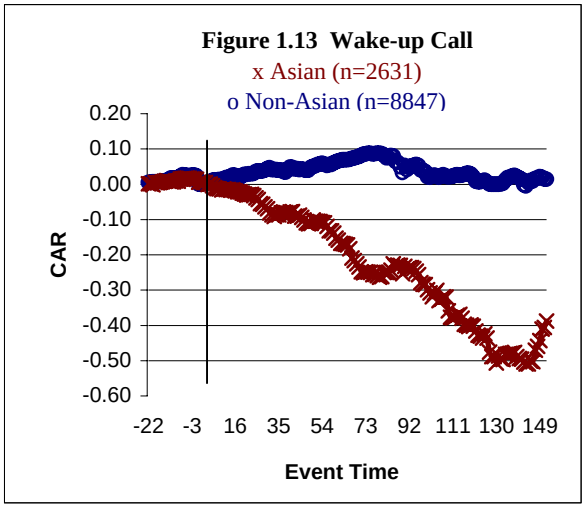


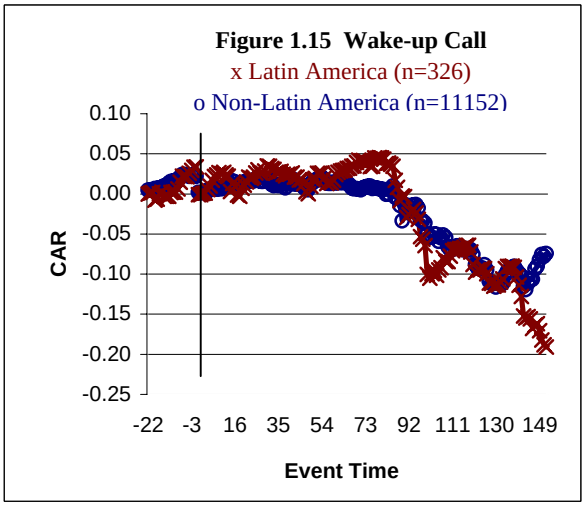


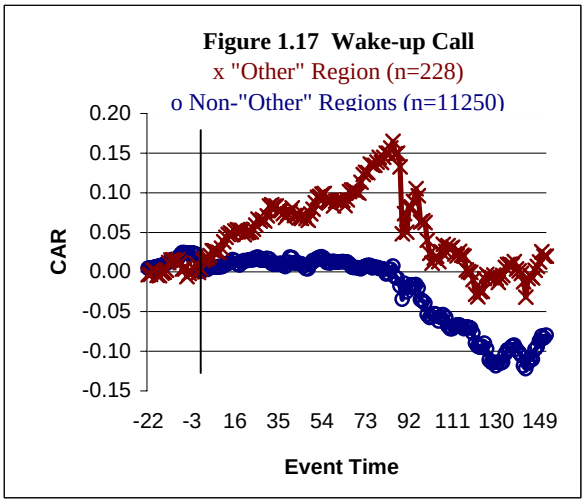


Figures 1.13 through 1.18

Asian Crisis CAR's







Russian Crisis CAR's