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Information, Trading Volume, and International Stock Return Comovements: Evidence from Cross-listed Stocks

Abstract

This paper investigates the dynamic relation between returns and trading volume in international stock markets. We test the heterogeneous-agent, rational-expectations model of Llorente, Michaely, Saar, and Wang (2002) for a comprehensive sample of 556 foreign stocks cross-listed on U.S. markets from 36 different markets. Their model argues that investors trade to speculate on their private information or to rebalance their portfolios and predicts that returns associated with portfolio rebalancing tend to reverse themselves while returns generated by speculative trades tend to continue themselves. We test this prediction by analyzing the relationship between trading volume and return comovements between the home and U.S. markets for the cross-listed shares. We hypothesize that returns in the home (U.S.) market on high-volume days are more likely to continue to spill over into the U.S. (home) market for those stocks subject to the risk of greater informed trading. Our empirical evidence provides support for this hypothesis, which highlights the link between information, trading volume and international stock return comovements that has eluded previous empirical investigations.

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1. Introduction

The notion that trading volume contains useful information about future price movements is probably as old as markets themselves. Market participants keep a close eye on trading volume because it is presumed to reflect the dynamic interplay between informed traders and uninformed traders who interact with each other in the marketplace in the pursuit of their own trading strategies and, ultimately, set market clearing prices. Trading volume is viewed by many as the critical piece of information which signals where prices will go next.

In recent years, a significant body of literature has developed which explores the relationship between trading volume and stock returns at short horizons.[1] Several papers focus on aggregate returns and volume [e.g. Duffee (1992), Gallant, Rossi, and Tauchen (1992), LeBaron (1992), and Campbell, Grossman, and Wang (1993)] and find that returns on high-volume days have a tendency to reverse themselves over the next trading day. Other papers [e.g. Morse (1980), Conrad, Hameed, and Niden (1992), Antoniewicz (1993), Stickel and Verrechia (1994), Cooper (1999), Gervais, Kaniel, and Minglegrin (2001), Blume, Easly, and O'Hara (1994)], focus on returns and volume of individual stocks.[2] In Campbell, Grossman, and Wang's (1993) model, risk-averse utility-maximizing agents act as market makers for liquidity or non-informational investors in a market environment characterized by symmetric information. This models implies that "price changes accompanied by high volume will tend to be reversed; this will be less true of price changes in days with low volume" (p. 906). Wang (1994) develops a more general model of competitive stock trading in which agents are heterogeneous both in their information and in their private investment opportunities. Informed agents trade rationally for both informational and non-informational

[1] A separate strand of the literature reveals a different pattern in the volume-return relationship over intermediate and longer returns horizons. Datar, Naik, and Radcliffe (1998) and Lee and Swaminathan (2000) show that low (high) volume stocks earn higher (lower) future returns.

[2] Other important heterogeneous agent trading models of the price formation process include Karpoff (1986), Holthausen and Verrechia (1990), Kim and Verrechia (1991), Harris and Raviv (1993), and Kandel and Pearson (1995). Karpoff (1987) and, more recently, Lo and Wang (2000) provide an extensive survey of the theoretical/empirical literature on trading volume and the price formation process. See also Campbell, Lo and MacKinlay (1997, Chapter 3).

reasons and the degree of information asymmetry embodied in their trades impacts the volume-return dynamics. Specifically, returns generated by non-informational, risk-sharing trades tend to reverse themselves while those generated by speculative trades tend to continue themselves. More recently, Llorente, Michaely, Saar, and Wang (LMSW, 2002) propose and test empirically in the U.S. a somewhat less complex version of the Wang (1994) model which offers sharper predictions regarding the dependence of a stock's dynamic volume-return relation on the degree of information asymmetry that surrounds it. They show that cross-sectional variation in the relation between volume and return autocorrelation is related to the extent of informed trading in a way predicted by the theory; that is, returns of firms with greater risk of information asymmetry (proxied by smaller capitalization stocks with higher bid-ask spreads and fewer analysts) have a greater tendency to continuations than reversals.

In this paper, we take the Llorente, Michaely, Saar, and Wang (2002) model to an international setting in an effort to expose the fundamental underpinnings of international stock return comovements, or "spillovers," examined previously.[3] Specifically, we examine the dynamic volume-return relationship for a large sample of international firms from several countries whose shares are traded in their home market and in the U.S. concurrently through an American Depositary Receipt (ADR) facility or in the form of ordinary programs, such as Canadian ordinary shares. We test whether the sign and the magnitude of return spillovers from the home (U.S.) market to the U.S. (home market) are linked to the extent of information asymmetry as LMSW predict. Do the home-market returns of firms with greater risk of information asymmetry (as proxied by a number of firm-specific and country-level attributes) tend to comove more strongly with the returns of U.S.-based ADRs or ordinaries? Conversely, do the U.S.-based returns of cross-listed firms with greater risk of information asymmetry tend to commove more strongly with the returns of their home-based counterparts? While notable contributions have been made to our understanding of the mechanisms through which short-horizon returns (and return volatilities) in one market are transmitted across international time zones to other markets [Eun and Shim (1989), King and Wadhwani (1990),

[3] A partial list of these "spillover" studies also include Neumark, Tinsley and Tosini (1991), Ng, Chang and Chou (1991), Koch and Koch (1991), Chan, Karolyi and Stulz (1992), Engle and Susmel (1993, 1994), Bae and Karolyi (1994), Karolyi (1995), Craig, Dravid and Richardson (1995), Karolyi and Stulz (1996), Ng (2000). For a comprehensive survey of the return and volatility spillover literature, refer to Gagnon and Karolyi (2006).

Hamao, Masulis and Ng (1991), Lin, Engle and Ito (1994)], few studies have been able to relate return spillovers to economic fundamentals successfully.[4]

Our focus on cross-listed stocks has several advantages from an experimental standpoint. First, since the cross-listed stock and its home-market counterpart represent identical claims to the underlying firm's cash flows, we do not need an equilibrium model of returns in order to relate the price changes experienced by the cross-listed stock and its underlying home-market share. Second, we can also distinguish with relative ease unique, firm-specific price changes from aggregate price changes, a feature which enables us to measure the relationship between information asymmetry and international return spillovers with greater precision. Third, a firm-level investigation, such as this one, gives us scope and breadth in exploring the impact of a wide variety of country-level as well as firm-specific proxies for information asymmetry.

With a sample which consists of 556 U.S. cross-listed pairs from 36 countries, we find that not only the volume-return interactions but also those between volume and international stock return spillovers are linked to the degree of firm-level information asymmetry in a manner that is consistent with the predictions of an international version of the Llorente, Michaely, Saar, and Wang (2002) model. Using a stock's market capitalization, illiquidity measure [Amihud (2002)], institutional ownership and even analyst following as proxies for information asymmetry, our evidence indicates that stocks characterized by a lower degree of information asymmetry tend to experience return reversals in one market following high-volume days in the the other market and that stocks associated with a higher degree of information asymmetry tend to exhibit weaker reversals or even continuations in one market following unusually high volume days in the other market. The magnitude of the return spillovers that originate in the home market for these cross-listed stocks are greater than those that originate in the U.S. market, but the return-volume interactions are

[4] Von Furstenberg and Jeon (1989), King, Sentana and Wadhwani (1994), Longin and Solnik (1995) and Ammer and Mei (1996) examined time-varying weekly and monthly global return correlations and found that factors such as aggregate dividend yields, interest rates and exchange rates were only weakly associated with the changes in correlations over time. Our study extends significantly the analysis of Gagnon and Karolyi (2003) who show that aggregate return spillovers between Japan and the U.S. are sensitive to interactions between information and trading volume in those markets.

consistent in both directions: stronger reversals for firms with lower information asymmetry and stronger continuations for firms with greater information asymmetry.

Our findings have significant implications for research on international stock returns as well as for markets participants and policy-makers. First, we provide further validity for the dynamic volume-return relationship proposed by Llorente, Michaely, Saar, and Wang (2002) out of sample. Second, by confirming the role of trading volume as a valuable tool for conveying information about future international return comovements, our study lends additional credence to the school of thought arguing that short-run dependence in returns observed across countries is likely driven more by fundamentals rather than by irrational financial market contagion.

This paper proceeds as follows. In Section 2, we introduce our empirical methodology and highlight our testable hypothesis. In Section 3, we describe our data and sampling procedure. In Section 4, we present our empirical findings and, in Section 5, we provide our concluding remarks.

2. Research Methodology and Hypothesis Development

Llorente, Michaely, Saar, and Wang (2002) develop a heterogeneous-agent, rational expectations model on which we base our empirical analysis. Their multi-period model of a competitive market includes two traded securities - a riskless bond and a stock – and two classes of investors with different endowments of shares of stock and income flows from a non-traded asset and different information (some private, others not) about the future dividends paid on the stock. Each investor maximizes her expected utility over her wealth next period. The model captures two motives for trading: allocation of risk and speculation on future returns. The returns on the stock and nontraded asset are correlated, investors adjust holdings of the non-traded asset and the stock to maintain an optimal risk profile generating "allocational," or "hedging," trades in the model.[5] When new private information arrives, those investors with that information take speculative positions in the stock in anticipation of high returns. This generates the informational trades in the model.

[5] We will use the adjectives "allocational," "risk-sharing" and "hedging" trades interchangeably in the same way that we will refer interchangeably to "informational" and "speculative" trades.

LMSW outline two key sets of propositions: one set that relates to equilibrium stock holdings and prices, and a second set that defines how returns generated by different sources (public information signals and hedging versus speculative trades) exhibit different dynamics. The second set (LMSW's Propositions 2 and 3) show how the actual dynamics of returns depends on the relative importance of the three return-generating mechanisms. Their focus is on those two that are generated by trading. Returns generated by trading are serially correlated. When investors trade for hedging reasons, the stock price adjusts to attract other investors (like risk-averse market-makers) to take the other side. This price change contains no information about the stock's future payoffs. When investors trade for speculative reasons, the price changes reflect the informed investors' expectation of the future payoffs, which is fulfilled later on as private information becomes public through trading. Thus, returns generated by speculative trade tend to continue themselves. To calibrate the relative importance of the two components, LMSW introduce a measure of information asymmetry in the variance of the dividend component on which informed investors have private information. When there is no information asymmetry (variance equals zero), investors trade only to hedge non-traded risk. When information asymmetry exists, informed investors can trade for both hedging and speculative reasons. With increasing information asymmetry, conditioned on positive volume, speculative trades become relatively more important and returns are increasingly more positively serially correlated.

These propositions embody the empirical predictions that we seek to test in our sample of internationally cross-listed stocks. We proceed in two steps. In the first step, we extend the U.S.-based tests of LMSW to firms from a number of countries around the world and, more importantly, not only for the joint dynamics of stock returns and trading volume in their home markets but also for that of their cross-listed shares in the U.S. markets. We refer to these as the "domestic tests." The second step extends the predictions to the two-market international setting. On average, the (contemporaneous) cross-correlations and cross-autocorrelations (on a delayed basis) between returns of the home-market and U.S. cross-listed shares are positive [Karolyi and Stulz (1996), Eun and Sabberwal, (2003), Grammig, Melvin and Schlag (2005)]. From the perspective of a U.S.-based investor in these cross-listed shares, LMSW would predict that, with increasing information asymmetry, speculative trades become relatively more important and the cross-correlations and cross-autocorrelations are increasingly more positive. We will call these extended experiments the "international spillover" tests.

A. The Domestic Tests

Llorente, Michaely, Saar, and Wang (2002) test the theoretical predictions of their model by analyzing the relation between daily volume and first-order return autocorrelation for individual stocks listed on the NYSE and AMEX between January 1, 1993, and December 31, 1998. Their final sample includes 2226 stocks. To represent the extent of informed trading in individual stocks, the authors rely on three proxies for information asymmetry: firm size [Lo and MacKinlay (1990)] measured by market capitalization, bid-ask spreads [Lee, Mucklow, and Ready (1993)], and the number of analysts following a stock, which is linked to the degree of information production in the market [Brennan and Subrahmanyam (1995) and Easly, O'Hara, and Paperman (1998)].

We implement Llorente, Michaely, Saar, and Wang's (2002) two-stage empirical strategy. In the first stage, we estimate the following time-series regression for each firm in our sample:

$$R_{i,t} = C_{0i} + C_{1i} \cdot R_{i,t-1} + C_{2i} \cdot V_{i,t-1} \cdot R_{i,t-1} + e_{i,t-1}, \qquad (1)$$

where $R_{i,t}$ represents firm i's return on day t, C_{0i} is a constant, C_{1i} is the firm's return autocorrelation estimate, and $V_{i,t}$ is the firm's volume innovation. Here, volume is represented by the stock's daily turnover, which is defined as the day's trading volume divided by the number of shares outstanding. Since daily turnover series are non-stationary, we use the logarithm of the series which we detrend by subtracting the 50-day moving average log-turnover after adding a small constant to avoid problems with zero volumes. The detrending process is modeled as follows:[6]

$$V_t = \text{Log}(\text{Turnover}_t) - \frac{1}{50}\sum_{-50}^{-1} \text{Log}(\text{Turnover}_{t+s})$$

where:

$$\text{Log}(\text{Turnover}_t) = \text{Log}(\text{Turnover}_t + 0.00000255).$$

[6] Llorente, Michaely, Saar, and Wang (2002) and Campbell, Grossman, and Wang (1993) employ a 200-day moving average. To ensure that our inferences are not influenced by the length of the detrending window, we conducted our whole experiment with a 100-day moving window as well and obtained results that are qualitatively similar to those reported below in Section 4.

The relative importance of speculative and allocational trading for a stock is revealed by C_{2i}, the coefficient associated with the lagged-volume-return interaction. This parameter will be negative and statistically significant if trading in the stock is predominantly motivated by allocational considerations, and it will be positive and significant if the stock is strongly associated with informational trading. If neither allocational nor speculative trading dominates overall trading activity in the stock, then C_2 will be close to zero and statistically insignificant.

The second stage of the experiment proceeds with the following cross-sectional regression in which the vector of C_2 coefficients obtained from the time-series regressions is regressed on the vector of information-asymmetry measures for each firm:

$$C_{2i} = a + b \cdot A_i + e_i \qquad (2)$$

C_{2i} is as defined in (1) above and A_i is a proxy for the degree of information asymmetry of firm i. Following Llorente, Michaely, Saar, and Wang's (2002), we use the firm's market capitalization as a proxy for its degree of information asymmetry. The model predicts that the sign associated with the slope of this regression is negative when size proxies for A_i because, the smaller the firm's market capitalization, the greater the degree of information asymmetry, and the more positive C_2 is. Even though market capitalization has been shown to be a useful proxy for information asymmetry in the domestic context [Lo and MacKinlay (1990)], it may not necessarily be the case in the context of foreign firms cross-listed in U.S. markets as many of these firms tend to be very large relative to their domestic peers [see, among others, Pagano, Roell and Zechner (2002); Doidge, Karolyi and Stulz (2004)]. Since price discovery is more likely to be taking place in the home market when a cross-listed stock is traded more predominantly at home [Eun and Sabberwal, (2003), Grammig, Melvin and Schlag (2005)], we use the U.S. stock's illiquidity measure [Amihud (2002)] as an alternative proxy for information asymmetry. When the firm's illiquidity measure is used as a proxy for A_i in equation (2), we expect the slope coefficient, b, to be positive. Although Llorente, Michaely, Saar, and Wang (2002) devote much more attention to C_2, their model also has implications for C_1. This coefficient captures the autocorrelation of returns holding volume at its average level. In their proposition 3 (p. 1014), the authors show that C_1 increases when the degree of information asymmetry associated with the stock decreases. We also do not explore cross-sectional tests based on C_1.

B. The International Spillover Tests

We extend the Llorente, Michaely, Saar, and Wang (2002) model to the international setting in order to highlight the link between information asymmetry and return spillovers across markets. We examine this relationship in both directions and separately for each of our sample of 556 firms. First, we tackle the home-to-U.S. market return spillovers by estimating the following time-series regression for each one of our sample firms:

$$R_{i,t}^{U.S.} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{U.S.} + C_{2i} \cdot V_{i,t-1}^{U.S.} \cdot R_{i,t-1}^{U.S.} + C_{3i} \cdot R_{i,t-1}^{H} + C_{4i} \cdot V_{i,t-1}^{H} \cdot R_{i,t-1}^{H} + \beta_{i,U.S.} \cdot R_{U.S.,t-1} + \beta_{i,H} \cdot R_{H,t-1} + \beta_{i,FX} \cdot R_{FX,t-1} + e_{i,t-1}, \quad (3)$$

The superscripts "H" and "U.S." for the returns, R_{it}, (volume, V_{it}) denote those associated with the home-market shares, R_{it}^{H} (V_{it}^{H}) and those of the U.S.-traded cross-listed shares, $R_{it}^{U.S.}$ ($V_{it}^{U.S.}$), respectively. In this equation, C_0, C_1, and C_2 are interpreted in the same way as the domestic version of the model presented in equation (1). C_3 captures the return spillover from the home-market shares during the preceding trading period, R_{it-1}^{H}, to the next-day U.S. market return.[7] C_4 is the volume-return interaction emanating from the home market that can spill over to the returns of the U.S. cross-listed share. Since return spillovers from the home market to the U.S. cross-listed stocks can be attributed to aggregate shocks at home, in the U.S., and/or in the foreign currency market, we control for these market wide sources of cross-autocorrelation by including home market index returns ($R_{H.,t-1}$), U.S. market index returns ($R_{US,t-1}$), as well as foreign currency returns ($R_{FX,t-1}$) on the right-hand side of this equation. This specification is designed to provide as fine a resolution as possible on the implications of the home-market's dynamic volume-return relationship for U.S. cross-listed stock return spillovers and to reduce the upward bias in the C_2 estimates that may arise if the error terms from the time-series regressions are correlated across stocks [Jorion (1990)].

Second, we examine the volume-return spillover relationship originating in the U.S. market for the home-market returns, by estimating the time-series regression equation (4) which mirrors equation (3):

[7] The extent of the time delay will depend on the 24-hour conventions adopted for the trading day and, of course, the region of the home-market of the particular stock. These conventions will be outlined in detail in the next section.

$$R_{i,t}^{H} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{H} + C_{2i} \cdot V_{i,t-1}^{H} \cdot R_{i,t-1}^{H}$$

$$+ C_{3i} \cdot R_{i,t-1}^{U.S.} + C_{4i} \cdot V_{i,t-1}^{U.S.} \cdot R_{i,t-1}^{U.S.} + \beta_{i,U.S.} \cdot R_{U.S.,t-1} + \beta_{i,H} \cdot R_{H,t-1} + \beta_{i,FX} \cdot R_{FX,t-1} + e_{i,t-1}, \qquad (4)$$

In the spirit of the Llorente, Michaely, Saar, and Wang (2002) model, we hypothesize that speculative trades in individual stocks originating in the home (U.S.) market have a greater tendency to continue themselves in the U.S. (home) market and, conversely, that risk-sharing trades originating at home (in the U.S.) exhibit a lesser tendency to continue themselves in the U.S. (at home). If the theory helps explain the dynamics of stock return spillovers, we expect the cross-sectional variation in the international volume-return dynamics across markets to be related to the extent of speculative trading in the stock. Hence, in the cross-sectional analysis, C_4, like C_2 in the domestic regression analysis, should be positively related to the degree of information asymmetry characterizing the stock. As for coefficient C_3, like C_1, we have no strong priors but, based on existing evidence on home-market dominance in price discovery for cross-listed stocks [Eun and Sabberwal (2003), Grammig, Melvin and Schlag (2005)], we expect the sign of this coefficient to be positive overall and its magnitude to be greater in the home-to-U.S.-market direction than in the U.S.-to-home-market direction. Beyond this expectation, it seems sensible that the magnitude of the spillover coefficients, C_3, could be linked to different firm-specific and country-level proxies for information asymmetry, so we offer some empirical results. However, in the end, we have no theory to guide us. We now turn to a detailed description of our data and sampling procedure and then, in Section 4, we present our results.

3. Data and Sampling Procedure

A. Sample and Data Sources

Our sample construction begins with the complete list of foreign stocks listed in the U.S. either in the form of American Depositary Receipts (ADR) or in the form of ordinary programs, such as for Canadian cross-listings, which are available in the Thomson Financial's Datastream database at the end of May 2002. Since our focus is on exchange-listed ordinary shares, we retain ADRs classified as exchange-listed Level II and Level III (capital-raising) programs and exclude over-the-counter issues (Level I ADRs), as well as Securities and Exchange Commission (SEC) Regulation S shares and private placements issues falling under SEC Rule 144a. We also exclude preferred shares, Real Estate Investment Trust units and other issues denoted as "Units" or "Funds" by Datastream. Cross-listed stocks with no home-market counterpart available in Datastream and stocks with no Datastream home-market stock code are also discarded. After applying these screens, we identify a sub-set of 607 potential home-U.S. pairs. We obtain daily closing price, volume, and market capitalization series for each pair from Datastream for the period starting on January 1, 1990 and ending on May 31, 2004. We then discard issues with missing or corrupt price, volume, or market capitalization data for the entire period.[8] As soon as Datastream stops covering a series due to a merger, an acquisition, a delisting, or any other event, we set all subsequent price and volume observations to a missing value. We ascertain the accuracy of our home-U.S. stock matching process by cross-referencing each issue with the Bank of New York (BONY) Complete DR Directory[9] and/or SEC 20F filings. We also validate each ADR bundling ratio inferred from Datastream series and, in some cases, fill-in missing ratios using these two sources of information.

With the exception of Canadian and most Latin American stocks, daily closing price series retrieved from Datastream for the home and the U.S. market are not synchronous. When the two markets do not close at the same time, we use the mid-point between the bid and the asking price of the U.S. cross-listed share observed at the close of the home market or the first available mid-point quote (within 30 minutes) after the home market closes. Intra-day bid and ask quotes are obtained from the NYSE Trade and Quote (TAQ) database and are only available from the beginning of 1993, which reduces our sample period by three years. For each country, we use Datastream national equity index series to proxy the market portfolio. For the U.S., since we need coincident market and price quotes in both markets, we use intra-day bid-ask quotes for Standard & Poor's 500 Depositary Receipts (SPY) listed on AMEX which are also drawn from the TAQ database. TAQ initiates coverage for SPY on February 1, 1993, so this reduces our sample period by one more month. We obtain our exchange rate series from Datastream and, in order to

[8] Our ability to measure the role of information in the volume-return dynamics depends critically on the integrity of our daily market capitalization series. Market capitalization appears in the denominator of the turnover measure and, in turn, changes in turnover impact our turnover innovation estimates directly. We detected unusually high turnover levels in many home-markets as well as U.S. series and realized that this pattern was due to recording errors in the Datastream market capitalization series for new issues. As a result, we screened each series carefully to identify these errors and substituted a missing value code when erroneous market capitalization entries were encountered.

[9] This comprehensive dataset is available on BONY's ADR web site (www.adrbny.com).

maximize the extent of synchronicity between home and U.S. prices, we translate home market prices into U.S. dollars at the exchange rate prevailing at the time of closing in the home market.[10]

A third important attribute of our analysis is that we partition the time series for each stock into calendar quarters instead of the complete time series of returns available. We do this because we are concerned about changes over time in the structure of the joint dynamics of returns and volume across these markets. In addition to influence of changes in the overall economic and capital market environment, there are at least two reasons to worry about structural instability over time. First, our sample includes firms from a number of emerging economies that liberalized their markets over our period of analysis. In fact, there is a significant increase in the number of firms from emerging and developed markets that comprise our sample during the 1990's. Several studies have shown that these liberalization events have a profound impact on the returns, return volatilities and their global market correlations [among others, Bekaert and Harvey (1995), Bekaert, Harvey and Ng (2005)]. Second, several regional markets experienced major financial crises over this period of analysis, including the Peso currency devaluation of 1994, the Asian financial crisis of 1997 and the Russian default in 1998. A number of studies have shown how these events have perturbed correlations and cross-correlations of international stock returns [Forbes and Rigobon (1999)]. As a result, we conduct our analysis per firm by quarter and conduct our regression analysis in a cross-sectional, time-series panel by firm quarters. We justify choosing a quarter to balance the risk of instability over time in the correlation structure of home- and U.S.-market returns with sufficient numbers of trading days (maximally 67 days per quarter) to render sufficient statistical precision to the parameter estimates in equations (1) and (3) above.

[10] We define the lagged returns and trading volume for models (1) and (3) differently for different stocks depending on where the home-market trading hours lie in a 24-hour period. For U.K. stocks, for example, London trading hours close at 4:30 p.m. (Greenwich Mean Time) or 11:30 a.m. in New York (Eastern Standard Time) where the ADRs of U.K. stocks trade. In this case, the U.S. ADR returns, $R_{it}^{U.S.}$, are defined for a 24-hour period from 11:30 a.m. yesterday (t-1) to 11:30 a.m. today (t) and that of the preceding day's returns (volume) in the home market, $R_{i,t-1}^{H}$ ($V_{i,t-1}^{H}$), are based on close-to-close returns (intraday trading) in London that corresponds to 11:30 a.m. two days back (t-2) to 11:30 a.m. yesterday (t-1). We are able to employ similar approaches for all European, African and Middle Eastern stocks that trade with five- or six-hour differences from Eastern Standard Time; Asian markets, however, with at least 12-hour differences from New York, have perfectly non-synchronous trading with the U.S. markets. For these markets, we compute U.S. market returns based on the open-to-open bid-ask spread midpoints, an imperfect solution as the Asian markets closing may have taken place up to seven hours earlier.

In the end, our screening process distills our sample down to 566 firms from 37 developed and emerging countries with shares listed simultaneously in their home market and in the U.S. with a total of 18,845 firm-quarters. Given the growing popularity of ADR programs and other cross-listings in the U.S. market during the 1990's, relatively few firms are present in our sample throughout the entire sample period and, in many instances, we notice episodes of non-trading either at home, in the U.S., or in both markets. In order to mitigate this data limitation and to safeguard the quality of our inferences, we exclude all firm-quarters with less than 24 valid observations from our analysis. We define a valid observation as one for which the return in the home and the U.S. stock is based on two consecutive non-zero trading volume days. This additional screen delivers a final sample of 556 firms and 12,935 firm-quarters representing 36 countries. Our final sample period starts on February 1, 1993 and ends on May 31, 2004.

Descriptive statistics for our sample are reported in Table 1. Our sample exhibits a considerable degree of dispersion, both from a geographic and industry standpoint. In Table 1, we provide a breakdown of our sample by country, industry and by year. Of the 556 firms included in our sample, 144 (25%) are domiciled in 17 emerging market countries, so defined according to The Economist Intelligence Unit. Of the 36 countries represented in our sample, Canada has the largest number of issues (137), followed by the UK (82), France (30), Japan (28), the Netherlands (26), Brazil (26), Mexico (22), Germany (20), and Hong Kong (20). Of the five regions represented in our sample, Europe is home to the largest number of firms with 227 firms or roughly 41% of our sample. Next largest is Canada with 137 firms or 25% of our sample, followed by Asia with 93 firms (17%), Latin America with 83 firms (15%) and finally, Africa and the Middle East with 16 firms (3%). The rapid growth in U.S. cross-listings during the 1990's and the subsequent wave of de-listings in the early part of this decade is evident in Panel B.[11] Our sample begins with 94 firms in 1993 (mostly Canadian ordinary shares) and expands quickly to 504 firms in 2005. Panel C reveals the diverse industrial make-up of our sample with representation from 55 industry sub-sectors based on the Standard & Poor's two-digit Global Industry Classification Standard (GICS). Of this total,

[11] Karolyi (2006) reports 150 net delistings between 2002 and 2004. Witmer (2005) investigates the factors motivating foreign firms to voluntary de-list their shares from the U.S. market and shows that firms experience a 5%-6% negative return around the delisting announcement.

Diversified Telecommunication Services (50), Metals and Mining (37), Media (31), Banks (28), Software (26), and Oil and Gas (25) are among the largest groups represented in our sample.

B. Summary Statistics

In Table 2, we present summary statistics for our entire sample as well as for three sub-groups based on market value. For each firm-quarter, we measure size (*Avg. Market Value*) as the daily average market capitalization (number of shares outstanding multiplied by the daily closing price) over the quarter. The average market capitalization for the firm-quarters included in our sample ranges between $1.11 million and $279.59 billion. The average market capitalization is $312 million, $2.74 billion, and $26.64 billion for the small, medium, and large group, respectively. On the size dimension, our sample fits comfortably within the top two size quintiles of Llorente, Michaely, Saar, and Wang (2002)'s sample. This is not a surprise since cross-listed firms tend to be fairly large. For each firm-quarter, we calculate the average daily trading volume (*Avg. Volume*), average daily share turnover (*Avg. Turnover*), and average daily closing price (*Avg. Price*) for the home stock as well as for the U.S. cross-listed stock and present sample summary statistics in the last six columns of Table 2. Turnover is the number of shares traded on a given day relative to the total number of shares outstanding. As shown in columns 4 and 6 for the home market and in columns 7 and 9 for the U.S. market, average trading volume and share price increase with firm size. Average turnover, on the other hand, does not increase with firm size. In the home market, it hovers around 0.35% across the three size groups while in the U.S., average turnover drops dramatically from 0.34% for the small firm group to 0.09% for the large firm group. In constrast, Llorente, Michaely, Saar, and Wang (2002) reported an increase in turnover from 0.27% for their smallest quintile to 0.36% for their largest quintile. Considering the evidence indicating that larger cross-listed firms tend to trade more actively at home than in the U.S. [Baruch, Karolyi and Lemmon (2006), Halling, Pagano, Randl, and Zechner (2004)], it is not surprising to observe a negative relationship between U.S. turnover and firm size.

4. Empirical Evidence

In this section, we report test results which identity patterns in the cross-section of return autocorrelation for individual cross-listed stocks. Our goal is to understand how these patterns relate to the underlying information asymmetry among investors. Our first set of results focus on the domestic setting, so we report our results for the home-market stocks and their U.S. cross-listed counterparts separately. Our second set of results focus on return spillovers between the home market and the U.S. and examine how information asymmetry stemming from the home market impacts these spillovers. Our domestic tests are based on equation (1) employed by Llorente, Michaely, Saar, and Wang (2002) and our spillover tests are based on equations (3) & (4) which expand equation (1) to allow for the cross-market influences of returns and volume-return spillovers between the home and U.S. market.

A. Domestic Test Results

In Table 3, we report time-series and cross-sectional regression results for home-market stocks and for U.S. cross-listed stocks. For each firm-quarter, we estimate two time-series regressions: one for the stock trading in the home market and one for the U.S. cross-listed stock. We report results from these two sets of regressions separately. In total, we run 12,935 time-series regressions for each group. Then, we collect the two sets of volume-return interaction coefficient estimates, C_2, from these time-series regressions and regress each of them against firm size which serves as proxies for information asymmetry. In Panel A, we present summary statistics for both sets of time-series regression coefficients (C_0, C_1, C_2, R^2, F-statistics, and average number of daily observations per regression) for the whole sample as well as for three equal-sized groupings (small, medium, and large). In the top section of Panel A which focuses on the home stocks, the negative relation between firm size and the volume-return interactions, C_2, predicted by Llorente, Michaely, Saar, and Wang (2002) is evident both in terms of the mean value of C_2 (-0.0044 for small firms versus -0.0288 for medium firms) and in terms of the number of firm-quarters with negative C_2 (2,157 for small firms and 2,328 for medium firms). However, contrary to expectations, the mean value for C_2 among large firms (-0.0256) is slightly higher than that for medium-sized firms (-0.0288). A similar pattern exists between the number of large and medium-sized firms with negative C_2 (2,298 versus 2,328, by firm-quarter). However, given that the mean value for C_2 among large firms is much smaller than for small firms (-0.0256 < -0.0044), one would be ill advised to interpret this apparent lack of monotonicity in the relation between firm size and C_2 as evidence contradicting the model. Our position is motivated in part by the evidence presented in the bottom section of Panel A which focuses on the cross-listed stocks. Here, we observe a very clear monotonic relationship between firm size and the volume-return interaction coefficients. The mean value of C_2 increases from -0.0061 for small firms, to -0.0173 for medium-sized firms, to -0.0247 for large firms. In terms of the count of firm-quarters with negative C_2, the pattern that we observe among cross-listed stocks is also basically consistent with theory (1,988 for small, 2,267 for medium, and 2,235 for large firms).

By and large, our categorical analysis supports the model's predictions in that, from one day to the next, price changes occurring on a given day are much more likely to continue over the next trading day when they are associated with a higher degree of information asymmetry. We complement our categorical analysis of Panel A with a formal statistical test of this proposition which rests on Fama-MacBeth (1973) cross-sectional regressions of equation (2).[12] If the theory holds, we expect b, the regression coefficient associated with firm size on the right-hand side of equation (2), to be negative. We estimate equation (2) with two measures of firm size: the logarithm of market capitalization and market capitalization quartiles. Results from this estimation are reported in Panel B. Regardless of the way in which we measure firm size, our regressions have a negative and statistically significant coefficient (at the 1% level or higher). For instance, when we measure size as the logarithm of market capitalization in column (1), the slope coefficient in the regression for the home-market stocks is equal to -0.006 and the associated t-statistic is equal to 3.479. In column (2), when firm size is represented as a categorical variable as opposed to market capitalization, the slope coefficient is equal to -0.010 and the t-statistic is equal to 2.682. As for the cross-listed stocks regression, we report similar results though they are more reliably statistically significant that their home-market counterparts. The slope coefficients reported in columns (3) and (4) of Panel B are both negative (-0.010 and -0.020) but their associated t-statistics (5.676 and 5.970) are higher than their

[12] The two-pass Fama-MacBeth procedure for running cross-sectional regressions, with associated standard errors for inference tests, involves a first-pass time-series regression (as we have done by quarter firm-by-firm) and then a second-pass cross-sectional regression by quarter across firms. The coefficients from the cross-sectional regressions are averaged across quarters and the standard deviations of the cross-sectional regression estimates are used to generate the standard errors for these estimates. The strength of the procedure lies in its correction for cross-sectional correlation, which panel regressions even with firm fixed or random effects ignore (Cochrane, 2001, p. 245-250).

counterparts in columns (1) and (2). We note that the explanatory power of the cross-listed stock regressions is slightly higher than that of the home-market stock regressions (14% versus 11%).[13]

Thus, in a domestic context, our findings offer support for the predictions of the Llorente, Michaely, Saar, and Wang (2002) model. Of course, firm size is only one of many potential measures of information asymmetry that may be brought to bear in order to test the validity of the volume-return relationship proposed by Llorente, Michaely, Saar, and Wang (2002). In their original study, the authors consider two alternative proxy variables, namely the stock's bid-ask spread and the number of analysts following the stock. The cross-country nature of our sample also suggests a number of plausible proxies for information asymmetry that are inspired by previous empirical studies. We consider twelve such variables, including six country-level variables and six firm-level variables. Firm size, *Ln(Market Value),* we have already examined. Our six country-level variables are per-capita GDP, *Ln(PCGDP)*, an index of accounting standards, *AS*, an index of legal protections for minority shareholders, *Legal*, a measure of openness for foreign investors, *Capital Controls*, a measure of the level of transactions costs in the home market, *Ln(Total Cost)*, and a dummy variable for economic development, *Emerging*. Our five additional firm-level variables include two proxies for market liquidity (*Home Illiquidity*, *U.S. Illiquidity*), a measure of the competition for trading in the two markets, *Home Share of Turnover*, and a proxy for U.S. investor interest through institutional holdings, *U.S. Institutional Ownership*, and a proxy for information asymmetry in terms of analyst coverage, *Ln(Home Analysts)*.

Ln(PCGDP) is the natural logarithm of per-capita GDP assembled by the Economist Intelligence Unit and retrieved via Datastream. We expect this variable to be inversely associated with information asymmetry since richer countries are usually endowed with a richer information environment. Accounting standards, *AS*, and the efficiency of the judicial process, *EJ,* are country-level indices compiled by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) that quantify the extent of transparency and legal protections for minority investors in a given country. Our *Legal* variable represents a composite measure of the quality of investor protections in a given country which we construct by taking the product of Spamann's (2006) re-

[13] The R^2 statistics reported throughout our regression tables are provided for indicative purposes only. These coefficients are extracted from separate panel-data regressions estimated on the full sample that include either country (or region) and quarter-year dummy variables.

coded anti-director rights index (*ADRI)* and La Porta, Lopez-de-Silanes, Shleifer and Vishny's (1998) *EJ* variable. Legal is a measure which recognizes that investor protections are jointly dependent on the existence of laws protecting investors and on their enforceability. We expect this variable to be positively associated with the degree of information asymmetry in a particular country. *Capital Controls* represents the fraction of a country's equity market capitalization that is not accessible to foreign investors [Bekaert (1995), Edison and Warnock, (2003)]. We calculate this measure annually from Standard & Poor's (S&P) Emerging Markets Database for each emerging market included in our sample and set its value to 0 for developed countries. *Ln*(*Total Cost)* is a country-level measure of trading costs (in basis points) which is compiled by Elkins/McSherry LLC.[14] This measure includes commissions, fees, market impact costs, excise taxes applicable to equity transactions, as well as taxes imposed on trading commissions during our sample period [Pollin, Baker, and Schaberg (2002)]. *Emerging* is an indicator variable set to one when a country is classified as emerging by the Economist Intelligence Unit and to zero, otherwise. We expect these three proxy variables for market restrictions and friction to be positively correlated with information asymmetry.

Among our firm-level proxies for information asymmetry, *Home Illiquidity* and *U.S. Illiquidity* constitute measures of the daily price impact of the order flow in the home and in the U.S. market, respectively. We calculate this measure for each firm-quarter by averaging its daily absolute-return-to-dollar-value-of-trading ratio over the number of days for which data is available during the quarter, as per Amihud (2002).[15] Given the positive relationship between illiquidity and information asymmetry, we expect the coefficients associated with these two measures to be positive. *Home Share of Turnover* measures the percentage of a firm's average aggregate turnover which is captured by its home market and constitutes a measure of the location of trading. If location of trading is a useful indicator of the location of price discovery [as shown by Eun and Sabberwal (2003), Grammig, Melvin and Schlag (2005)], then we would expect the higher fraction of trading captured by the home market to act as a useful proxy for information

[14] We are grateful to Richard McSherry for originally supplying this country-level data to us. Details on methodology of data construction are available at www.elkinsmcsherry.com.

[15] There are many critics of the reliability of this Amihud (2002) measure of illiquidity. For example, Bessembinder and Kalcheva (2006) show that there is an inherent bias in the proxy that leads to a spurious inference that illiquidity is priced in the cross-section of average returns.

asymmetry surrounding the stock from the perspective of a U.S. investor. *U.S. Institutional Ownership* represents the percentage of a firm's shares outstanding which are held by institutional investors and is extracted from the Thomson Financial/Spectrum database (a compilation of 13F filings to the SEC). Since institutional (and especially foreign institutional) investors tend to focus on larger, highly visible, and more transparent firms [Gompers and Metrick (2001), Bradshaw, Bushee and Miller (2004)], we expect the degree of informed trading in a stock to be inversely related to this variable. Finally, *Ln*(*Home Analysts)* is based on the number of estimates underpinning the one-fiscal-year-ahead (FY1) earnings-per-share (EPS) consensus analyst forecasts published in the I/B/E/S International Summary database. If the amount of information available to investors in positively related to the number of analysts following the stock in the home market, we anticipate a negative relationship between C_2 and this variable. Summary statistics for these country-level and firm-level variables are provided in Table 4.

As with firm size, we estimate the cross-sectional regression model using Fama-MacBeth two-pass methods from equation (2) with each one of our supplementary proxies for information asymmetry and report results from these regressions in Table 5. Regression results from our country-level proxies are in Panel A and those from our firm-level proxies are presented in Panel B. The first six columns of each panel are for the home-market stock regressions while the last six columns contain results from the cross-listed stock regressions. In Panel A, the only proxy that stands out in the home-market regressions is *Emerging* with a regression coefficient equal to -0.032, which is statistically significant at the 5% level, based on its t-statistic. Since emerging markets are usually prone to a greater degree of information asymmetry than their more developed counterparts, we expected the sign of this coefficient to be positive rather than negative. Turning to the cross-listed stock regressions, which are presented in columns (7) through (12), three of our proxies are statistically significant and the coefficients associated with these variables all have the expected sign. Notably, the coefficients for *Ln(PCGDP)*, *Capital Controls*, and *Emerging* are equal to -0.015, 0.080, and 0.041, respectively, with statistical significance at the 5%, 1%, and 5% levels, respectively. Compared to our firm size regressions of Table 3, our country-level variables have much less explanatory power. The average adjusted R^2 from our country-level regressions range between 3.3 and 3.8%, which is low considering that regional dummies are included in the panel regressions.

In Panel B, we report cross-sectional regression results for our firm-level proxies for information asymmetry. For the home stock regressions reported in the first six columns of this panel, we find that the regression coefficients associated with our proxies all have the sign predicted by theory. Of the six variables included in our set, three are statistically significant and they are significant at the 1% level. The first variable is *Ln(Market Value)*, which we examined in Table 3. The other two proxies for information asymmetry which stand out as highly significant are *Home Illiquidity*, and *U.S. Illiquidity* with coefficients equal to 0.958 and 0.457, respectively. Therefore, the more illiquid the stock, the greater the degree of information asymmetry which surrounds it, and the higher its propensity to exhibit price continuations from one day to the next. As for the cross-listed stock regressions (columns (7) through (12)), our findings are equally supportive of the theory's predictions but we note some interesting differences. For example, *Home Illiquidity* is no longer statistically significant but, this time, *U.S. Institutional Ownership* and *Ln(Home Analysts)* are highly statistically significant (1% level) and, consistent with Llorente, Michaely, Saar and Wang's theoretical predictions, both have a negative sign. The coefficients associated with these variables are equal to -0.068 and -0.017, respectively. At the risk of overstating the reliability of our R^2 estimates, we note that our firm-level proxies have a slightly higher degree of explanatory power in the U.S. context than in the home market. Furthermore, our results indicate that our firm-level variables have more explanatory power than our country-level proxies. Overall, the evidence presented in Table 5 adds further support to the Llorente, Michaely, Saar, and Wang (2002) model. In the next section, we extend their framework to an international setting in order to examine the impact of information asymmetry on international stock return spillovers.

B. Volume-Return Relation and Home-to-U.S. Return Spillovers

Arguably, our study has one distinct advantage over previous investigations of international stock return spillovers. Since we rely on individual firms whose shares are listed simultaneously in two markets, and since the stocks traded in both markets represent an identical claim to the same underlying cash flows, we are able to examine return spillovers in both directions outside of the confines of a particular equilibrium model of expected returns. Therefore, by removing the confounding influence of risk on return comovements across markets, we are able to isolate the impact of information asymmetry on the dynamics of international return spillovers. In this subsection, we focus on the time-series regression equation (3) which examines spillovers from the home market to the U.S. market for each of 12,935 firm-quarters included in our sample and, in the following subsection, we examine return spillovers in the other direction, - from the U.S. market to the home market - by way of equation (4). Again, as we emphasized in Section 2, by controlling for the influence of market-wide returns at home, in the U.S., as well as in the foreign exchange market, equations (3) and (4) allow us to measure the firm-specific return and volume signals originating in each market with greater precision.

As in the domestic tests, we first present a categorical analysis of our time-series regression (3) results in Table 6 and we continue with cross-sectional regression results in Table 7. Our categorical analysis is divided into three parts. In Panel A of Table 6, we examine the properties of our time-series regression coefficients [equation (3)] for three firm-level proxies for information asymmetry shown above to have some explanatory power in the domestic tests: firm size, the number of analysts in the home market, and the cross-listed stock's illiquidity measure in the home market. As in Table 3, each section consists of three groups of equal size which are formed by sorting our 12,935 firm-quarters from high to low information asymmetry given the proxy variable under consideration. For each information proxy, we report the mean regression coefficient estimates, the number of negative regression coefficients, as well as the number of firm-quarters included in each of the three groups.

Although the two parameters of interest in this part of our experiment are the model's cross-autocorrelation coefficients, C_3, as well as the home-to-U.S. volume-return interaction coefficients, C_4, we note that the U.S. market volume-return interaction, represented by C_2, is again monotonically increasing with the degree of information asymmetry (using each proxy of firm size, the number of home-market analysts and Home. Iliquidity). This result corroborates the evidence from our cross-listed stock regressions presented in Table 3. In Table 6, we observe a similar monotonically increasing pattern in the C_3 coefficients also with respect to these three proxies for information asymmetry. We find that stock return spillovers (C_3 coefficient) are positive on average and increasing with respect to size, number of analysts, and home-market liquidity. The mean cross-autocorrelation coefficient is equal to 0.2951, 0.3198, and 0.3637 for small, medium, and large firms, respectively, and the corresponding number of firm-quarters with a positive C_3 coefficient is 785, 829, and 855, respectively. For the whole sample, the mean value of C_3 is positive (0.3262), which confirms the findings from earlier investigations of international return spillovers.[16] However, these studies are based on aggregate stock returns. Here, we disaggregate stock returns to the firm level and we find not only that return spillovers are positive on average but also that the magnitude of these spillovers is inversely related to the degree of information asymmetry characterizing the stocks in the home market. This means that a price change in the stock in the home market on day *t* is more likely to be followed by a price change in the same direction in its U.S. cross-listed counterpart on the next trading day *t+1* if the underlying firm is larger, if it has more analyst coverage at home, and if the stock is more illiquid at home. In other words, price continuations from the home market to the U.S. market are more likely when trading in the home market is more likely to be informational. This finding is also consistent with the flow-back documented by Halling, Pagano, Randl, and Zechner (2004). Their evidence shows that larger cross-listed firms tend to be traded more heavily at home than in the U.S., especially within a few years following the initial U.S. listing.[17] If price discovery is related to location of trading and information production, the degree of information asymmetry facing U.S. investors trading in the cross-listed stock will be proportional to the firm's size, the number of analysts following the stock at home, and the stock's illiquidity at home. The evidence presented in the thee panels of Table 6 provides support for this hypothesis.[18]

Turning to the home-market volume-return spillover interactions represented by coefficient C_4, we observe a negative mean value of -0.014 across our entire sample (Panel A). Therefore, on average, return

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[16] Consider King and Wadhwani (1990), Theodossiou and Lee (1993), and Lin, Engle, and Ito (1994), among others. Gagnon and Karolyi (2006) offer a comprehensive survey of the price and volatility transmission literature.

[17] Karolyi (2003) examines flow-back in the context of a case study of DaimlerChrysler following their 1998 merger. This phenomenon has become an important concern among cross-listed firms in recent years since the implementation of the Sarbanes-Oxley Act in 2002. A Darden case study by Chaplinsky and Wang entitled "Fisher & Paykel Industries Ltd Restructuring" explores the strategic implications of flow-back for firms seeking to cross-list their shares in the U.S.

[18] Although, it is not the focus of our empirical investigation, note that the negative relation between illiquidity and C_1 in Table 6 is consistent with the findings from several studies investigating the properties of short-horizon return autocorrelations [e.g., French and Roll (1986), Lo and MacKinlay (1988), Conrad, Kaul, and Nimalendran (1991), Jegadeesh and Titman (1995), Canina, Michaely, Thaler, and Womack (1998)]. This result is also consistent with the notion that the market takes more time to capitalize information into prices when the stock is subjected to a higher degree of information asymmetry [French and Roll (1986)].

shocks emanating from the home market have a moderating influence on the (positive) return spillovers between home and the U.S. documented earlier. In theory, if Llorente, Michaely, Saar, and Wang's (2002) model is useful in explaining the dynamic cross-market volume-return relationship, we expect liquidity-induced price changes originating at home to have a tendency to reverse in the U.S. while we expect the opposite effect to prevail (price continuation) when the price change is driven by information. Therefore, in the cross-section, we expect C_4 to be higher for high-information asymmetry stocks and lower for low information-asymmetry stocks. Across firm-size groupings, Panel A of Table 6 reveals a non-linear pattern in the mean values of C_4 (-0.0092 for small firms, -0.0264 for medium-sized firms, and -0.0063 for large firms) which is also present in the number of firm-quarters with a negative coefficient C_4 within each group. The same unexpected pattern emerges in Panel B where we sort on the number of analysts following the stock at home. The mean value of C_4 is equal to -0.0139, -0.0161 and -0.0136 for firms with small, medium, and high analyst following. Based on this theory, we would expect a negative monotonic relationship to prevail between C_4 and these two variables. However, given that our categorical analysis is based on univariate sorts that do not distinguish between large firms in low- and high-quality information environments, these non-monotonic patterns may be induced in part by the flow-back phenomenon discussed above. In Panel C, where we sort on home illiquidity, we observe a clearer decrease in C_4 from the most highly illiquid group (-0.0112) to the most liquid group (-0.0195).

To now, our evidence uncovers reveals an interesting and important pattern in the cross-section of international stock return spillover coefficients. Return spillovers from the home market to the U.S. are not only positive, on average, but they are more intense for stocks in which U.S. investors are at an informational disadvantage compared to investors in the home market. Our categorical analyses also suggest that volume shocks in the home market are more likely to be reversed in the U.S. when the degree of information asymmetry characterizing trades in the home market is low. We now turn to our cross-sectional regression analysis.

In Table 7, we present results from Fama-MacBeth cross-sectional regressions. We estimate two sets of six univariate regressions on country-level and firm-level information proxies: one set with C_3 as the dependent variable and another set with C_4. As in Table 5, both sets of results are presented side-by-side in each panel of the table. In Panel A, we find that return spillovers, measured by C_3, are positively related to the quality of the information environment in the home country. Columns (1) and (2) show a strong and positive association between C_3 and per-capita-GDP [slope coefficient b, equation (2), equals 0.059 and t-statistic of 6.867] and accounting standards [b equals 0.003 and t-statistic of 3.660] and columns (4), (5), and (6) reveal a strong and negative association between C_3 and capital controls [b equals -0.295 and t-statistic of 7.036], trading costs [b equals -0.050 and t-statistic of 4.492], and the emerging market dummy [b equals -0.111 and t-statistic of 6.010]. Therefore, we observe stronger return spillover effects from the home market to the U.S. when U.S. investors are more likely to be at an informational disadvantage compared to investors in the home market. A consistent, but statistically weaker, pattern is observed in the volume-return interactions, C_4, reported in columns (7) through (12). We document a greater propensity for return continuations in the U.S. following high-volume days in the home market when home-market returns are more likely to be informative. Indeed, we report a positive association between C_4 and per-capita GDP [b equals 0.011 and t-statistic of 1.599], accounting standards [0.001, t-statistic of 1.883], as well as the legal environment variable [0.001, t-statistic of 2.192] and we observe a negative, though weekly significant relation between C_4 and the emerging market dummy variable [-0.019, t-statistic of 1.492]. We also note that the volume-return interactions shown in columns (7) through (12) are modest in size compared to the return spillover effects reported in the first six columns of Panel A.

In Panel B of Table 7, we examine the relation between C_3 and C_4 and the firm-level proxies for information asymmetry and we draw inferences that are consistent with the ones revealed in Panel A with respect to the country-level proxies. Return spillovers from the home market tend to be stronger with firms for which U.S. investors are more likely to be at an informational disadvantage compared to investors in the home market, and returns coincident with a large volume shock originating in the home-market are more likely to continue into the U.S. market when the likelihood of informed trading at home is high in relation to the U.S. Indeed, we observe a statistically reliable and positive relationship between return spillovers, C_3, and firm size, home share of aggregate turnover, as well as with the number of analysts following the stock in the home market and we observe a strong and negative relationship between C_3 and home illiquidity and U.S. institutional ownership. The slope coefficients for firm size, *Home Share of Turnover*, and *Home*

Analyst are equal to 0.015, 0.294, and 0.037, respectively, with reliable t-statistics of 5.695, 15.802, and 4.899, respectively. With respect to *Home Illiquidity* and *U.S. Institutional Ownership*, the slope coefficients (t-statistics) are -3.886 (2.957) and -0.339 (7.258), respectively. If the stock is illiquid at home or if U.S. institutional investors hold a greater share of the firm's shares, the U.S. investors' informational disadvantage is somewhat mitigated so return spillovers from the home market to the U.S. are somewhat more modest. As for the volume-return interaction regressions, presented in columns (7) through (12), we observe the predicted tendency for return continuations in the U.S. following high volume days at home when the degree of information asymmetry between the two markets is higher or when U.S. investors are at a comparative informational disadvantage. This is evident in the statistically positive relation between C_4 and *Home Illiquidity* [1.749, t-statistic 2.346], *U.S. Illiquidity* [0.810, t-statistic 3.520], and *Home Share of Turnover* [0.029, t-statistic 2.436].

In sum, the evidence presented in Tables 6 and 7 exposes the link between information and international return spillovers that has eluded previous researchers and demonstrates that high-volume returns at home are more likely to be interpreted as liquidity shocks by U.S. investors and be reversed in the U.S. when U.S. investors are at a lesser informational disadvantage than their home-market counterparts. We now turn to our analysis of the dynamics of return spillovers in the other direction: from the U.S. to the home market.

C. Volume-Return Relation and U.S.-to-Home Return Spillovers

We present our categorical analysis of the parameter estimates from time-series regression equation (4) in Table 8 and the Fama-MacBeth cross-sectional regression test results in Table 9. Tables 8 and 9 are constructed in the same manner as Tables 6 and 7.

In Table 8, the categorical analysis is based on firm size, U.S. institutional ownership, and U.S. illiquidity, as proxies for firm-level information asymmetry. Based on our findings above, we expect return spillovers from the U.S. to the home market, measured by C_3, to be higher when U.S. investors are at an informational advantage in relation to home investors or, perhaps more plausibly, when their informational disadvantage is lower compared to those in the home market. We also expect C_4 to become progressively more negative – tendency toward reversals or, at least, weaker continuations associated with large volume shocks - when the informational disadvantage in relation to home investors is smaller. We note that the explanatory power (R^2) of the U.S.-to-home time-series regressions reported in Table 8 is much lower, on average, than that of the home-to-U.S. regressions shown in Table 6 (16% versus 21%). Also, the average value of C_3 reported in Table 8 (0.1431) is less than half as large as that reported in Table 6 (0.3262). In combination, these findings suggests that U.S. investors are more influenced by price changes that occur in the home market than domestic investors are about price changes that they observe in the U.S. and they lend support to the notion that more information about cross-listed stocks is produced at home than in the U.S. In spite of the smaller magnitude of U.S.-to-home spillover effects, Table 8 reveals patterns in the firm-level cross-sectional analysis of C_3, and C_4 coefficients that are consistent with Llorente, Michaely, Saar and Wang's theoretical predictions. In Panel A, return spillovers (C_3) decreases monotonically from small to large firms. As in Section 4.B, this is not surprising since trading in large firms tends to be concentrated in the home market so price changes originating in the U.S. market are less informative. On the other hand, in panels B and C, we observe a positive and monotonic relation between C_3 and U.S. institutional ownership as well as with respect to U.S. liquidity. This is also consistent with the key theoretical predictions as increased ownership by U.S. institutions and greater liquidity in the cross-listed stock follow naturally from a richer informational environment in the host U.S. market. Turning to C_4, we observe the monotonic decreasing relationship with respect to firm-level information asymmetry predicted by theory, when proxied by *U.S. Institutional Ownership* and *U.S. Illiquidity*. In Panel A, C_4 is negatively related firm size, as expected, but not monotonically so.

Cross-sectional regression results are presented in Table 9. As discussed earlier, we expect return spillovers from the U.S. to the home market to be more modest (pronounced) when home-market investors are likely to be more (less) informed than their U.S. counterparts. We also expect price changes accompanying volume-shocks in the U.S. to exhibit a greater tendency to reverse (continue) in the home market when home-market investors possess more (less) information than U.S. investors. In Panel A, our test results based on country-level proxies for information asymmetry support this theoretical prediction. C_3 is negatively related to per-capita GDP [b equals -0.053 and t-statistic 7.371] and accounting standards [-0.003, t-statistic 5.033], and it exhibits a strong and positive association with respect to C*apital Controls*

[0.148, t-statistic 4.096] and the emerging market dummy variable [0.095, t-statistic 5.526]. A consistent pattern emerges from the C_4 regressions presented in columns (7) through (12). Volume-return spillovers are large in magnitude and positively associated with Capital Controls [0.092, t-statistic 3.725] and Total Cost [0.017, t-statistic 2.194] which reveal continuation patterns that theory would associated with comparatively more opaque and less informative markets.

In Panel B of Table 9, regression results for the firm-level proxies produce a picture which is consistent with Llorente, Michaely, Saar and Wang's theoretical predictions also. Return spillovers (C_3) from the U.S. to the home market are statistically significantly smaller for larger firms [-0.008, t-statistic 4.002], less liquid cross-listed stocks [-1.561, t-statistic 5.958], stocks that are traded to a larger extent at home than in the U.S. [-0.285, t-statistic 16.393], and stocks that have a larger analyst following at home [-0.018, t-statistic 2.729]. Conversely, return spillovers are positively associated with *U.S. Institutional Owmership* [0.428, t-statistic 12.261] but only weakly with *Home Illiquidity*. As for volume-return interactions, we see much greater effects with respect to country-level measures of information asymmetry than with firm-level measures. Of the five regressions presented in Panel B, only one, *Home Analysts,* is significant. Indeed, the slope coefficient associated with this proxy is negative (-0.005) but it is not significant. While this result is consistent with the key theoretical predictions, it suggests that the degree of information asymmetry reflected in U.S. trading volume has a much more modest impact on subsequent returns in the home market than informed trading on the home front has on subsequent U.S. returns.

5. Conclusion

In this paper, we uncover a novel feature of the dynamic relation between stock returns and trading volume. We find not only that high-volume days are associated with predictable patterns in the serial correlation in stock returns (as prior research has shown) but also with predictable patterns in cross-correlations among different stock returns. Our experiment is conducted using a special international setting combining price and volume data for 566 stocks from 36 countries that have home-market shares cross-listed in U.S. markets by way of ADRs, ordinary shares or other forms. Our analysis is conducted with daily returns using price and volume data from their home-markets as well as for their U.S. cross-listed counterparts. We frame our analysis in the context of the heterogeneous-agent, rational-expectations model of Llorente, Michaely, Saar, and Wang (2002). This model predicts that returns generated by allocational or 'risk-sharing' trades tend to reverse themselves in the short run and that informational or 'speculative' trades tend to continue in the short run. By implication, they argue that stocks that are associated with a higher degree of information asymmetry tend to exhibit stronger serial correlation at short horizons than stocks that are more transparent. In the international context for our sample of internationally cross-listed shares, we conjecture that price changes that are observed in the home market or U.S. market are more likely to spillover into the other market when U.S. investors are subjected to more rather than less information asymmetry. The multi-market setting facilitates our analysis in two critical ways: (1) the home-market and U.S. cross-listed shares represent claims on the same underlying cash flows so no equilibrium model of expected returns is needed to calibrate differential risks, and (2) there is a wide dispersion of country-level and firm-specific proxies for information asymmetry to lend power to tests of the predictions in the Llorente, Michaely, Saar and Wang model.

Our findings provide support for the predictions of the model in both directions (home-market-to-U.S. as well as U.S.-to-home-market return spillovers). For returns that originate in the home market and spillover to the U.S. market, our evidence shows that stock return cross-autocorrelations and their interactions with home-market volume shocks are linked to the degree of information asymmetry characterizing the stock, when information asymmetry is proxied by the stock's illiquidity, the share of aggregate turnover captured by the home market, and by U.S. institutional ownership. Home-market returns associated with large volume shocks are more likely to continue among those stocks with higher levels of home or U.S. market illiquidity, a higher fraction of shares trading in the home-market and a smaller fraction of shares held by U.S. institutional investors. In the other direction (returns originating in the U.S. cross-listed shares to home-market shares), our evidence shows that stock return cross-autocorrelations and their interactions with U.S.-market volume shocks, though smaller and statistically less robust, are similarly linked to the degree of information asymmetry characterizing the stock, when information asymmetry is proxied by firm size, the stock's U.S. market illiquidity, the share of aggregate turnover captured by the home market, and by the number of analysts following the stock in the home market. Our findings also reveal that interactions of international stock return comovements with volume shocks exhibit sensitivity to market frictions, like transactions costs and foreign ownership restrictions.

The empirical findings support the general notion that volume does tell us something about future price movements and comovements across stocks. The analysis also suggests that the actual dynamic relation between volume and returns comovements depends on the underlying forces driving trading. By considering separately liquidity-motivated and informationally-motivated trading, as the model of Llorente, Michaely, Saar and Wang guides us to do, realistic predictions obtain for short-horizon returns comovements that seem to encompass the variety that actually exists in international markets. There are still a number of unanswered questions, however. The focus of the experiment on cross-listed stocks is rationalized for its convenience, but these are a very selective set of stocks. One cannot help but wonder if the interactions of volume shocks with cross-correlations and cross-autocorrelations follow a similar pattern among a broader cross-section of international stocks. Another limitation of our analysis to now is its focus on short-horizon (daily) return comovements. This is a reasonable horizon for some traders, but it is unlikely to be so for global portfolio managers with longer-horizon diversification and strategic/tactical asset-allocation programs. Finally, perhaps the greatest challenge to our current analysis is that the volume shocks at the firm-level are treated as exogenous signals about future stock return comovements, though trading decisions, however motivated, are endogenous and should be modeled in this way. Indeed, there are likely strong commonalities in volume shocks among stocks within a market and perhaps even across international markets that arise in response to past, as much as in anticipation of future, stock return movements or comovements [Chordia, Roll and Subrahmanyam (2000), Chordia, Sarkar and Subrahmanyam (2006), Brunnermeier and Pedersen (2006), Hameed, Kang and Viswanathan (2005)].

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Table 1: Summary Statistics on Firm Sample of Cross-listings by Country, Year and Industry

This table describes the composition of our sample by country of origin, industry classification, and by year. Our sampling period starts on February 1, 1993 and ends on May 31, 2004. Our sample is drawn from the universe of U.S. cross-listed stocks available in Datastream at the end of May 2002 and consists of 556 firms from 36 countries whose common shares were listed concurrently at home and in the U.S., on the AMEX, NYSE, or NASDAQ, in the form of American Depositary Receipts (ADRs) or ordinary shares (Canadian issues). We exclude Regulation S, 144A, and Level 1 ADR programs using the Bank of New York's Complete DR Directory (www.adrbny.com). Daily closing price, volume, and market capitalization series are from Datastream. When the two markets do not trade synchronously, we use the mid-point between the bid and the ask price for the cross-listed share observed at the close in the home market or the first available quote midpoint after the home market close. Intraday bid and ask quotes are obtained from the NYSE Trade and Quote (TAQ) database. A pair is eligible for inclusion in our sample if it has a minimum of 24 observations for which returns are based on two consecutive non-zero trading volumes. The industry classification corresponds to the Standard & Poor's two-digit Global Industry Classification Standard (GICS)..

Panel A: By Country

Country	#	%	Country	#	%	Country	#	%
Argentina	10	1.80	Hong Kong	20	3.6	Philippines	1	0.18
Australia	17	3.06	India	7	1.26	Portugal	3	0.54
Austria	1	0.18	Indonesia	2	0.36	Singapore	2	0.36
Belgium	2	0.36	Ireland	9	1.62	South Africa	8	1.44
Brazil	26	4.68	Israel	8	1.44	Spain	8	1.44
Canada	137	24.64	Italy	9	1.62	Sweden	8	1.44
Chile	21	3.78	Japan	28	5.04	Switzerland	11	1.98
Colombia	1	0.18	Korea	7	1.26	Taiwan	5	0.9
Denmark	2	0.36	Mexico	22	3.96	U.K.	82	14.75
Finland	6	1.08	Netherlands	26	4.68	Venezuela	2	0.36
France	30	5.40	New Zealand	4	0.72	**Total**	**556**	**100.00**
Germany	20	3.60	Norway	9	1.62			
Greece	1	0.18	Peru	1	0.18			

Panel B: By Year

Year	#
1993	94
1994	134
1995	160
1996	194
1997	248
1998	296
1999	364
2000	459
2001	503
2002	504
2003	474
2004	450

Panel C: By Industry

Industry	#	%	Industry	#	%	Industry	#	%	Industry	#	%
Aerospace & Defense	2	0.36	Construction Materials	5	0.9	Household Durables	11	1.98	Oil & Gas	25	4.5
Air Freight & Couriers	1	0.18	Containers & Packaging	6	1.08	IT Consulting & Services	5	0.9	Paper & Forest Products	11	1.98
Airlines	8	1.44	Diversified Financials	9	1.62	Industrial Conglomerates	8	1.44	Pharmaceuticals	18	3.24
Auto Components	4	0.72	Diversified Telecomm Svcs	50	8.99	Insurance	11	1.98	Real Estate	4	0.72
Automobiles	6	1.08	Electric Utilities	17	3.06	Internet & Catalog Retail	2	0.36	Road & Rail	3	0.54
Banks	28	5.04	Electrical Equipment	6	1.08	Internet Software & Services	14	2.52	Semicond. Equip & Prods	16	2.88
Beverages	9	1.62	Electronic Equip & Instru	16	2.88	Leisure Equip. & Products	1	0.18	Software	26	4.68
Biotechnology	19	3.42	Energy Equipment & Services	9	1.62	Machinery	7	1.26	Specialty Retail	1	0.18
Building Products	4	0.72	Food & Drug Retailing	8	1.44	Marine	3	0.54	Textiles & Apparel	4	0.72
Chemicals	18	3.24	Food Products	10	1.8	Media	31	5.58	Tobacco	4	0.72
Comm. Svcs & Supplies	7	1.26	Gas Utilities	4	0.72	Metals & Mining	37	6.65	Trading Cos. & Distrib	2	0.36
Communications Equipment	13	2.34	Health Care Equipment & Supp	7	1.26	Multi-Utilities	3	0.54	Trans Infrastructure	1	0.18
Computers & Peripherals	4	0.72	Health Care Providers & Svcs	7	1.26	Multiline Retail	2	0.36	Wireless Telecomm Svcs	21	3.78
Construction & Engineering	2	0.36	Hotels Restaurants & Leisure	4	0.72	Office Electronics	2	0.36	**Total**	**556**	**100.00**

Table 2: Sample Characteristics for the Home Markets and for the U.S. Market

This table presents descriptive statistics by size groups. Our sampling period starts on February 1, 1993 and ends on May 31, 2004. Our sample is drawn from the universe of U.S. cross-listed stocks available in Datastream at the end of May 2002 and consists of 556 firms from 36 countries whose common shares were listed concurrently at home and in the U.S., on the AMEX, NYSE, or NASDAQ, in the form of American Depositary Receipts (ADRs) or ordinary shares (Canadian issues). We exclude Regulation S, 144A, and Level 1 ADR programs using the Bank of New York's Complete DR Directory (www.adrbny.com). Daily closing price, volume, and market capitalization series are from Datastream. When the two markets do not trade synchronously, we use the mid-point between the bid and the ask price for the cross-listed share observed at the close in the home market or the first available quote midpoint after the home market close. Intraday bid and ask quotes are obtained from the NYSE Trade and Quote (TAQ) database. Our final sample consists of 12,935 firm-quarters. A home-U.S. pair is eligible for inclusion in our sample if it has a minimum of 24 return observations based on two consecutive non-zero trading volumes. For each firm-quarter, Average Market Value is the daily average market capitalization (number of outstanding multiplied by the daily closing price). Average Volume is the average number of shares traded daily. Average Turnover is the average daily turnover which is the number of shares traded divided by the number of shares outstanding). For the home market, Average Price is the average daily closing price and, for the U.S. market, Average Price is either based on the closing price in the U.S. or on the average bid-ask quote in the U.S. at the close in the home market. All prices are expressed in U.S. dollars. Home market prices are translated into U.S. dollars at the exchange rate prevailing at the time of closing in the home market.

			Home Market			U.S. Market		
Market Value Quintile	Statistic	Avg. Market Value (USD Millions)	Avg. Volume (‘000)	Avg. Turnover ('000)	Avg. Price (USD)	Avg. Volume (‘000)	Avg. Turnover ('000)	Avg. Price (USD)
Entire Sample	Mean	9893.69	5532.10	0.0035	26.11	405.32	0.0021	26.56
	Std. Dev.	21177.86	29663.72	0.0045	79.51	1844.67	0.0114	80.04
	Min	1.11	0.36	<0.0000	0.05	0.12	<0.0000	0.04
	Median	2374.08	666.48	0.0025	16.60	57.27	0.0005	16.77
	Max	279588.34	1310000.00	0.1381	3208.29	60510.23	0.7787	3216.60
	Firm-quarters	12935	12935	12935	12935	12935	12935	12935
Small	Mean	312.39	2457.30	0.0035	14.40	160.92	0.0034	15.08
	Std. Dev.	218.49	36926.92	0.0060	53.61	1425.37	0.0182	57.09
	Min	1.11	0.78	<0.0000	0.05	0.19	0.0000	0.04
	Median	270.20	113.56	0.0019	8.22	26.47	<0.0011	8.24
	Max	815.00	1310000.00	0.1381	2265.95	52122.43	0.7787	2264.87
	Firm-quarters	4312	4312	4312	4312	4312	4312	4312
Medium	Mean	2735.75	4139.64	0.0037	30.93	295.69	0.0021	31.23
	Std. Dev.	1505.72	21045.86	0.0042	118.68	1324.94	0.0060	117.99
	Min	815.64	0.36	<0.0000	1.08	0.12	<0.0000	1.08
	Median	2374.28	629.38	0.0025	17.40	69.64	0.0005	17.62
	Max	6193.11	517455.88	0.0798	3208.29	37346.75	0.1789	3216.60
	Firm-quarters	4312	4312	4312	4312	4312	4312	4312
Large	Mean	26636.81	10000.41	0.0035	33.00	759.44	0.0009	33.35
	Std. Dev.	30333.24	28325.11	0.0026	42.43	2495.27	0.0042	42.93
	Min	6196.99	1.26	<0.0000	2.23	0.56	<0.0000	2.22
	Median	15532.78	3359.97	0.0029	26.82	115.52	0.0001	27.25
	Max	279588.34	443488.09	0.0295	1360.51	60510.23	0.1432	1366.95
	Firm-quarters	4311	4311	4311	4311	4311	4311	4311

Table 3: Information Asymmetry and the Influence of Volume on Stock Return Autocorrelation

This table shows the relationship between the degree of information asymmetry and the influence of volume on the autocorrelation of individual stock returns for firms whose stocks are listed in their home market and cross-listed in the U.S. market simultaneously. We use the daily average market capitalization of the stock over the quarter as a proxy for information asymmetry. For each firm-quarter, we estimate the following time-series regression:

$$R_{i,t} = C_{0i} + C_{1i} \cdot R_{i,t-1} + C_{2i} \cdot V_{i,t-1} \cdot R_{i,t-1} + error_{i,t-1},$$

where $R_{i,t}$ is the return for stock i on day t. For each firm-quarter, the parameter C_{1i} measures the stock's return autocorrelation coefficient and C_{2i} measures the influence of volume on the autocorrelation of stock returns. $V_{i,t}$ represents the stock's volume innovation and is based on a detrended measure of the stock's log-turnover. In Panel A, we report the mean of the parameter estimates for each of three size-based groups (small, medium, and large) which are used as a proxy for the degree of information asymmetry, the number of negative parameters, as well as the number of statistically significant parameters, at the 5% level. We report our results for the home-market shares and for their U.S. cross-listed counterparts separately. In Panel B, we present a similar analysis by estimating the following cross-sectional regression model:

$$C_{2i} = a + b \cdot MV_i + e_i ,$$

where MV, market capitalization, is our proxy for information asymmetry. We use firm size and size quartile two separate measures of market capitalization:. The first one is a dollar measure and the second one corresponds to the stock's size-quartile number, and the third one is an ordinal transformation of the dollar series. Our sample comprises 12,935 firm-quarters. Fama-MacBeth t-statistics are in parentheses while *, **, and *** denote the statistical significance of the estimates at the 10%, 5%, and 1% level, respectively. We obtain R^2 coefficients from separate panel regressions estimated on the full sample using country and quarter-year dummy variables.

Panel A: Categorical Analysis Along Size Dimension

Market	Size	Statistic	C_0 # < 0	C_1 # < 0	C_2 # < 0	t_{C0} |#| > 1.64	t_{C1} |#| > 1.64	t_{C2} |#| > 1.64	R^2	F-stat.	Avg. # of Obs.
Home	Small	Mean	-0.0005	0.0236	-0.0044	-0.0171	0.0864	-0.0023	0.05	2.17	60.11
		N	2179	1926	2157	609	941	879			
		Firm-quarters	4312	4312	4312	4312	4312	4312			
	Medium	Mean	-0.0001	0.0541	-0.0288	0.0704	0.3353	-0.1309	0.04	1.85	60.59
		N	2029	1622	2328	535	850	844			
		Firm-quarters	4312	4312	4312	4312	4312	4312			
	Large	Mean	<0.0000	0.0354	-0.0256	0.1069	0.2254	-0.0904	0.04	1.64	60.85
		N	1986	1824	2298	407	759	792			
		Firm-quarters	4311	4311	4311	4311	4311	4311			
	All	Mean	-0.0002	0.0377	-0.0196	0.0534	0.2157	-0.0745	0.04	1.89	60.52
		N	6194	5372	6783	1551	2550	2515			
		Firm-quarters	12935	12935	12935	12935	12935	12935			
U.S.	Small	Mean	-0.0006	-0.007	0.0061	-0.0637	-0.1225	0.0965	0.07	4.39	57.32
		N	2242	2165	1988	609	1209	1012			
		Firm-quarters	4312	4312	4312	4312	4312	4312			
	Medium	Mean	<0.0000	0.0276	-0.0173	0.0391	0.1638	-0.0841	0.06	3.65	57.14
		N	2058	1790	2267	521	1007	931			
		Firm-quarters	4312	4312	4312	4312	4312	4312			
	Large	Mean	0.0005	-0.003	-0.0247	0.1072	-0.045	-0.1453	0.07	53.15	56.23
		N	1938	1960	2235	392	1083	944			
		Firm-quarters	4311	4311	4311	4311	4311	4311			
	All	Mean	-0.0001	0.0059	-0.012	0.0276	-0.0012	-0.0443	0.07	20.39	56.90
		N	6238	5915	6490	1522	3299	2887			
		Firm-quarters	12935	12935	12935	12935	12935	12935			

Table 3:

Panel B: Cross-sectional Regression Analysis

	(1) Home C2	(2) Home C2	(3) U.S. C2	(4) U.S. C2
Ln(Market Value)	-0.006		-0.010	
	(3.479)***		(5.676)***	
Market Value (Quartiles)		-0.010		-0.021
		(2.628)***		(5.970)***
Constant	0.109	0.006	0.207	0.033
	(3.223)***	(0.792)	(5.766)***	(5.539)***
Firm-quarters	11671	11671	11671	11671
R^2	0.1129	0.1119	0.1432	0.1425

Table 4: Descriptive Statistics for Country-level and Firm-level Proxies for Information Asymmetry

This table presents descriptive statistics for our country-level and firm-level proxies for information asymmetry. *Ln(PCGDP)* is equal to the natural logarithm of per-capita GDP assembled by the Economist Intelligence Unit and retrieved via Datastream. Accounting standards, *AS*, and the efficiency of the judicial process, *EJ*, are country-level indexes compiled by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) that quantify the extent of transparency and legal protections for investors in a given country. *Legal* is a composite measure of the quality of investor protections in a given country that we construct by taking the product of Spamann's bias-corrected ADRI measure and *EJ*. This measure recognizes that investor protections are jointly dependent on the existence of laws protecting investors and on their enforceability. *Capital Controls* measures the fraction of a country's equity market capitalization that is not accessible to foreign investors [Bekaert (1995), Edison and Warnock, (2003)]. We calculate this measure annually from S&P's Emerging Markets Database for each emerging market included in our sample and set its value to 0 for developed countries. *Total Cost* is a country-level measure of trading costs (in basis points) which is compiled by Elkins/McSherry LLC. This measure includes commissions, fees, market impact costs, excise taxes applicable to equity transactions, as well as taxes imposed on trading commissions during our sample period [Pollin, Baker, and Schaberg (2002)]. *Emerging* is an indicator variable set to one when a country is classified as emerging by the Economist Intelligence Unit and to zero otherwise. *Home illiquidity* and *U.S. illiquidity* are firm-quarter measures of the daily price impact of the order flow in the home and in the U.S. market, respectively. We calculate this measure for each firm-quarter by averaging its daily absolute-return-to-dollar-value-of-trading ratio over the number of days for which data is available during the quarter, as per Amihud (2002). *Market Value* is the average daily market value of common shares outstanding for each firm-quarter. *Home Share of Turnover* measures the percentage of a firm's average aggregate turnover which is captured by its home market and constitutes a measure of the location of trading. *U.S. Institutional Ownership* represents the percentage of a firm's shares outstanding which are held by institutional investors and is extracted from Thomson Financial's 13F database. *Home Analysts* is based on the number of estimates underpinning the FY1 EPS consensus analyst forecasts published in the I/B/E/S International Summary database.

Country-level Variables	Firm-quarters	Mean	Std. Dev.	Min	Max
Ln(PCGDP)	12,935	9.7452	0.8063	6.09	10.91
AS	12,935	68.4525	8.8781	36	83
Legal	12,935	35.1579	14.2830	0	50
Capital Controls	12,935	0.0229	0.0987	0	1
Ln(Total Cost)	12,786	3.9519	0.4437	3.39	5.50
Emerging	12,935	0.2371	0.4253	0	1

Firm-level Variables	Firm-quarters	Mean	Std. Dev.	Min	Max
Home Illiquidity	12,935	0.0008	0.0130	0.00	0.94
U.S. Illiquidity	12,935	0.0011	0.0138	0.00	1.00
Ln(Market Value)	12,935	21.4669	1.9853	13.82	26.36
Home Share of Turnover	12,935	0.7705	0.2624	0.007	1.000
U.S. Institutional Ownership	10,130	0.1038	0.1497	0.00	0.98
Ln(Home Analysts)	12,087	2.4151	0.8445	0	3.95

Table 5: Univariate Own-Country Cross-Sectional Regressions for the Home and the U.S. Market

This table examines the influence of country-level and firm-level proxies for information asymmetry on the magnitude of volume-return interactions in the home market and in the U.S. Test results for the home-market and for the U.S. are reported separately. We use country-level proxies for the degree of information asymmetry prevailing in the home market. In Panels A and B, we present results from our country-level variables. *Ln(PCGDP)* is equal to the natural logarithm of per-capita GDP assembled by the Economist Intelligence Unit and retrieved via Datastream. Accounting standards, *AS*, and the efficiency of the judicial process, *EJ*, are country-level indexes compiled by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) that quantify the extent of transparency and legal protections for investors in a given country. *Legal* is a composite measure of the quality of investor protections in a given country that we construct by taking the product of Spamann's bias-corrected ADRI measure and *EJ*. This measure recognizes that investor protections are jointly dependent on the existence of laws protecting investors and on their enforceability. *Capital Controls* measures the fraction of a country's equity market capitalization that is not accessible to foreign investors [Bekaert (1995), Edison and Warnock, (2003)]. We calculate this measure annually from S&P's Emerging Markets Database for each emerging market included in our sample and set its value to 0 for developed countries. *Total Cost* is a country-level measure of trading costs (in basis points) which is compiled by Elkins/McSherry LLC. This measure includes commissions, fees, market impact costs, excise taxes applicable to equity transactions, as well as taxes imposed on trading commissions during our sample period [Pollin, Baker, and Schaberg (2002)]. *Emerging* is an indicator variable set to one when a country is classified as emerging by the Economist Intelligence Unit and to zero otherwise. H*ome illiquidity* and *U.S. illiquidity* are firm-quarter measures of the daily price impact of the order flow in the home and in the U.S. market, respectively. We calculate this measure for each firm-quarter by averaging its daily absolute-return-to-dollar-value-of-trading ratio over the number of days for which data is available during the quarter, as per Amihud (2002). *Market Value* is the average daily market value of common shares outstanding for each firm-quarter. *Home Share of Turnover* measures the percentage of a firm's average aggregate turnover which is captured by its home market and constitutes a measure of the location of trading. *U.S. Institutional Ownership* represents the percentage of a firm's shares outstanding which are held by institutional investors and is extracted from Thomson Financial's 13F database. *Home Analysts* is based on the number of estimates underpinning the FY1 EPS consensus analyst forecasts published in the I/B/E/S International Summary database. In Panels A and B, we report home-market and U.S. cross-sectional regression results of firm-quarter return spillover coefficients, C_2, on our country-level and firm-level proxies for information asymmetry, respectively. Our sample comprises 12,935 firm-quarters. Fama-MacBeth t-statistics are in parentheses while *, **, and *** denote the statistical significance of the estimates at the 10%, 5%, and 1% level, respectively. We obtain R^2 coefficients from separate panel regressions estimated on the full sample which are estimated with quarter-year dummies.

Panel A: Cross-Sectional Regression Analysis of Home and U.S. Volume-Return Interactions (C_2) on Country-Level Variables

	(1) Home C_2	(2) Home C_2	(3) Home C_2	(4) Home C_2	(5) Home C_2	(6) Home C_2	(7) U.S. C_2	(8) U.S. C_2	(9) U.S. C_2	(10) U.S. C_2	(11) U.S. C_2	(12) U.S. C_2
Ln(PCGDP)	-0.001						-0.015					
	(0.148)						(2.310)**					
AS		0.001						-0.001				
		(0.834)						(0.421)				
Legal			0.000						-0.000			
			(0.219)						(0.206)			
Capital controls				-0.010						0.080		
				(0.359)						(2.652)***		
Ln(Total cost)					-0.000						-0.009	
					(0.048)						(1.147)	
Emerging						-0.032						0.041
						(2.131)**						(2.385)**
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.004	-0.047	-0.015	-0.013	-0.012	-0.008	0.132	0.003	-0.007	-0.011	0.027	-0.017
	(0.072)	(1.206)	(1.625)*	(2.580)***	(0.375)	(1.289)	(2.157)**	(0.104)	(0.776)	(2.810)***	(0.851)	(3.009)***
Firm-quarters	12676	12676	12676	12676	12562	12676	12676	12676	12676	12676	12562	12676
R^2	0.0380	0.0381	0.0381	0.0380	0.0358	0.0380	0.0354	0.0350	0.0350	0.0355	0.0331	0.0357

Table 5: Univariate Own-Country Cross-Sectional Regressions for the Home and the U.S. Market (Continued)

Panel B: Cross-Sectional Regression Analysis of Home and U.S. Volume-Return Interactions (C_2) on Firm-Level Variables

	(1) Home C_2	(2) Home C_2	(3) Home C_2	(4) Home C_2	(5) Home C_2	(6) Home C_2	(7) U.S. C_2	(8) U.S. C_2	(9) U.S. C_2	(10) U.S. C_2	(11) U.S. C_2	(12) U.S. C_2
Ln(Market Value)	-0.006						-0.010					
	(3.479)***						(5.676)***					
Home Illiquidity		0.958						0.014				
		(3.483)***						(0.021)				
U.S. Illiquidity			0.457						0.519			
			(3.818)***						(4.619)***			
Home Share of Turnover				0.010						0.008		
				(0.908)						(0.793)		
U.S. Institutional Ownership					-0.015						-0.068	
					(0.700)						(2.510)***	
Ln(Home Analysts)						-0.003						-0.017
						(0.732)						(4.509)***
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.109	-0.017	-0.016	-0.022	-0.016	-0.007	0.207	-0.009	-0.011	-0.015	-0.005	0.033
	(3.223)***	(3.440)***	(3.233)***	(2.870)***	(2.913)***	(0.572)	(5.766)***	(2.316)**	(2.699)***	(1.543)	(1.093)	(3.351)***
Firm-quarters	11671	11671	11671	11671	8940	10871	11671	11671	11671	11671	8940	10871
R^2	0.1129	0.1142	0.1110	0.1110	0.1614	0.1104	0.1432	0.1387	0.1387	0.1387	0.1703	0.1413

Table 6: Information Asymmetry and the Influence of Volume on Home-to-U.S. Stock Return Spillovers

This table shows the relationship between the degree of information asymmetry and the influence of volume on the autocorrelation of individual stock returns for firms whose stocks are listed in their home market and cross-listed in the U.S. market simultaneously. We use firm size in Panel A, number of analysts in the home market in Panel B, as well as Amihud's (2002) illiquidity measure in Panel C, as proxies for information asymmetry. For each firm-quarter, we estimate the following time-series regression which is expanded to include the return spillover from the home market as well as the volume-return interaction originating in the home market:

$$R_{i,t}^{U.S.} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{U.S.} + C_{2i} \cdot V_{i,t-1}^{U.S.} \cdot R_{i,t-1}^{U.S.} + C_{3i} \cdot R_{i,t-1}^{H} + C_{4i} \cdot V_{i,t-1}^{H} \cdot R_{i,t-1}^{H} + \beta_{i,U.S.} \cdot R_{U.S.,t-1} + \beta_{i,H} \cdot R_{H,t-1} + \beta_{i,FX} \cdot R_{FX,t-1} + error_{i,t-1}, \quad (3)$$

where $R_{i,t}^{U.S.}$ is the return for stock i on day t in the U.S. For each firm-quarter, the parameter C_{1i} measures the stock's return autocorrelation, C_{2i} measures the influence of volume on the stock's return autocorrelation, C_{3i} is a cross-autocorrelation parameter which captures the return spillover effect from the home market to the U.S., and the parameter C_{4i} measures the influence of information asymmetry on the magnitude of return spillovers from the home market to the U.S. market. $V_{i,t-1}^{U.S.}$ and $V_{i,t-1}^{H}$ are measures of the stock's volume innovation observed in the U.S. and in the home market, respectively. The U.S. and home volume innovation series are estimated separately and both series are based on a detrended measure of the stock's log-turnover. $R_{U.S.,t-1}$, $R_{H,t-1}$, and $R_{FX,t-1}$ are index return series for the U.S. market, the home market, and the foreign exchange series, respectively. For each parameter estimate, we report the group average, the number of negative parameters, as well as the number of statistically significant parameters, at the 5% level.

	Statistic	C_0 # < 0	C_1 # < 0	C_2 # < 0	C_3 # < 0	C_4 # < 0	t_{C0} |#| > 1.64	t_{C1} |#| > 1.64	t_{C2} |#| > 1.64	t_{C3} |#| > 1.64	t_{C4} |#| > 1.64	R^2	F-stat.	Avg. # of Obs.
Panel A: Size														
Small	Mean	-0.0006	-0.1921	-0.0112	0.2951	-0.0092	-0.0650	-0.9545	-0.0630	1.1687	-0.0297	0.21	3.95	53.99
	N	2,277	3,227	2,205	785	2,181	481	1,485	916	1,683	846			
	Firm-quarters	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312			
Medium	Mean	-0.0001	-0.2098	-0.0250	0.3198	-0.0264	0.0202	-0.8908	-0.1093	1.1357	-0.08	0.20	4.38	54.71
	N	2,153	3,220	2,322	829	2,271	448	1,375	876	1,639	861			
	Firm-quarters	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312			
Large	Mean	0.0002	-0.2722	-0.0378	0.3637	-0.0063	0.0935	-1.1149	-0.1852	1.1075	-0.0577	0.21	7.75	54.68
	N	1,971	3,344	2,296	855	2,254	369	1,521	936	1,590	792			
	Firm-quarters	4,311	4,311	4,311	4,311	4,311	4,311	4,311	4,311	4,311	4,311			
All	Mean	-0.0002	-0.2247	-0.0247	0.3262	-0.014	0.0162	-0.9867	-0.1192	1.1373	-0.0558	0.21	5.36	54.46
	N	6,401	9,791	6,823	2,469	6,706	1,298	4,381	2,728	4,912	2,499			
	Firm-quarters	12,935	12,935	12,935	12,935	12,935	12,935	12,935	12,935	12,935	12,935			
Panel B: # Home Analysts														
Small	Mean	-0.0004	-0.2108	-0.0169	0.3066	-0.0139	0.0014	-0.9647	-0.0922	1.1135	-0.0431	0.21	5.70	53.64
	N	2,259	3,407	2,354	849	2,313	487	1,512	927	1,684	886			
	Firm-quarters	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500			
Medium	Mean	0.0000	-0.2131	-0.0283	0.3214	-0.0161	0.0095	-0.9605	-0.1341	1.1925	-0.0813	0.21	5.71	54.90
	N	1,798	2,737	1,946	679	1,916	368	1,171	779	1,447	681			
	Firm-quarters	3,661	3,661	3,661	3,661	3,661	3,661	3,661	3,661	3,661	3,661			
Large	Mean	0.0000	-0.2636	-0.0352	0.3743	-0.0136	0.0524	-1.0356	-0.1514	1.1572	-0.0571	0.20	4.22	55.29
	N	1,886	3,036	2,125	726	2,052	357	1,370	823	1,500	774			
	Firm-quarters	3,926	3,926	3,926	3,926	3,926	3,926	3,926	3,926	3,926	3,926			
All	Mean	-0.0001	-0.2286	-0.0263	0.3331	-0.0145	0.0204	-0.9864	-0.1241	1.1516	-0.0592	0.21	5.22	54.56
	N	5,943	9,180	6,425	2,254	6,281	1,212	4,053	2,529	4,631	2,341			
	Firm-quarters	12,087	12,087	12,087	12,087	12,087	12,087	12,087	12,087	12,087	12,087			

Table 6: Information Asymmetry and the Influence of Volume on Home-to-U.S. Stock Return Spillovers (Continued)

	Statistic	C_0 # < 0	C_1 # < 0	C_2 # < 0	C_3 # < 0	C_4 # < 0	t_{C0} |#| > 1.64	t_{C1} |#| > 1.64	t_{C2} |#| > 1.64	t_{C3} |#| > 1.64	t_{C4} |#| > 1.64	R^2	F-stat.	Avg. # of Obs.
Panel C: Home Illiquidity														
High	Mean	-0.0008	-0.1811	-0.0161	0.2815	-0.0112	-0.0889	-0.9057	-0.0829	1.1017	-0.0315	0.20	3.46	54.47
	N	2339	3187	2255	834	2191	493	1457	881	1603	843			
	Firm-quarters	4,311	4,311	4,311	4,311	4,311	4,311	4,311	4,311	4,311	4,311			
Medium	Mean	0.0000	-0.2362	-0.0246	0.3408	-0.0111	0.0439	-0.9614	-0.1064	1.1904	-0.0444	0.20	3.42	54.88
	N	2095	3258	2318	810	2220	406	1416	858	1704	865			
	Firm-quarters	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312			
Low	Mean	0.0003	-0.2568	-0.0332	0.3563	-0.0195	0.0937	-1.0932	-0.1682	1.1198	-0.0915	0.21	9.19	54.04
	N	1967	3346	2250	825	2295	399	1508	989	1605	791			
	Firm-quarters	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312	4,312			
All	Mean	-0.0002	-0.2247	-0.0247	0.3262	-0.014	0.0162	-0.9867	-0.1192	1.1373	-0.0558	0.21	5.36	54.46
	N	6401	9791	6823	2469	6706	1298	4381	2728	4912	2499			
	Firm-quarters	12,935	12,935	12,935	12,935	12,935	12,935	12,935	12,935	12,935	12,935			

Table 7: Cross-Sectional Regression Tests of the Influence of Country- and Firm-level Proxies for Information Asymmetry on Home-to-U.S. Stock Return Spillovers

This table examines in a cross-sectional regression setting the influence of country-level and firm-level proxies for information asymmetry on the magnitude of return spillovers from the home market to the U.S. *Ln(PCGDP)* is equal to the natural logarithm of per-capita GDP assembled by the Economist Intelligence Unit and retrieved via Datastream. Accounting standards, *AS*, and the efficiency of the judicial process, *EJ*, are country-level indexes compiled by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) that quantify the extent of transparency and legal protections for investors in a given country. *Legal* is a composite measure of the quality of investor protections in a given country that we construct by taking the product of Spamann's bias-corrected ADRI measure and *EJ*. This measure recognizes that investor protections are jointly dependent on the existence of laws protecting investors and on their enforceability. *Capital Controls* measures the fraction of a country's equity market capitalization that is not accessible to foreign investors [Bekaert (1995), Edison and Warnock, (2003)]. We calculate this measure annually from S&P's Emerging Markets Database for each emerging market included in our sample and set its value to 0 for developed countries. *Total Cost* is a country-level measure of trading costs (in basis points) which is compiled by Elkins/McSherry LLC. This measure includes commissions, fees, market impact costs, excise taxes applicable to equity transactions, as well as taxes imposed on trading commissions during our sample period [Pollin, Baker, and Schaberg (2002)]. *Emerging* is an indicator variable set to one when a country is classified as emerging by the Economist Intelligence Unit and to zero otherwise. *Home illiquidity* and *U.S. illiquidity* are firm-quarter measures of the daily price impact of the order flow in the home and in the U.S. market, respectively. We calculate this measure for each firm-quarter by averaging its daily absolute-return-to-dollar-value-of-trading ratio over the number of days for which data is available during the quarter, as per Amihud (2002). *Market Value* is the average daily market value of common shares outstanding for each firm-quarter. *Home Share of Turnover* measures the percentage of a firm's average aggregate turnover which is captured by its home market and constitutes a measure of the location of trading. *U.S. Institutional Ownership* represents the percentage of a firm's shares outstanding which are held by institutional investors and is extracted from Thomson Financial's 13F database. *Home Analysts* is based on the number of estimates underpinning the FY1 EPS consensus analyst forecasts published in the I/B/E/S International Summary database. In Panel A, we regress the cross-section of home-to-U.S. spillover coefficients, C_3, and home-to-U.S. volume-return interactions, C_4, against our country-level proxies while, in Panel B, these coefficients are regressed against our firm-level proxies. Our sample comprises 12,935 firm-quarters. Fama-MacBeth t-statistics are reported in parentheses while *, **, and *** denote the statistical significance of the estimates at the 10%, 5%, and 1% level, respectively. We obtain R^2 coefficients from separate panel regressions estimated on the full sample.

Panel A: Return Spillover Coefficients (C_3) and Volume-return Interaction Coefficients (C_4) Regressed on Country-level Proxies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	C3	C3	C3	C3	C3	C3	C4	C4	C4	C4	C4	C4
Ln(PCGDP)	0.059						0.011					
	(6.867)***						(1.599)*					
AS		0.003						0.001				
		(3.660)***						(1.883)**				
Legal			0.001						0.001			
			(0.229)						(2.192)**			
Capital controls				-0.295						0.003		
				(7.036)***						(0.047)		
Ln(Total cost)					-0.050						-0.007	
					(4.492)***						(0.695)	
Emerging						-0.111						-0.019
						(6.010)***						(1.492)*
Constant	-0.247	0.153	0.322	0.336	0.522	0.351	-0.119	-0.078	-0.038	-0.017	0.010	-0.013
	(2.970)***	(3.151)***	(18.242)***	(48.100)***	(11.662)***	(45.349)***	(1.822)**	(2.264)**	(3.212)***	(3.123)***	(0.269)	(2.215)**
Firm-quarters	12933	12933	12933	12933	12784	12933	12933	12933	12933	12933	12784	12933
R^2	0.0051	0.0008	0.0004	0.0028	0.0008	0.0047	0.0001	0.0001	0.0001	0.0000	0.0000	0.0002

Table 7: Cross-Sectional Regression Tests of the Influence of Country- and Firm-level Proxies for Information Asymmetry on Home-to-U.S. Stock Return Spillovers (Continued)

Panel B: Return Spillover Coefficients (C_3) and Volume-return Interaction Coefficients (C_4) Regressed on Firm-level Proxies

	(1) C3	(2) C3	(3) C3	(4) C3	(5) C3	(6) C3	(7) C4	(8) C4	(9) C4	(10) C4	(11) C4	(12) C4
Ln(Market Value)	0.015						-0.003					
	(5.695)***						(0.921)					
Home Illiquidity		-3.886						1.749				
		(2.957)***						(2.346)**				
U.S. Illiquidity			-0.078						0.810			
			(0.289)						(3.520)***			
Home Share of Turnover				0.294						0.029		
				(15.802)***						(2.436)***		
U.S. Institutional Ownership					-0.339						-0.019	
					(7.258)***						(0.597)	
Ln(Home Analysts)						0.037						-0.004
						(4.899)***						(0.694)
Constant	0.003	0.332	0.327	0.103	0.362	0.242	0.038	-0.019	-0.021	-0.040	-0.019	-0.009
	(0.056)	(48.179)***	(46.997)***	(6.714)***	(46.437)***	(12.178)***	(0.665)	(3.623)***	(3.657)***	(4.398)***	(2.483)***	(0.715)
Firm-quarters	12933	12933	12933	12933	10128	12085	12933	12933	12933	12933	10128	12085
R^2	0.0037	0.0001	0.0000	0.0252	0.0103	0.0035	0.0000	0.0002	0.0003	0.0002	0.0000	0.0000

Table 8: Information Asymmetry and the Influence of Volume on U.S.-to-Home Stock Return Spillovers

This table shows the relationship between the degree of information asymmetry and the influence of volume on the autocorrelation of individual stock returns for firms whose stocks are listed in their home market and cross-listed in the U.S. market simultaneously. We use firm size in Panel A, number of analysts in the home market in Panel B, as well as Amihud's (2002) illiquidity measure in Panel C, as proxies for information asymmetry. For each firm-quarter, we estimate the following time-series regression which is expanded to include the return spillover from the U.S. market as well as the volume-return interaction originating in the U.S.:

$$R_{i,t}^{H} = C_{0i} + C_{1i} \cdot R_{i,t-1}^{H} + C_{2i} \cdot V_{i,t-1}^{H} \cdot R_{i,t-1}^{H} + C_{3i} \cdot R_{i,t-1}^{U.S.} + C_{4i} \cdot V_{i,t-1}^{U.S.} \cdot R_{i,t-1}^{U.S.} + \beta_{i,U.S.} \cdot R_{U.S.,t-1} + \beta_{i,H} \cdot R_{H,t-1} + \beta_{i,FX} \cdot R_{FX,t-1} + \text{error}_{i,t-1}, \quad (4)$$

where $R_{i,t}^{H.}$ is the return for stock i on day t in the home market. For each firm-quarter, the parameter C_{1i} measures the stock's return autocorrelation, C_{2i} measures the influence of volume on the stock's return autocorrelation, C_{3i} is a cross-autocorrelation parameter which captures the return spillover effect from the U.S. market to the home market, and the parameter C_{4i} measures the influence of information asymmetry on the magnitude of return spillovers from the U.S. market to the home market. $V_{i,t-1}^{H}$ and $V_{i,t-1}^{U.S.}$ are measures of the stock's volume innovation observed in the home market and the U.S., respectively. The home and U.S. volume innovation series are estimated separately and both series are based on a detrended measure of the stock's log-turnover. $R_{U.S.,t-1}$, $R_{H,t-1}$, and $R_{FX,t-1}$ are index return series for the U.S. market, the home market, and the foreign exchange series, respectively. For each parameter estimate, we report the group average, the number of negative parameters, as well as the number of statistically significant parameters, at the 5% level.

	Statistic	C_0 # < 0	C_1 # < 0	C_2 # < 0	C_3 # < 0	C_4 # < 0	t_{C0} |#| > 1.64	t_{C1} |#| > 1.64	t_{C2} |#| > 1.64	t_{C3} |#| > 1.64	t_{C4} |#| > 1.64	R^2	F-stat.	Avg. # of Obs.
Panel A: Size														
Small	Mean	-0.0006	-0.0971	-0.0050	0.1659	-0.0051	-0.0500	-0.4930	-0.0656	0.6727	-0.0114	0.18	2.51	54.77
	N	2219	2764	2239	1291	2161	524	1083	834	1138	881			
	Firm-quarters	4312	4312	4312	4312	4312	4312	4312	4312	4312	4312			
Medium	Mean	-0.0001	-0.0757	-0.0260	0.1534	-0.0191	0.0413	-0.2757	-0.0996	0.5178	-0.0717	0.16	2.33	55.85
	N	2114	2560	2329	1462	2261	469	877	786	997	788			
	Firm-quarters	4312	4312	4312	4312	4312	4312	4312	4312	4312	4312			
Large	Mean	0.0000	-0.0453	-0.0267	0.1101	-0.0129	0.0990	-0.1587	-0.0846	0.3389	-0.0394	0.15	2.11	56.40
	N	1978	2378	2312	1699	2216	396	805	755	917	883			
	Firm-quarters	4311	4311	4311	4311	4311	4311	4311	4311	4311	4311			
All	Mean	-0.0002	-0.0727	-0.0192	0.1431	-0.0124	0.0301	-0.3091	-0.0833	0.5098	-0.0408	0.16	2.32	55.67
	N	6311	7702	6880	4452	6638	1389	2765	2375	3052	2552			
	Firm-quarters	12935	12935	12935	12935	12935	12935	12935	12935	12935	12935			
Panel B: U.S. Institutional Ownership														
Small	Mean	-0.0003	-0.0373	-0.0230	0.0753	-0.0087	0.0277	-0.2006	-0.0817	0.3045	-0.0204	0.16	2.36	54.52
	N	1,679	1,901	1,806	1,342	1,697	356	679	622	687	680			
	Firm-quarters	3377	3377	3377	3377	3377	3377	3377	3377	3377	3377			
Medium	Mean	-0.0002	-0.0494	-0.0293	0.1257	-0.0106	0.0373	-0.2260	-0.1200	0.4866	-0.0497	0.16	2.36	55.61
	N	1613	1914	1840	1202	1732	352	710	581	812	703			
	Firm-quarters	3377	3377	3377	3377	3377	3377	3377	3377	3377	3377			
Large	Mean	-0.0001	-0.1237	-0.0202	0.2125	-0.0236	0.0626	-0.4293	-0.0622	0.6464	-0.0782	0.16	2.21	56.44
	N	1595	2163	1774	1017	1790	369	706	619	843	626			
	Firm-quarters	3376	3376	3376	3376	3376	3376	3376	3376	3376	3376			
All	Mean	-0.0002	-0.0702	-0.0242	0.1378	-0.0143	0.0425	-0.2853	-0.0880	0.4792	-0.0494	0.16	2.31	55.52
	N	4887	5978	5420	3561	5219	1077	2095	1822	2342	2009			
	Firm-quarters	10130	10130	10130	10130	10130	10130	10130	10130	10130	10130			

Table 8: Information Asymmetry and the Influence of Volume on U.S.-to-Home Stock Return Spillovers (Continued)

	Statistic	C_0 # < 0	C_1 # < 0	C_2 # < 0	C_3 # < 0	C_4 # < 0	t_{C0} |#| > 1.64	t_{C1} |#| > 1.64	t_{C2} |#| > 1.64	t_{C3} |#| > 1.64	t_{C4} |#| > 1.64	R^2	F-stat.	Avg. # of Obs.
Panel C: U.S. Illiquidity														
High	Mean	-0.0007	-0.0513	-0.0003	0.0835	-0.0038	-0.0753	-0.3319	-0.0189	0.3761	-0.0163	0.17	2.40	54.39
	N	2263	2577	2174	1632	2180	509	992	826	891	871			
	Firm-quarters	4311	4311	4311	4311	4311	4311	4311	4311	4311	4311			
Medium	Mean	-0.0001	-0.0649	-0.0281	0.1451	-0.0138	0.0519	-0.2762	-0.1157	0.5409	-0.0455	0.16	2.25	56.16
	N	2084	2533	2347	1480	2195	449	890	781	1077	825			
	Firm-quarters	4312	4312	4312	4312	4312	4312	4312	4312	4312	4312			
Low	Mean	0.0001	-0.102	-0.0293	0.2007	-0.0195	0.1136	-0.3193	-0.1152	0.6124	-0.0607	0.16	2.30	56.47
	N	1964	2592	2359	1340	2263	431	883	768	1084	856			
	Firm-quarters	4312	4312	4312	4312	4312	4312	4312	4312	4312	4312			
All	Mean	-0.0002	-0.0727	-0.0192	0.1431	-0.0124	0.0301	-0.3091	-0.0833	0.5098	-0.0408	0.16	2.32	55.67
	N	6311	7702	6880	4452	6638	1389	2765	2375	3052	2552			
	Firm-quarters	12935	12935	12935	12935	12935	12935	12935	12935	12935	12935			

Table 9: Cross-Sectional Regression Tests of the Influence of Country- and Firm-level Proxies for Information Asymmetry on U.S.-to-Home Stock Return Spillovers

This table examines in a cross-sectional regression setting the influence of country-level and firm-level proxies for information asymmetry on the magnitude of return spillovers from the U.S. to the home market. *Ln(PCGDP)* is equal to the natural logarithm of per-capita GDP assembled by the Economist Intelligence Unit and retrieved via Datastream. Accounting standards, *AS*, and the efficiency of the judicial process, *EJ*, are country-level indexes compiled by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) that quantify the extent of transparency and legal protections for investors in a given country. *Legal* is a composite measure of the quality of investor protections in a given country that we construct by taking the product of Spamann's bias-corrected ADRI measure and *EJ*. This measure recognizes that investor protections are jointly dependent on the existence of laws protecting investors and on their enforceability. *Capital Controls* measures the fraction of a country's equity market capitalization that is not accessible to foreign investors [Bekaert (1995), Edison and Warnock, (2003)]. We calculate this measure annually from S&P's Emerging Markets Database for each emerging market included in our sample and set its value to 0 for developed countries. *Total Cost* is a country-level measure of trading costs (in basis points) which is compiled by Elkins/McSherry LLC. This measure includes commissions, fees, market impact costs, excise taxes applicable to equity transactions, as well as taxes imposed on trading commissions during our sample period [Pollin, Baker, and Schaberg (2002)]. *Emerging* is an indicator variable set to one when a country is classified as emerging by the Economist Intelligence Unit and to zero otherwise. H*ome illiquidity* and *U.S. illiquidity* are firm-quarter measures of the daily price impact of the order flow in the home and in the U.S. market, respectively. We calculate this measure for each firm-quarter by averaging its daily absolute-return-to-dollar-value-of-trading ratio over the number of days for which data is available during the quarter, as per Amihud (2002). *Market Value* is the average daily market value of common shares outstanding for each firm-quarter. *Home Share of Turnover* measures the percentage of a firm's average aggregate turnover which is captured by its home market and constitutes a measure of the location of trading. *U.S. Institutional Ownership* represents the percentage of a firm's shares outstanding which are held by institutional investors and is extracted from Thomson Financial's 13F database. *Home Analysts* is based on the number of estimates underpinning the FY1 EPS consensus analyst forecasts published in the I/B/E/S International Summary database. In Panel A, we regress the cross-section of U.S.-to-home spillover coefficients, C_3, and U.S.-to-home volume-return interactions, C_4, against our country-level proxies while, in Panel B, these coefficients are regressed against our firm-level proxies. Our sample comprises 12,935 firm-quarters. Fama-MacBeth t-statistics are reported in parentheses while *, **, and *** denote the statistical significance of the estimates at the 10%, 5%, and 1% level, respectively. We obtain R^2 coefficients from separate panel regressions estimated on the full sample.

Panel A: Return Spillover Coefficients (C_3) and Volume-return Interaction Coefficients (C_4) Regressed on Country-level Proxies

	(1) C3	(2) C3	(3) C3	(4) C3	(5) C3	(6) C3	(7) C4	(8) C4	(9) C4	(10) C4	(11) C4	(12) C4
Ln(PCGDP)	-0.053						-0.001					
	(7.371)***						(0.106)					
AS		-0.003						0.001				
		(5.033)***						(1.067)				
Legal			-0.001						-0.001			
			(1.764)**						(0.490)			
Capital controls				0.148						0.092		
				(4.096)***						(3.725)***		
Ln(Total cost)					0.008						0.017	
					(0.931)						(2.194)**	
Emerging						0.095						-0.001
						(5.526)***						(0.136)
Constant	0.667	0.342	0.173	0.147	0.120	0.132	-0.007	-0.038	-0.008	-0.013	-0.077	-0.011
	(9.459)***	(8.561)***	(11.706)***	(25.042)***	(3.433)***	(23.146)***	(0.262)	(1.464)*	(1.052)	(4.226)***	(2.561)***	(3.406)***
Firm-quarters	12933	12933	12933	12933	12784	12933	12933	12933	12933	12933	12784	12933
R^2	0.0063	0.0017	0.0000	0.0011	0.0000	0.0044	0.0001	0.0000	0.0002	0.0007	0.0010	0.0003

Table 9: Cross-Sectional Regression Tests of the Influence of Country- and Firm-level Proxies for Information Asymmetry on U.S.-to-Home Stock Return Spillovers (Continued)

Panel B: Return Spillover Coefficients (C_3) and Volume-return Interaction Coefficients (C_4) Regressed on Firm-level Proxies

	(1) C3	(2) C3	(3) C3	(4) C3	(5) C3	(6) C3	(7) C4	(8) C4	(9) C4	(10) C4	(11) C4	(12) C4
Ln(Market Value)	-0.008						-0.001					
	(4.002)***						(0.373)					
Home Illiquidity		2.464						-1.184				
		(1.478)*						(0.766)				
U.S. Illiquidity			-1.561						0.082			
			(5.958)***						(1.227)			
Home Share of Turnover				-0.285						-0.011		
				(16.393)***						(1.057)		
U.S. Institutional Ownership					0.428						-0.024	
					(12.261)***						(0.806)	
Ln(Home Analysts)						-0.018						-0.005
						(2.729)***						(1.308)
Constant	0.324	0.149	0.158	0.369	0.107	0.194	0.002	-0.010	-0.011	-0.002	-0.010	-0.001
	(7.726)***	(25.734)***	(25.384)***	(24.091)***	(16.545)***	(11.207)***	(0.068)	(3.535)***	(3.540)***	(0.252)	(2.373)**	(0.057)
Firm-quarters	12933	12933	12933	12933	10128	12085	12933	12933	12933	12933	10128	12085
R^2	0.0019	0.0002	0.0005	0.0401	0.0229	0.0009	0.0002	0.0000	0.0000	0.0001	0.0007	0.0003