THREE ESSAYS ON INTERNATIONAL ASSET PRICING

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

Tae-Hoon Lim

August 2013

THREE ESSAYS ON INTERNATIONAL ASSET PRICING

Tae-Hoon Lim, Ph. D.

Cornell University 2013

This dissertation studies international linkages between stock returns and information trading in options.

In Chapter 2, “How Important are Foreign Ownership Linkages for International Stock Returns?” joint work with Söhnke M. Bartram, John Griffin, and David Ng, we look develop a simple measure of international ownership linkages and show that this measure is of similar importance as the traditional effects coming from country and industry fundamentals. International ownership linkages are not explained by omitted country/industry variations, wealth effects or other explanations like liquidity, investment style, or fund flows. We find that ownership linkage is a summary measure of investment locale that links investor capital around the world. Beyond the level of foreign ownership, the specific ownership composition of a stock is an important facet of international equity returns – a finding which has important implications for diversification.

In Chapter 3, “Trade Linkage and Cross-country Stock Return Predictability”, I test whether cross-predictability exists among trade-linked industries across international borders, and explore possible explanations. I find strong evidence of cross-border stock return predictability among trade-linked industries. A trading strategy of buying industry portfolios whose trade-linked industry had high returns, and shorting industry portfolios whose trade-linked industry had low returns, yields an annualized return of 12%. I find some evidence against the leading explanation,

which posits information segmentation as the only reason for cross-predictability, and find support for illiquidity as a new channel of explanation.

In Chapter 4, “Information based Trading in Index Options and Futures”, joint work with Seung Won Woo, we study intraday information based trading. The trade imbalances of index options with the largest leverage contain better information content on intraday KOSPI 200 return movements compared to that of options with smaller implicit leverage. We find that domestic brokerage proprietary traders are better informed on KOSPI 200 intraday returns among investor groups. However, we show that the futures trade imbalances of foreigners contain superior information content in predicting KOSPI 200 intraday return movements during the recent sub-prime mortgage crisis in 2008. This indicates that foreign traders may possess better information processing skills on news that originates from outside of Korea.

BIOGRAPHICAL SKETCH

Tae-Hoon Lim graduated from Korea University with a bachelor's and a master's degree in Economics in 2005 and 2007. He began his doctoral study in Economics at Cornell University in 2007. During his doctoral study, he has developed interest in empirical studies in financial markets and was fascinated by the idea of interdependencies of firms and assets.

ACKNOWLEDGMENTS

I would like to thank my committee members for their support, encouragement, and valuable input. Without them, this dissertation would have not been possible. I am especially thankful to my committee chair David Ng for his time and effort in guiding my research. His encouragement and input was immensely helpful in writing my dissertation.

I would also like to thank faculty members and my colleagues in Department of Economics, Applied Economics and Management, and Johnson Graduate School of Management at Cornell University from whom I gained knowledge and insights on numerous topics.

Finally, I would like express my special thanks to my family for their support during my study at Cornell.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

This dissertation studies two topics in international finance. First two chapters investigate economic linkages between stocks across country boarders, namely linkages created by international institutional investors and linkages that are naturally formed through international trades. Last chapter studies information based trading in options market. It touches upon issues in international finance and investigates whether local or foreign investors are at advantage when trading options on local index.

In Chapter 2, “How Important are Foreign Ownership Linkages for International Stock Returns?” joint work with Söhnke M. Bartram, John Griffin, and David Ng, we look develop a simple measure of international ownership linkages and show that this measure is of similar importance as the traditional effects coming from country and industry fundamentals. International ownership linkages are not explained by omitted country/industry variations, wealth effects or other explanations like liquidity, investment style, or fund flows. We find that ownership linkage is a summary measure of investment locale that links investor capital around the world. Beyond the level of foreign ownership, the specific ownership composition of a stock is an important facet of international equity returns – a finding which has important implications for diversification.

In Chapter 3, “Trade Linkage and Cross-country Stock Return Predictability”, I test whether cross-predictability exists among trade-linked industries across international borders, and explore possible explanations. I find strong evidence of cross-border stock return predictability among trade-linked industries. A trading strategy of buying industry portfolios whose trade-linked industry had high returns, and shorting industry portfolios whose trade-linked industry had low returns, yields an annualized return of 12%. I find some evidence against the leading explanation, which posits information segmentation as the only reason for cross-predictability, and find support for illiquidity as a new channel of explanation.

In Chapter 4, “Information based Trading in Index Options and Futures”, joint work with Seung Won Woo, we study intraday information based trading. Using KOSPI 200 (the Korea Stock Index 200) index options and futures data, we find that the trade imbalances of index options with the largest leverage, the out-of-the-money options, contain better information content on intraday KOSPI 200 return movements compared to that of options with smaller implicit leverage. We find that domestic brokerage proprietary traders are better informed on KOSPI 200 intraday returns among investor groups. However, we show that the futures trade imbalances of foreigners contain superior information content in predicting KOSPI 200 intraday return movements during the recent sub-prime mortgage crisis in 2008. This indicates that foreign traders may possess better information processing skills on news that originates from outside of Korea.

CHAPTER 2

HOW IMPORTANT ARE FOREIGN OWNERSHIP LINKAGES FOR INTERNATIONAL STOCK RETURNS?

(Join with Söhnke M. Bartram, John Griffin, David T. Ng)

1. Introduction

What drives stock price variation in international securities? A large literature debates the relative importance of country and industry forces in affecting variation in stock returns and international diversification. This is predominantly a cash flow view of international stock variation. We recast this debate by creating a summary measure of international ownership linkages and show that this measure is of similar importance as the traditional economic channels.

We build upon a growing literature that predominantly points to the relevance of stock ownership for international equities. Froot and Dabora (1999), Chan, Hameed, and Lau (2003), and Foerster and Karolyi (1999) show in different contexts that when a stock switches its country of trading its covariation shifts. Barberis, Shleifer, and Wurgler (2005) use this intuition to formalize a view where investors in certain investment 'habitats' move capital in and out of the securities they hold and drive their return comovement. We find that the importance of our ownership return variable is largely because it is a summary measure of investor habitat (or capital locale). We add to the literature by: a) providing a new and intuitive measure to capture stock linkages, b) documenting the economic importance of foreign ownership on a large and systematic scale, and c) decomposing and empirically analyzing the channels through which ownership matters. By proposing a specific channel of foreign ownership linkage and showing that this channel has similar economic importance as stock return variation due to traditional country and industry effects, our paper provides important evidence on how global investments connect stocks.[1]

In order to capture a stock's connectedness to foreign securities, we construct a measure of the foreign equity returns of the stock's shareholders. For example, for Samsung, a Korean firm, we first find that its largest shareholder is an investment company called Capital World Investors. Second, we calculate the value-weighted return of all non-Korean stocks held by Capital World Investors. We perform this calculation for all institutions holding Samsung and then use the weight of the funds' ownership in Samsung to calculate an average (foreign) ownership return. Because the ownership return captures the returns of other stocks held by Samsung shareholders outside of Korea, it is a measure of foreign ownership linkage.[2] Using detailed holding data from the LionShares Holdings database, we are able to capture ownership for 8,791 firms domiciled outside of the United States.

Using weekly, monthly, and quarterly data, we document that foreign ownership returns are important for driving cross-sectional variation in returns. For stocks with more than five percent foreign ownership, a one percent increase in the ownership return is associated with an economically large 0.395 increase in a firm's stock return, even after controlling for the local market and industry movements. In time-series analyses, we use the approach of Bekaert, Hodrick, and Zhang (2009) to analyze the covariance structure of international stock returns and find that the ownership return captures considerable covariation beyond the local market, global market, and industry returns. Here we show that the ownership return is important even beyond the inclusion of local and global versions of size, value, and momentum factors. To see if the

[1] On a broader scale, this finding is in contrast to Forbes and Chinn (2004), who examine channels of cross-market linkages and find that financial markets are connected through global trade but not through foreign investment. Bekaert and Wang (2010)'s survey article concludes that global betas are linked to financial openness.

[2] The Samsung example is illustrated in Appendix A. We initially focus on variation due to ownership returns outside of a country because ownership returns within a country are highly correlated with the local market return, making the interpretation more difficult. Nevertheless, we also show similar effects for domestic ownership returns.

ownership return is capturing some unobserved preferences of institutions for stocks in certain countries and industries, we calculate a 'non-ownership return' where each stock in a stock's ownership return is replaced with a stock with matching country, industry, and size characteristics, but with no ownership linkage. This 'non-ownership return' is completely unrelated to stock returns, indicating that ownership is not capturing unobserved country/industry fundamentals. The role of the ownership return is also not explained by stock liquidity levels, the level of foreign ownership, market integration channels, nor even the change of ownership itself.[3] We use a quasi-natural experiment, which is a shift in ownership composition around an American Depository Receipt (ADR) or Global Depository Receipt (GDR) listing date. Consistent with the ownership linkage relation being driven by the owners of the stock rather than an omitted firm characteristic, we find that the cross-listed stocks become more highly correlated with the new owners' other stock holdings following the listing.

Having established the importance of ownership for stock returns, we consider additional explanations for why ownership returns matter. Our primary contenders are investor habitat and wealth effects. In Barberis, Shleifer, and Wurgler (2005)'s explanation of investor habitat, investors with certain views move capital in and out of related securities in a correlated fashion. In the model of Daniel, Hirshleifer, and Subrahmanyam (2001), overconfident investors cause covariation as they misinterpret signals arising from economic factors. Consistent with these explanations, we find that stocks with common ownership have strong related changes in institutional ownership. Additionally, we classify stocks into low, medium, and high ownership linkage and find that ownership changes in a stock are most closely related to those stocks with

[3] Under the market integration explanation, stocks with low institutional ownership may be segmented from the rest of the world, while stocks with high institutional ownership are more integrated. The importance of foreign ownership returns can then be captured by a world index that is tilted towards stocks with high foreign ownership, but this index has no effect on the ownership return.

the most similar ownership habitat. Return covariation is also strongest for stocks with the most common ownership habitat. We further explore the implication of a stock's habitat by regressing returns on a decomposition of the change in ownership where we are also able to separate out the effects of flows. We find that the return and ownership linkages are clearly distinct from investment flows. The value fluctuation of a stockholder's holdings in other securities in the investment locale bears the largest relation to returns. Although most of our paper focuses on foreign ownership, we also find that the domestic return habitat also plays an economically significant role.

Inconsistent with wealth effects, we find that institutions are no more likely to invest in a stock when their other stocks' returns increase. Inconsistent with some related time-specific contagion explanations, we find no evidence of asymmetry around negative returns or of the ownership return effect clustering in times of crisis.

We briefly examine the practical diversification implications of our findings. Institutions can increase diversification by avoiding stocks with high ownership return linkages. If a fund adds a security with a high ownership linkage to its portfolio, the average covariation of that security with the fund portfolio is 77 percent higher than if the fund were to add a security with a low ownership linkage. While the level of foreign ownership is also important, the magnitude of ownership linkages is economically larger. Since investors hoping to obtain diversification cannot easily escape the effects of other foreign investors in a firm's investment habitat, investment locales transcend country and industry boundaries.

Our paper relates to and yet extends the growing domestic and international literature relating ownership structure and returns.[4] In a domestic context, Anton and Polk (2010) show

[4] Papers examining the behavior of international investing at the fund level include Kaminsky, Lyons, and Schmukler (2004), Chan, Covrig, and Ng (2005), Broner, Gelos, and Reinhart (2006), Ferreira and Matos (2008 and 2009), Covrig,

that covariation between stock pairs is related to their common ownership. Coval and Stafford (2007) find that common flows in or out of a stock can cause long-term price dislocations, while Greenwood and Thesmar (2011) show that U.S. mutual funds with highly correlated fund flows exhibit higher volatility and correlations.[5] Internationally, Jotikasthira, Lundblad, and Ramadorai (2011) find that mutual fund flows from domestic markets can drive emerging market returns, and Hau and Lai (2012) provide evidence of fire sales pressuring prices by examining losses due to financial firms during the financial crisis. Our paper differs from this literature in that we construct a specific measure of ownership linkage, provide a unique decomposition of the change in institutional ownership, find that the fund flow channel in previous studies is not the primary driver of our findings, and demonstrate practical diversification implications of ownership linkages. While a growing literature has illustrated the effects of various habitats [Pirinsky and Wang (2004), Greenwood (2005 and 2008), Sun (2008), Green and Hwang (2009), and Kumar, Page, and Spalt (2010)], our paper provides a new and important way of summarizing the effects of ownership habitat and details the large economic importance of this channel.

Section 2 briefly introduces our statistical measure and relates it to the relevant theoretical and empirical literature. Section 3 describes the ownership data, while our main cross-sectional and time-series findings are presented in Section 4. Section 5 examines alternative explanations for our findings, while Section 6 examines investor habitat and wealth effects. Section 7 offers further insights into the role of institutional ownership by decomposing it into economically meaningful elements. Section 8 discusses diversification implications. Our

---

Fontaine, Jimenez-Garces, and Seasholes (2010), and Hau and Rey (2009). Faias, Ferreira, Matos, and Santa-Clara (2011) examine the country/industry diversification issue for various levels of foreign ownership that we also examine in conjunction with the ownership return in Section 7. The importance of capital flows at the market level is examined by Froot, O'Connell, and Seasholes (2001), Bekaert, Harvey, and Lumsdaine (2002), and Froot and Ramadorai (2008), among others.

[5] Frazzini and Lamont (2008) and Lou (2011) find domestic evidence of flows moving prices. Ellul, Jotikasthira, and Lundblad (2011) find fire sales in the bond market. Calomiris, Love, and Peria (2011) argue that negative global equity returns during the financial crisis are related to price pressure as proxied for by previous turnover.

conclusions are presented in Section 9.

2. Ownership Channels and Testable Implications

In this section we seek to provide a brief overview of the channels in which ownership may relate to variation in stock price movement.

2.1 Country/Industry Variations and the Ownership Return

The international finance literature typically decomposes realized return variation into common country and industry variations [Roll (1992), Heston and Rouwenhorst (1994)]. Returns of stock *i* can be written as follows:[6]

$$R_{i,t} = \alpha + \beta_C R_{C,t} + \beta_I R_{I,t} + e_{i,t} \qquad (1)$$

where $R_{C,t}$ is stock *i*'s country market return in period *t*, and $R_{I,t}$ is the industry return for stock *i*. Note that unlike Heston and Rouwenhorst (1994), this framework allows beta to differ from one, which is recommended by Bekaert, Hodrick, and Zhang (2009). The country component can also be refined into global and local components as follows:[7]

$$R_i = \alpha + \beta_G R_G + \beta_L R_L + \beta_I R_I + e_i \qquad (2)$$

where R_G is the global market return and R_L is the local market return. All returns and errors are measured at time *t*.

If foreign investors facilitate the globalization of a security, stocks owned by foreign institutions have higher global betas (β_G) and lower local betas (β_L). Under this scenario the level

---

[6] Other papers analyzing country and industry sources of variation include Griffin and Karolyi (1998), Carrieri, Errunza, and Sarkissian (2004), and Bekaert, Hodrick, and Zhang (2009). Papers analyzing the importance of exchange rates in determining return covariation (like Jorion (1990) and Ng (2004)) generally find only a small role for exchange rates.

[7] We examine covariation of realized returns. In the international asset pricing literature, local and global factors depend on the degree of integration/segmentation [Stulz (1981a), Errunza and Losq (1985)]. This literature is surveyed in Bekaert and Harvey (2003) and Karolyi and Stulz (2003).

of foreign ownership matters, but the specific composition of ownership is unimportant.[8] If the specific holders of a security influence the price of the stock, then we would expect to see stocks held by common owners as an important source of covariation. In that case, the ownership return is a part of the determinants of a stock's return in the following equation:

$$R_i = \alpha + \beta_G R_G + \beta_L R_L + \beta_I R_I + \beta_O R_{i,O} + e_i \quad (3)$$

where $R_{i,O}$ is the ownership return which is specific for each stock i.[9] To capture the combined effect of all ownership-linked securities, the ownership return is the value-weighted average return of the holdings of a stock's owners. $R_{i,O}$ measures the return of stock i's holders' stock holdings:

$$R_{i,O} = \sum_{n=1}^{N_i} W_{i,n} \left(\sum_{k=1}^{K_i} V_{k,n} R_k \right) \quad (4)$$

where n=1 to N_i denote the institutions that have ownership holdings of stock i. k=1 to K_i are the stocks held by these institutions. $W_{i,n}$ is the percentage of market capitalization of stock i held by institution n at the end of the previous quarter. $V_{k,n}$ is the percentage of market capitalization of stock k in the equity portfolio that institution n holds at the end of the previous quarter. R_k denotes the return of stock k. For simplicity, we suppress the time subscript t, but it should be understood that the weights are as of the end of the last quarter, while the returns are over the course of the current period.

For empirical analysis, it can be advantageous to divide the ownership returns into a part due to foreign stocks that investors hold, and a part due to domestic stocks. Note that we

---

[8] In a related fashion, the model of Dumas, Lewis and Osambela (2011) predicts that once domestic stocks become familiar to foreign investors, they would be willing to hold more of such domestic stocks and require less expected returns. Hence, again the level of foreign ownership is important as it proxies for the familiarity of foreign investors with the stock.

[9] Note that since the ownership return is unique for each stock, it is not a factor. To avoid introducing a bias by regressing a stock on itself, our local market indices also exclude the stock of examination. For consistency, the value-weighted global industry return only includes stocks in a given industry outside of the country of examination.

distinguish between foreign and domestic relative to the country of incorporation of stock *i* and not the location of institution *n* owning the stock. Since the foreign ownership return comes from a diverse set of countries, it leads to clear identification, whereas a domestic ownership return can be highly correlated with local market returns. Hence, we first focus on foreign ownership returns in most of the paper, but for robustness also examine the domestic ownership return. An example of the ownership return calculation for Samsung is discussed and illustrated in Appendix 1.

In our empirical implementation of ownership return measures, we impose that the observed ownership weights sum up to one:

$$\sum_{n=1}^{N_i} W_{i,n} = 1 \quad \text{and} \quad \sum_{k=1}^{K_i} V_{k,n} = 1 . \qquad (5)$$

This makes it easier to interpret our results since foreign ownership returns of different stocks will be comparable. The ownership return captures the composition of the holdings of the owners of a stock, but not the level of foreign institutional ownership. We expect (and confirm in Supplemental Table S2.1) that the ownership return is more important for stocks where the holders represent a large fraction of the shares. Therefore, for our main results, we examine securities with more than five percent foreign ownership. The ownership return can be constructed for higher frequencies than the quarterly changes in ownership by combining the previous quarter's holdings weights with the updated weekly and monthly stock returns.[10]

[10] It is interesting to think of the possible role played by measurement error. The returns not involving ownership in equation (3) simply involve weighted averages of global, country, and industry returns, and hence, are easily measured. The ownership return depends on knowing ownership, which is often incompletely measured or updated infrequently. Such effect will lead to more error in estimating foreign ownership returns, decreasing the power of our tests and biasing results against the significance of the ownership return.

2.2 Hypotheses for the Ownership Return

The ownership return fits closely with a few different explanations in the literature. We consider if the ownership return is acting as a proxy for omitted country/industry variation, investor habitat, or wealth effects.

1.2.1 Omitted country/industry variation

As shown in equation (3), global, local, and industry factors are separately examined. Additionally, we will perform several checks to examine if an empirical regression like equation (3) is properly controlling for these effects. Most notably, institutions may purchase stocks with similar country and industry characteristics, and the ownership return could be a more precise proxy of these characteristics. We examine this hypothesis by creating a non-ownership return that has identical country, industry and size characteristics as the ownership return, but is based on stocks with no common ownership connection. Additionally, we perform robustness checks based upon different market and industry return definitions.

2.2.2 Habitat investing

Barberis, Shleifer, and Wurgler (2005) formalize a 'habitat' view of comovement where investors trade in a limited set of stocks. If investors in a habitat have certain views, they push the prices of stocks in their habitat up and down together.[11] Daniel, Hirshleifer, and Subrahmanyam (2001) show that overconfident investors misinterpret information about economic factors in a correlated fashion, which causes stock price fluctuations and mispricing.[12] Hirshleifer and Jiang (2010) build on this intuition to show that a misvaluation factor generates comovement in returns beyond standard factors. This provides another motivation for why an

[11] Stulz (1981b) proposes that investors may prefer home country assets because these assets could provide superior hedges against future state variables that affect investors' intertemporal expected utility. It is possible that an investor's habitat of stocks is determined by certain intertemporal hedging properties.

[12] Hence, variation due to common country and industry effects need not be due purely to rational pricing.

investor habitat can proxy for investors with either similar levels of overconfidence or who react to public signals in a manner that causes stock price comovement.

In our setting, heterogeneous global investors with different market perceptions could influence stock prices as their holdings and preferences for stocks in particular investment locales oscillate in ways that cut across national borders and industries. For each stock, the ownership return could be thought of as the weighted average of the actions of the investors in all related stocks. If there truly exists a common investment locale or 'habitat' for groups of stocks, institutions should move capital into and out of these habitats in a similar fashion. We test this by examining if the changes in ownership for a stock *i* is related to the value-weighted holding changes in stocks held by the firm's owners. Moreover, we also examine habitat by grouping stocks into those with low, medium, and high ownership linkages to stock *i*. We then identify whether the covariation of ownership changes as well as returns is strongest from those stocks with the highest cross-ownership.

In a related vein, the category view [Barberis and Shleifer (2003)] hypothesizes that stocks move together because investors mentally lump them into categories (e.g. value vs. growth). To examine this category based view, we use detailed size, value, and momentum proxies both at the local and global level.

2.2.3 Wealth effects

A simple implication of portfolio rebalancing is that if stock prices increase in one group of securities, investors may want to diversify away from this group and increase their holdings in other securities. This basic aspect of portfolio rebalancing plays a role in many models.[13] We will test this basic feature of portfolio rebalancing by examining if owners experiencing an

[13] See for example equation 4 in Bohn and Tesar (1996), equation 6 in Griffin, Nardari, and Stulz (2004), Figure 5 in Goldstein and Pauzner (2004), and page 1412 in Kyle and Xiong (2001).

increase in wealth through high returns on other securities increase their holdings in a stock in the form of a wealth effect.

Some of the portfolio rebalancing models are derived in the context of international contagion. For example, Goldstein and Pauzner (2004) propose that when an international investor's domestic holdings decrease, she has lower wealth and is more likely to sell her foreign holdings. However, the investor is also more averse to the strategic risk that other international investors will be in a similar position and want to sell their international holdings. This generates international comovement in returns of assets that are held by the same investors, even without common fundamentals.[14] Thus, in addition to basic portfolio rebalancing mechanisms, some of these models call for asymmetries surrounding negative returns and particularly in periods of crisis.

3. Data and Methodology

Our international institutional holdings are from FactSet/LionShares. Ferreira and Matos (2008) is the first academic paper to use the annual institutional filings from this data source. We follow many of their data cleaning procedures augmented with other standard checks for 13f filings as described in Supplemental Appendix A. Like Ferreira and Matos (2008), we obtain the historical LionShares database that is free from survivorship bias. FactSet/LionShares do not provide detailed disclosure of their sources, but they do use data from public filings obtained in various countries supplemented by companies' annual reports. Their coverage appears to be lacking in

[14] Calvo (1999) finds that leveraged losses in one market will cause forced liquidations in another, and Kyle and Xiong (2001) propose that when convergence traders suffer trading losses they have a reduced capacity for risk bearing and sell positions in both countries. Such effects are intensified when there is information asymmetry and herding by uninformed agents [Calvo (1999), Kodres and Pritsker (2002), and Yuan (2005)]. Empirically, Choe, Kho, and Stulz (1999), Bae, Karolyi, and Stulz (2003), and Boyer, Kumagai, and Yuan (2006), among others, examine contagion.

capital originating outside of the United States. Wei (2011) finds that the United States and the United Kingdom account for slightly over 70 percent of LionShares' non-domestic capital.

LionShares contains two main databases: the aggregate institutional filings (similar to 13f in the United States), and the mutual fund database (similar to N-CSR mutual fund filings in the United States). LionShares provides the number of shares held by a fund or institution, as well as the total number of shares outstanding for each stock at a point in time. We aim to maximize data coverage. Hence, we use the institutional database as our primary database but add additional ownership information from the fund database if the parent institution's holdings are not in the institutional ownership database.

Appendix Table A2.1 details the frequency of coverage by database for the final sample and shows that 48 percent is annual, 32 percent biannual, and 14 percent quarterly. While most of the data in the United States is reported quarterly, in most other countries biannual and annual data is the norm. Appendix Table A2.2 details the number of institutions and mutual funds in the database through time and shows that the sample grows rapidly from 2001 to 2005.

For returns and market value data, we use Thomson Financial's Datastream total return indices and market values. In order to have a common currency to compute global returns, we download data in local currency and convert it into U.S. dollars using exchange rates from Datastream. We use filters for common equity as well as reversion and extreme return filters to smooth potential data errors as described with other details in Supplemental Appendix A. To ensure that our results are not driven by infrequent trading, we require stocks to exhibit trading for at least 30 percent in the previous year.[15]

[15] The percentage of zero returns is the main measure of liquidity used by Bekaert, Harvey, and Lundblad (2007). This measure is similar to Lesmond, Ogden, and Trzcinka (1999)'s transactions costs measure, but is less subject to estimation problems. Higher trading filters of 50 and 75 percent yield similar results (as shown in Panel B of Table S2.4).

Table 2.1: Summary Statistics

The table shows summary statistics on the percent of firms in the sample with foreign institutional ownership, the number of firms with foreign institutional ownership, and the percentage of foreign institutional ownership. The sample period is 01/01/2000-03/31/2009. To be included in the sample, firms are required to have non-missing data on lagged foreign ownership and at least 30% non-zero trading days in the previous year. Panel A shows statistics for Developed Markets, while Panel B shows results for Emerging Markets (based on the MSCI classification as of June 2006). In each panel, results are broken down by country, region and size quintiles (small to large, using common U.S. breakpoints). Size is measured by market capitalization in U.S. Dollars as of December in the previous year. The first group of columns shows the percentage of firms in the sample that have data on foreign institutional ownership. The second group shows the number of firms with foreign ownership, and the third shows the average percentage of (free-float adjusted) foreign institutional ownership. Foreign Ownership is free-float adjusted by dividing it by one minus the percentage of closely held shares, where missing values of closely held shares are set to zero. Averages are first taken by year and subsequently across time. Ownership data is from LionShares, market capitalization data is from Datastream, and data on closely held shares is from Worldscope.

(continued)

Table 2.1: Summary Statistics (continued)

Panel A: Developed Markets

	% of Firms with Foreign Ownership					Number of Firms with Foreign Ownership					Foreign Institutional Ownership (%)				
	Small	2	3	4	Large	Small	2	3	4	Large	Small	2	3	4	Large
Australia	33.2	74.9	86.3	91.3	91.7	126	99	67	52	47	3.3	4.9	5.8	7.8	12.2
Austria	66.0	71.8	89.0	97.5	98.9	7	7	7	13	10	3.7	10.6	14.3	17.8	23.8
Belgium	78.8	74.5	79.2	74.6	88.5	12	13	13	10	15	1.3	8.1	17.8	13.0	14.7
Canada	35.6	79	85.5	90.0	94.0	390	144	87	70	67	3.5	7.3	14.2	17.3	26.3
Denmark	54.5	71.3	81.2	72.8	90.8	12	22	18	12	14	3.7	2.3	4.2	9.3	16.2
Finland	74.5	91.1	89.2	88.7	96.2	18	22	16	19	14	2.8	10.7	14.0	18.4	26.4
France	54.3	72.2	89.0	89.6	94.8	102	73	75	60	79	3.4	6.7	10.7	16.1	18.4
Germany	58.5	78.7	83.1	81.3	92.1	135	79	62	52	67	1.8	6.2	11.4	18.6	20.1
Ireland	68.0	81.9	81.4	83.5	91.6	6	7	6	8	11	13.4	18.0	22.5	32.8	34.3
Italy	61.4	75.1	79.0	84.0	82.5	13	32	38	34	46	1.8	4.5	8.4	10.9	15.5
Japan	27.5	69.1	89.1	95.1	97.3	205	551	572	434	351	1.2	1.7	3.2	5.7	9.5
Luxembourg	30.0	85.7	86.4	69.7	96.8	1	1	3	3	3	14.2	0.6	22.3	48.1	37.0
Netherlands	35.5	59.2	69.7	69.7	84.2	7	12	14	18	23	3.2	12.5	24.3	24.2	31.0
New Zealand	53.3	89.7	93.8	92.0	100	8	15	12	9	3	1.3	6.6	10.7	8.1	37.6
Norway	66.0	81.4	93.7	96.8	95.1	17	21	23	20	11	2.0	4.5	12.7	19.3	28.1
Portugal	47.0	74.0	75.9	57.6	94.5	5	6	7	4	10	2.3	4.2	7.4	23.0	11.8
Spain	93.8	79.5	82.9	72.2	79.0	3	11	18	17	33	1.0	2.3	6.9	10.6	15.5
Sweden	58.3	83	93	94	99.6	57	46	32	26	28	2.4	6.1	9.9	14.2	16.8
Switzerland	68.5	74.5	75.8	66.9	69.2	11	23	30	27	11	3.6	5.2	13.0	19.8	16.5
United Kingdom	73.0	88.4	88.2	82.9	85.0	144	155	151	124	135	1.8	3.4	5.3	8.4	11.6
United States	96.9	99.5	99.0	96.9	99.1	741	871	873	881	944	0.7	1.2	2.1	2.6	4.8
Developed	**51.9**	**82.8**	**91.6**	**92.1**	**95.3**	**2,018**	**2,208**	**2,122**	**1,893**	**1,920**	**1.8**	**3.0**	**4.9**	**7.0**	**10.1**
Developed ex US	**40.9**	**74.7**	**87.1**	**88.3**	**91.8**	**1,277**	**1,337**	**1,249**	**1,012**	**977**	**2.6**	**4.1**	**6.8**	**10.6**	**15.0**

(continued)

Table 2.1: Summary Statistics (continued)

Panel B: Emerging Markets

	% of Firms with Foreign Ownership					Number of Firms with Foreign Ownership					Foreign Institutional Ownership (%)				
	Small	2	3	4	Large	Small	2	3	4	Large	Small	2	3	4	Large
Argentina	53.9	75.4	94.2	93.2	90.4	5	5	7	8	5	1.1	1.8	3.4	9	19.5
Bangladesh	6.3	16.1	13.6	14.3	0.0	2	2	2	1		2.5	0.8	0.6	2.4	
Bermuda	0.0	100	44.4	66.7	100		1	1	2	2		61.6	85.9	45.9	44.6
Brazil	52.6	58.3	63.6	75.6	86.5	3	5	9	14	19	7.0	2.4	5.5	13.5	16.2
Bulgaria	16.7	33.3	70.0	100		1	2	2	2		1.4	2.4	1.8	5.0	
Chile	38.1	57.1	61.8	77.6	88.1	2	4	7	13	13	2.8	2.6	1.7	12.1	20.2
China	9.9	3.4	8.1	17.0	54.5	5	10	39	53	31	3.0	15.4	10.8	9.1	17.1
Colombia	0.0	33.3	55.0	79.1	93.1		1	2	4	5		2.9	0.7	1.6	1.1
Croatia	0.0	55.6	85.7	100	71.4		1	2	1	1		2.7	5.0	24.6	21.7
Cyprus	5.8	14.5	26.1	45.0	69.2	3	4	2	2	2	1.5	0.0	0.1	6.7	4.5
Czech Republic	7.1	0.0	57.1	100	100	1		1	2	3	0.0		11.5	43.9	41.4
Egypt	8.2	24.1	57.4	71	100	2	3	6	6	5	1.0	1.0	1.6	7.5	15.9
Estonia	57.5	84.6	100	100		5	1	3	3		15.2	42.0	48.0	24.1	
Greece	40.3	45.2	57.2	70.2	91.5	33	31	28	21	16	0.6	1.8	4.4	6.7	18.4
Hong Kong	34.2	56.9	70.9	84.1	91.6	61	80	68	42	37	2.6	7.1	13.3	25.1	22.9
Hungary	24.0	40.0	57.1	74	100	4	3	2	3	4	8.7	15.9	14.5	41.0	34.2
Iceland	0.0	0.0	0.0	60	67.0				3	4				5.8	0.2
India	16.5	42.4	61.0	67.5	83.0	37	65	69	47	37	1.3	2.3	4.5	8.5	17.4
Indonesia	27.3	39.2	42	70	72.7	15	13	9	10	8	7.2	10.0	11.1	20.4	35.6
Israel	35.5	50.5	76.8	95.7	99.0	19	21	21	17	8	2.9	5.0	9.6	10.7	17.6
Kenya	32.8	64.4	51.6	88.9	100	3	4	3	4	1	1.8	0.6	0.6	0.9	1.3
Korea, Republic Of	21.0	52.7	83.2	93.5	98.4	100	137	86	55	40	1.9	4.4	8.1	13.5	19.4
Latvia	50.9	90.9	86.7	66.7		4	3	2	1		9.8	10.7	8.5	0.3	
Lithuania	53.5	83.1	42.3	94.1	100	9	8	2	3	1	8.1	8.0	3.9	10.9	2.8
Malaysia	32.6	57.0	84.5	96.3	100	73	74	60	40	20	2.2	2.1	6.7	7.7	14.6
Malta		100	100	100			1	1	2			2.7	3.4	1.9	
Mauritius		80.0	87.5	100			2	4	1			0.3	1.5	6.3	
Mexico	23.8	54.5	69.0	80.4	98.0	1	2	4	8	11	0.5	6.2	8.1	11.9	15.4
Morocco	2.2	4.1	29.5	60	70.8	1	1	3	5	3	0.1	0.0	0.7	0.7	3.2
Pakistan	7.2	25.1	52.3	81.5	100	4	6	10	5	3	0.8	1.9	1.7	4.0	7.7
Peru	22.0	27.3	55.6	65.2	81.3	1	2	3	5	2	5.6	9.5	0.5	3.1	25.8
Philippines	38.6	73.0	78.0	83.3	86.0	8	9	8	7	5	22.2	19.9	24.8	63.2	93.2
Poland	43.7	76.2	89.1	95.7	100	41	22	15	12	7	1.7	6.6	13.9	16.7	36.4
Romania	46.8	81.8	90.0	100	100	10	5	2	2	2	6.4	10.5	4.5	2.1	2.5

(continued)

Table 2.1: Summary Statistics (continued)

Panel B: Emerging Markets

	% of Firms with Foreign Ownership					Number of Firms with Foreign Ownership					Foreign Institutional Ownership (%)				
	Small	2	3	4	Large	Small	2	3	4	Large	Small	2	3	4	Large
Singapore	34.3	63.1	72.8	85.5	84.4	45	54	32	20	14	1.9	4.3	11.6	17.3	39.9
Slovakia	25.0	50.0	100	100	100	1	1	1	1	1	23.7	1.2	17.0	13.8	7.4
Slovenia	66.7	54.5	45.0	81.8	100	10	5	4	3	3	2.3	0.0	0.4	1.8	2.5
South Africa	30.7	59.9	66.9	61.6	78.4	13	20	26	24	22	0.5	1.7	4.3	9.8	21.1
Sri Lanka	27.0	61.4	52.6	100		6	6	1	2		4.5	12.3	8.5	38.6	
Taiwan	20.8	45.3	65.8	87.1	97.4	53	108	109	72	42	1.0	2.4	3.8	7.2	13.2
Thailand	27.5	55.6	75.9	93.3	100	25	29	25	18	12	5.3	7.2	12.6	14.9	24.9
Turkey	27.9	72.0	80.2	93.4	99.0	22	37	29	20	12	2.2	5.3	9.4	21.4	27.1
United Arab Em.			100	100	100			1	1	1			27.5	35.6	38.7
Venezuela	77.3	90.0	62.5	66.7	100	3	2	2	2	2	4.4	0.3	1.3	21.2	91.8
Emerging	**26.8**	**45.0**	**53.6**	**59.5**	**86.3**	**572**	**760**	**678**	**545**	**384**	**2.6**	**4.2**	**7.3**	**12.2**	**20.1**
All countries	**43.0**	**68.1**	**78.2**	**82.1**	**93.6**	**2,589**	**2,969**	**2,800**	**2,439**	**2,304**	**2.0**	**3.3**	**5.5**	**8.1**	**11.7**

Table 2.1 shows the percent of firms with foreign ownership coverage, the number of firms with foreign ownership, and the fraction of market capitalization held by foreign institutions for those firms with coverage in the LionShares database over the January 1, 2000 to March 31, 2009 period. We use common U.S. breakpoints based on U.S. dollar market capitalization. Panel A is for developed markets and Panel B is for developing (emerging) markets. In terms of the number of firms with foreign ownership coverage, the sample is naturally more heavily tilted towards developed markets, where all size bins have more than 1,000 firms as compared to 384 to 760 firms per bin in emerging markets. Overall, our sample includes a total of 13,101 firms, 8,790 of which are from outside of the U.S.

Finally, for stocks with foreign ownership, we report the percent of foreign institutional ownership. Panel A shows that firms in developed countries outside of the United States have 15.0 percent foreign ownership in the largest size quintile, and 2.6 percent in the smallest size quintile. For our regressions we will focus on non-U.S. firms since foreign ownership is small in the United States. Panel B shows similar coverage in emerging markets with 20.1 percent of shares held by foreigners in the largest quintile, and 2.6 percent in the smallest. Our main tests focus on stocks with more than five percent foreign ownership. Table 2.1 indicates that this sample is tilted toward large stocks but still captures many stocks in the bottom three size bins.

4. Cross-sectional and Time-series Importance of Ownership Returns

To examine the potential economic and statistical importance of the ownership return, we first evaluate the ownership returns with cross-sectional and time-series tests.

Table 2.2: Cross-Sectional Regressions with Ownership Returns

The table shows the results of Fama-MacBeth regressions of stock returns on an intercept (not reported), the foreign institutional ownership return (Ownership Return), Ownership Return lagged by one period, the average of Ownership Return lagged by 2-4 periods, expected returns from a CAPM with local and world market index, and global industry index returns excluding the industry in the local market (Industry). Local Beta and World Beta are first estimated from rolling regressions using past two-year returns, where the returns of each stock is regressed on the returns on the value-weighted local country market returns, and the returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_L R_{L,t} + \beta_W R_{MSCI,t} + \varepsilon_{jt}$. The Local Beta is then multiplied with the contemporaneous local market returns (Local Beta*Local Market), and the World Beta is multiplied with the contemporaneous MSCI world market returns (World Beta * World Market) to construct the CAPM expected returns. The sample period is 01/01/2000-03/31/2009. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The table shows results for regressions with weekly, monthly, and quarterly returns, respectively. It reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. Ownership data is from LionShares, and return data for individual stocks, market indices, and industry indices is from Datastream.

	Weekly			Monthly			Quarterly		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Ownership Return	0.484	0.224	0.215	0.625	0.338	0.309	0.710	0.391	0.358
	(21.4)	(13.6)	(12.6)	(11.5)	(9.52)	(7.51)	(7.11)	(4.76)	(3.71)
Ownership Return (lagged)			0.097			0.060			-0.069
			(5.64)			(1.54)			(-1.01)
Ownership Return (lagged, avg. of 2, 3, 4)			0.080			-0.029			0.376
			(2.54)			(-0.47)			(3.07)
Local Beta*Local Market		0.784	0.782		0.789	0.788		0.768	0.746
		(81.3)	(82.2)		(32.5)	(33.1)		(15.4)	(15.3)
World Beta*World Market		1.354	1.347		72.950	72.986		0.203	0.223
		(2.33)	(2.39)		(1.02)	(1.02)		(0.40)	(0.47)
Industry		0.256	0.255		0.344	0.339		0.405	0.408
		(25.4)	(25.7)		(13.8)	(13.6)		(9.78)	(10.2)
Adjusted R^2	0.008	0.105	0.108	0.012	0.120	0.123	0.015	0.132	0.138
Average Number of Firms	2,117	1,997	1,990	2,118	2,002	1,969	2,088	1,607	1,441

4.1 Cross-sectional Regressions

Table 2.2 reports results from cross-sectional Fama-MacBeth (1973) regressions for all non-U.S. stocks with more than five percent foreign ownership for weekly, monthly, and quarterly frequencies. In the univariate specification, we find that a one percent increase in contemporaneous weekly ownership returns is associated with a 48.4 basis point increase in a stock's return. In order to control for the expected local and global cost of capital changes due to both returns and betas, we use prior estimated betas times the contemporaneous local or global stock return movement.[16] After controlling for the local and global cost of capital and the industry return, a one percent increase in the ownership return is associated with a 0.224 return increase. The comparable specification 2 shows a stronger ownership effect (0.338) at the monthly frequency, and an even stronger coefficient (0.391) at the quarterly frequency. Interestingly, these coefficients are nearly as large as those of the industry return at the weekly (0.256), monthly (0.344), and quarterly (0.405) frequencies.

In specification 3 we include the lagged foreign ownership return. At the weekly frequency the lags are significant, especially in the prior week. These lag effects are potentially consistent with portfolio rebalancing, but the effects are small and dissipate rather quickly. We imagine that they would be difficult to trade on in real time. Lag effects show no significance at the monthly frequency and potentially some significance at the quarterly frequency over the entire prior year, though our ten-year time-series sample seems too short to make such prior-year inferences.[17]

In supplemental results (Panel A of Table S2.2), for stocks with foreign ownership greater than five percent, we also estimate panel regressions with time fixed effects and standard errors

[16] We later perform other risk adjustments as well.

[17] We also examine stocks with low (0-1 percent), medium (1-5 percent), and high (greater than 5 percent) foreign ownership in Panel A of Supplemental Table S2.1. The coefficients and *t*-statistics are increasing in the level of foreign ownership.

clustered by firm to account for firm and time effects. Given that our sample size increases over time, the panel regressions put more weight on recent periods, while Fama-MacBeth regressions treat each period equally. After controls for the local and world cost of capital and the industry return, the ownership return coefficient is 0.313 with a *t*-statistic of 5.35 for stocks with high foreign ownership.[18]

4.2 Time-series Regression

We now turn to examining the explanatory power of the ownership returns using the time-series approach of Bekaert, Hodrick, and Zhang (2009), which is advantageous in that we can control for multiple forms of risk in the standard time-series regression framework. In order for the coefficient estimates to vary fully across stocks, we estimate regressions at the individual stock level and then aggregate up the coefficients. For stocks with more than five percent foreign ownership, Panels A-C of Table 2.3 shows the regressions estimates over three sub-periods with weekly data.

We first examine the importance of the ownership return beyond the local market return. The average coefficient on the ownership return (specification 3) is 0.308 in the 2000 to 2002 period (Panel A), 0.207 from 2003 to 2005 (Panel B), and 0.208 from 2006 to the first quarter of 2009 (Panel C). A coefficient of 0.208 indicates that a weekly stock return increases by twenty basis points when the ownership return increases by 100 basis points, even after controlling for variation in the local market. This coefficient is similar in size to that of the world market return (0.361, 0.183, and 0.171 for the three sub-periods in specification 2) or global industry return

[18] The ownership return factor will be inaccurate to the extent that institutions sell off their stocks over the quarter. In Supplemental Figure S1 we show weekly ownership return coefficients averaged over the course of quarters and find that the ownership return coefficients reduce only very slightly at the end of the quarter, and are generally quite stable.

Table 2.3: Time-Series Regressions with Ownership Returns

The table shows the results of time-series regressions of weekly stock returns on an intercept (not reported), the local market index excluding own stock (Local Market), the foreign institutional ownership return (Ownership Return), the world market index excluding the local market (World Market), global industry index returns excluding the industry in the local market (Industry), as well as local and global zero-investment portfolios based on market-to-book (HML), market capitalization (SMB), and momentum (WML). The sample period is 01/01/2000-03/31/2009. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The regression models are as follows:

$$(1)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \varepsilon_{jt}$$

$$(2)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \chi_j R_{WorldMarket,t} + \varepsilon_{jt}$$

$$(3)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \delta_j R_{Ownership,t} + \varepsilon_{jt}$$

$$(4)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \phi_j R_{Industry,t} + \varepsilon_{jt}$$

$$(5)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \chi_j R_{WorldMarket,t} + \phi_j R_{Industry,t} + \varepsilon_{jt}$$

$$(6)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \chi_j R_{WorldMarket,t} + \delta_j R_{Ownership,t} + \varepsilon_{jt}$$

$$(7)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \chi_j R_{WorldMarket,t} + \delta_j R_{Ownership,t} + \phi_j R_{Industry,t} + \varepsilon_{jt}$$

$$(8)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \chi_j R_{WorldMarket,t} + \varphi_j R_{LocalHML,t} + \lambda_j R_{WorldHML,t} + \gamma_j R_{LocalSMB,t} + \mu_j R_{WorldSMB,t} + \rho_j R_{LocalWML,t} + \omega_j R_{WorldWML,t} + \varepsilon_{jt}$$

$$(9)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \chi_j R_{WorldMarket,t} + \delta_j R_{Ownership,t} + \varphi_j R_{LocalHML,t} + \lambda_j R_{WorldHML,t} + \gamma_j R_{LocalSMB,t} + \mu_j R_{WorldSMB,t} + \rho_j R_{LocalWML,t} + \omega_j R_{WorldWML,t} + \varepsilon_{jt}$$

The table reports the mean coefficients and adjusted R^2 across firms, as well as the number of firms. Panels A, B, and C show results for the sub-periods 2000Q1-2002Q4, 2003Q1-2005Q4, and 2006Q1-2009Q1, respectively. Panel D shows the average Mean Squared Error (MSE) of correlations following Bekaert, Hodrick, and Zhang (2009) for each of the models (1)-(9) as well as the difference in the MSE. Tests of significance of differences in MSE are based on bootstrapped standard errors using 1,000 randomly drawn samples with replacement. Ownership data is from LionShares. Accounting data is from Worldscope, while return data for individual stocks, market indices, and industry indices is from Datastream.

Panel A: First Quarter 2000 – Fourth Quarter 2002

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ownership Return			0.308			0.298	0.150		0.213
Local Market	0.808	0.603	0.599	0.566	0.609	0.594	0.603	0.631	0.628
World Market		0.361			-0.128	0.028	-0.277	0.360	0.113
Industry				0.409	0.444		0.428		
Local HML								-0.088	-0.075
World HML								0.031	0.034
Local SMB								0.036	0.040
World SMB								0.129	0.126
Local WML								-0.001	-0.001
World WML								0.001	0.000
Adjusted R^2	0.164	0.179	0.183	0.210	0.216	0.188	0.221	0.243	0.247
Number of Firms	233	233	233	233	233	233	233	233	233

(continued)

Table 2.3: Time-Series Regressions of Ownership Returns (continued)

Panel B: First Quarter 2003 – Fourth Quarter 2005									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ownership Return			0.207			0.299	0.264		0.417
Local Market	0.892	0.815	0.779	0.761	0.780	0.775	0.744	0.815	0.766
					-	-	-		-
World Market		0.183			0.082	0.113	0.333	0.258	0.155
Industry				0.247	0.286		0.279		
								-	-
Local HML								0.014	0.013
World HML								0.109	0.132
Local SMB								0.086	0.119
World SMB								0.174	0.160
								-	-
Local WML								0.001	0.001
World WML								0.000	0.001
Adjusted R^2	0.217	0.227	0.229	0.236	0.241	0.232	0.245	0.250	0.255
Number of Firms	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408	1,408
Panel C: First Quarter 2006 – First Quarter 2009									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ownership Return			0.208			0.364	0.315		0.435
Local Market	0.985	0.874	0.818	0.815	0.850	0.818	0.805	0.878	0.823
					-	-	-		-
World Market		0.171			0.174	0.186	0.482	0.229	0.182
Industry				0.237	0.339		0.339		
Local HML								0.259	0.252
								-	-
World HML								0.138	0.178
Local SMB								0.103	0.155
World SMB								0.214	0.204
								-	-
Local WML								0.002	0.002
World WML								0.001	0.001
Adjusted R^2	0.339	0.349	0.351	0.355	0.362	0.356	0.368	0.381	0.387
Number of Firms	3,126	3,126	3,126	3,126	3,126	3,126	3,126	3,126	3,126

(continued)

Table 2.3: Time-Series Regressions of Ownership Returns (continued)

Panel D: MSE Tests of Model Comparison

	Reg #	MSE	Reg #	MSE	Reg #	MSE	Reg #	MSE
Incremental Contribution of the Ownership Return								
Base Model	(1)	0.038	(2)	0.025	(5)	0.021	(8)	0.013
Base Model with Ownership Return	(3)	0.026	(6)	0.023	(7)	0.019	(9)	0.012
Difference		*0.012*		*0.002*		*0.002*		*0.001*
p-value		*<.0001*		*<.0001*		*<.0001*		*<.0001*
Incremental Contribution of the Industry Return								
Base Model	(1)	0.038	(2)	0.025	(6)	0.023		
Base Model with Industry Return	(4)	0.026	(5)	0.021	(7)	0.019		
Difference		0.012		0.004		0.004		
p-value		<.0001		<.0001		<.0001		
Incremental Contribution of the World Return								
Base Model	(1)	0.038	(4)	0.026	(3)	0.026		
Base Model with World Return	(2)	0.025	(5)	0.021	(6)	0.023		
Difference		0.013		0.005		0.003		
p-value		<.0001		<.0001		<.0001		

(0.409, 0.247, and 0.237 in specification 4).[19] Comparing the incremental adjusted R^2 in specifications 2-4 to specification 1 shows that the incremental explanatory power of the ownership return is higher than that of the world return, but not quite as large as that of the global industry return. Regressions (6) and (7) show similarly large coefficients and incremental explanatory power on the ownership return, over and above the local market, global market, and industry factors. This indicates that the importance of ownership is not attributable to fundamentals proxied for by global market or industry returns.

We also wish to control for variation due to common styles such as value and growth. To do so, we construct the weekly regional and global value, size and momentum factors (i.e. HML, SMB and WML) following Bekaert, Hodrick and Zhang (2009) and Fama and French (2012).[20] Regression (9) shows that the ownership return coefficients are still of large magnitude with these alternative controls, indicating that the ownership return effect is not simply due to the common movement of global style or factors.

We now turn to a more formal evaluation of the various models. Bekaert, Hodrick, and Zhang (2009) convincingly argue that comparing models with the mean squared error of correlations is appropriate for examining which model best characterizes the covariance matrix of returns.[21] We follow their procedures, except that we use individual stocks rather than portfolios.[22] For specifications in Panel D, we follow Bekaert, Hodrick, and Zhang (2009) and

[19] Because the global market and the foreign ownership return are highly correlated, when both terms are included, the global market coefficients are often negative (specification 6).
[20] We include both local and global factors to give maximum chance to the factor model. Similar to Griffin (2002), Fama and French (2012) find that the local factors perform better in time-series tests. Karolyi and Wu (2012) show that global factors are more important with globally traded ADR/GDR assets.
[21] The approach involves determining which model provides the best fit for the sample covariance structure. If a factor model is true, the common factors should explain as much as possible of the sample covariance matrix and the residual covariance components should be small. To compare the performance of alternative models, one can use a mean squared error criterion, which is the time series mean of a weighted average of squared errors.
[22] In the context of standard asset pricing tests, Ang, Liu, and Schwartz (2010) propose that using individual stocks is more efficient than using portfolios.

estimate the regressions over six-month periods to allow for possible time-variation. Bootstrapped *p*-values are computed following their procedure where we bootstrap from the time-series of our MSEs to compute an empirical distribution.

Panel D shows that the MSE with only the local market is 0.038, whereas it improves to 0.026 when the ownership return is added. Interestingly, the improvement due to adding the global industry or world market return to the local market factor is extremely similar (MSEs of 0.026 and 0.025). Other specifications examine the incremental improvement from adding the ownership return onto models without the factor and find that the ownership return leads to smaller MSEs than using a model with the global market, industry returns, or global style factors.

5. Does the Ownership Return Simply Proxy for Missing Economic Characteristics?

Here we examine possible explanations for whether the ownership return proxies for an omitted stock characteristic.

5.1 A simulation experiment

The ownership return may capture a common set of country and industry characteristics held by the institutional base in the stock. Institutional shareholders may specialize in country and industry characteristics beyond what our linear country and industry classifications can capture. Thus, we create a non-ownership return that has the exact same country, industry, and size composition as our ownership return, except that we sever the ownership link. For example, for Samsung's largest shareholder, Capital World Investors, we look at each stock held by Capital World Investors and replace that stock with a stock in the same country, industry, and size bin

Table 2.4: Non-Ownership Returns and Adjusted Returns

The table shows the results of Fama-MacBeth regressions of quarterly stock returns on the foreign ownership return and various control variables. In particular, returns are regressed on an intercept (not reported), the foreign institutional ownership return (Ownership Return), one of four alternative versions of a Non-Ownership return, Local Market returns, global industry index returns (Industry), betas and expected returns from a CAPM with local and world market index, and Fama and French (2011) factors and betas. The Non-Ownership Return variables are constructed by replacing each of the actual (foreign) holdings of a stock by an institution with stocks in the same country and industry not held by any owner of the stock in question. The four alternative versions of the Non-Ownership return are based on either using the average return of all stocks in the same country and industry (based on 48 Fama French classifications) that are not held by any other institution owning the stock (Non-Ownership Return (Average Stock)), or by using the average return of all stocks in the same country and industry (based on 2-digit SIC code classifications) that are not held by any other institution owning the stock (Non-Ownership Return (Average Stock) (2-digit SIC)), or by using the return of the largest stock in the same country and industry (based on 48 Fama French classifications) that are not held by any other institution owning the stock (Non-Ownership Return (Largest Stock)), or by using the return of the largest stock in the same country and industry (based on 2-digit SIC code classifications) that are not held by any other institution owning the stock (Non-Ownership Return (Largest Stock) (2-digit SIC)). Local Beta and World Beta are first estimated from rolling regressions using past two-year returns, where the returns of each stock is regressed on the returns on the value-weighted local country market returns, and on the returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_L R_{L,t} + \beta_W R_{MSCI,t} + \varepsilon_{jt}$. Specification (8) includes Industry, local market, HML, SMB, and Momentum factors, as well as Local and Global Market Betas, Local and Global HML Betas, Local and Global SMB Betas, Local and Global Momentum Betas. We obtain Local market, Local HML, Local SMB, and Local momentum factors from Fama and French (2011). We estimate Local and Global Market Betas, Local and Global HML Betas, Local and Global SMB Betas, and Local and Global Momentum Betas from rolling regressions on the corresponding 8 Fama and French factors using past two-year returns. The estimated Fama and French betas are windsorized to 10 (-10) if they are above 10 (below -10). Specifications (1)-(8) use the raw stock return as a dependent variable. Specification (9) subtracts the expected return from a CAPM with local and global market from the raw return, and uses this adjusted return as a dependent variable. The Local Beta is then multiplied with the contemporaneous local market returns (Local Beta*Local Market), and the World Beta is multiplied with the contemporaneous MSCI world market returns (World Beta * World Market) to construct the CAPM expected returns. Specification (10) subtracts the expected returns from an International Fama and French (2011) model from the raw return and uses this adjusted return as a dependent variable. The eight Fama and French Betas are multiplied with the contemporaneous factors to construct the Fama-French expected returns. They are insignificant and not reported. The sample period is 01/01/2000-03/31/2009. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The table reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. Ownership data is from LionShares, and return data for individual stocks, market indices, and industry indices is from Datastream.

(continued)

Table 2.4: Non-Ownership Returns and Adjusted Returns (continued)

	Returns								Adj. Ret. (Intl. CAPM)	Adj. Ret. (Intl. FF)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ownership Return		0.728	0.726	0.732	0.733	0.405	0.349	0.345	0.433	0.124
		(7.20)	(7.33)	(7.63)	(7.85)	(5.78)	(4.48)	(4.16)	(3.89)	(1.63)
Non-Ownership Ret (Avg. Stock)	0.113	-0.100								
	(1.47)	(-1.08)								
Non-Ownership Ret (Avg. Stock) (SIC2)			-0.090							
			(-1.17)							
Non-Ownership Ret (Largest Stock)				-0.081						
				(-1.09)						
Non-Ownership Ret (Largest Stock) (SIC2)					-0.083					
					(-1.15)					
Industry						0.537	0.418	0.480	0.457	0.354
						(15.03)	(10.68)	(12.88)	(10.16)	(4.84)
Local Market						0.827	0.831			
						(18.99)	(22.66)			
Local Beta							-0.004			
							(-0.37)			
Global Beta							-0.005			
							(-0.59)			
Local Market, Local HML, Local SMB, Local and Global Market Betas, Local and Global HML Betas, Local and Global SMB Betas, Local and Global Momentum Betas all included								Yes		
Adjusted R^2	0.004	0.019	0.019	0.018	0.017	0.113	0.141	0.122	0.030	0.010
Average Number of Firms	2,086	2,086	2,086	2,086	2,086	2,086	1,607	1,569	1,607	1,569

that is not held by any of the owners of Samsung.[23] The results reported in Table 2.4 show that the coefficient on the non-ownership return is close to zero. We repeat this process with two-digit SIC industries that are potentially more precise. We also perform the analysis where we always pick the largest non-ownership stock within the country-industry bucket to make sure the non-ownership return is of similar or larger size composition. We also combine the industry and large stocks analysis. All of these coefficients in specifications 2-4 are close to zero, indicating that ownership returns are not simply proxying for stocks of similar country and industry characteristics.

A potential concern of our non-ownership return is that it is just one realization. To further investigate the importance of the returns with the same country and industry structure, we slightly modify our approach and conduct a simulation based on non-ownership returns. In each draw, we do the following. For each stock (e.g. Samsung) held by the foreign investor (e.g. Capital World Investor), we randomly draw another stock from the same country, industry, and size bin that is not held by any of the stock's shareholders. We then create a non-ownership return. This non-ownership return is added to an artificial data set that also includes the original ownership returns and other control variables. We create 200 such datasets based on alternative random draws of non-ownership returns. We then estimate univariate and multivariate regressions and generate regression coefficients for each of the datasets to obtain an empirical distribution of regression statistics. Our simulation regression coefficients have a mean of 0.0034 and range from 0.0018 to 0.061 (Panel A of Table S2.3). In none of the 200 datasets is the

[23] We take two approaches in sampling comparable stocks. First, we take the average of stocks in the same country, industry, and size bucket. Second, because stocks less likely to be held by foreign investors are typically smaller, we sample the largest stock in the same country and industry that is not owned by any existing shareholder. When there are fewer than five stocks in the country, industry, and size bucket not owned by any existing shareholder, which happens in 44% of the cases, we pick stocks from the same country bucket.

coefficient of the non-ownership return anywhere close to that of the actual ownership return of 0.710 shown for quarterly data frequency in Table 2.2.

5.2 Alternative Factor and Industry Controls

For robustness, rather than estimating expected returns (beta*market), we examine the components separately as controls.[24] In specification 7 of Table 2.4, we show that controlling for prior betas has little effect on the ownership return inferences. Specification 8 shows that the inclusion of both local SMB, HML, and Momentum factors (constructed by Fama and French (2012)), as well as prior local and global on these factor betas, does not drive out the significance of the ownership return coefficient.

It is also feasible to control for factor variation by first purging the left hand side returns from all factor variation as is commonly done with benchmark adjusted returns. We first construct the expected returns by using estimated local and global betas over the prior 36 months times the contemporaneous local and global market return in specifications 9 of Table 2.4. The adjusted return is the difference between the actual return and the expected return. In Specification 10, we use the same approach with the local and global Fama and French (2012) factors in the model. Using risk-adjusted returns implicitly assumes that all variation due to the factors is more fundamental, and that the approach rules out capturing variation due to the ownership return that is correlated with the factors. Nevertheless, specifications 9 and 10 in Table 2.4 show that ownership returns remain highly significant.

The ownership return may simply be capturing the relation between changes in ownership and returns as found in the United States by Wermers (1999) and by Nofsinger and Sias (1999). Table 2.5 also shows that contemporaneous changes in foreign ownership are

[24] Since the global market is constant at each point in time, it cannot be used in the cross-sectional regression, but the local market return varies across countries. Similarly, global style factors are also the same at each point in time.

Table 2.5: Ownership Change, Domestic Ownership, and Alternative Industry Controls

The table shows the results of Fama-MacBeth regressions of quarterly stock returns on the foreign ownership return and various control variables. In particular, stock returns are regressed on an intercept (not reported), the foreign institutional ownership return (Ownership Return), an institutional ownership return using only the local holdings of an institution (Domestic ownership Return), the change in foreign ownership (Ownership Change), the beta on the local market, expected returns from a CAPM with local and world market index, global industry index returns excluding the industry in the local market using either the 48 Fama-French Industry classification (Industry (Fama French)) or 2-digit SIC code industry classifications (Industry (2-digit SIC)), and fund geographic style returns. Local Beta and World Beta are first estimated from rolling regressions using past two-year returns, where the returns of each stock is regressed on the returns on the value-weighted local country market returns, and on the returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_L R_{L,t} + \beta_W R_{MSCI,t} + \varepsilon_{jt}$. The Local Beta is then multiplied with the contemporaneous local market returns (Local Beta*Local Market), and the World Beta is multiplied with the contemporaneous MSCI world market returns (World Beta * World Market) to construct the CAPM expected returns. Fund geographic style returns are the world, region, or country index return depending on the classification of the fund as country, region, or global fund. If the maximum average percentage of the holdings in a country over the previous 12 quarters is more than 80% of the funds' total holdings, the fund is classified as a country fund. Otherwise, if the maximum average percentage in a region is more than 80%, it is a region fund. Otherwise it is a global fund. The sample period is 01/01/2000-03/31/2009. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The table shows results controlling for the change in ownership as well as using alternative industry controls. The table reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. Ownership data is from LionShares, and return data for individual stocks, market indices and industry indices is from Datastream.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Foreign Ownership Returns	0.391	0.395	0.350	0.265	0.239	0.389	0.324
	(4.76)	(4.76)	(4.15)	(3.84)	(3.25)	(4.86)	(3.62)
Domestic ownership Return			0.764	0.664	0.643		
			(12.9)	(11.0)	(10.9)		
Ownership Change		0.455					
		(6.66)					
Local Market			0.219	0.300			
			(4.84)	(6.80)			
Local Beta*Local Market	0.768	0.764			0.390	0.763	0.753
	(15.4)	(15.3)			(5.27)	(15.3)	(16.41)
World Beta*World Market	0.203	0.209			0.074	0.206	0.190
	(0.40)	(0.42)			(0.16)	(0.39)	(0.37)
Industry (Fama French)	0.405	0.399		0.490	0.396		0.397
	(9.78)	(10.0)		(15.3)	(11.3)		(10.9)
Industry (2-digit SIC)						0.343	
						(8.02)	
Fund Geographic Style							-0.039
							(-0.33)
Adjusted R^2	0.132	0.137	0.101	0.128	0.154	0.130	0.137
Average Number of Firms	1,607	1,607	2,085	2,085	1,606	1,607	1,535

strongly related to a stock's quarterly return, consistent with the U.S. evidence. Interestingly, the coefficient on the foreign ownership return is not affected by the inclusion of quarterly ownership changes (in Specification 2) – the quarterly ownership return is doing much more than capturing changes in institutional ownership.

Recall that for ease of interpretation, the ownership return is a foreign ownership return constructed as the sum of the returns coming from the holders of the security for all stocks outside of the country of origin of the stock. However, we can also examine, with more caution, the return coming from all owners of the security from all stocks in the same country as the respective security. We call this return the 'domestic ownership return.' Examining the domestic ownership return provides a holdout sample to examine the robustness of the foreign ownership return. The domestic ownership return has an average correlation of 0.786 with the local market return, which makes controlling for the local market return important. Even with the local market return and foreign market returns in the cross-sectional regression, Table 2.5 shows that a one percent increase in the domestic ownership return is associated with a 0.76 percent increase in a firm's stock return. This coefficient is about twice as high as the foreign ownership return.

Another potential concern regarding our results is that the industry portfolios based on 49 Fama-French industries do not adequately capture all industrial variation. To control for this possibility, we create a finer industrial index which is based on 2-digit SIC codes.[25] Table 2.5 shows that the ownership return coefficient remains of similar magnitude and significance with the finer industry control.

[25] In our dataset, firms are in 822 4-digit SIC codes, 353 3-digit SIC codes, and 72 2-digit SIC codes.

We also classify funds as world, region, or country funds based on their holdings, and use accordingly the world, region, or country index return as a geographic style control.[26] Specification 7 in Table 2.5 shows that the size of the coefficients on the ownership return and changes in ownership is unaffected, indicating that the ownership return is not emanating from simple country-style investing, while more explicit size, value, and momentum style variation was examined in Table 2.3 and 2.4.

5.3 An ADR/GDR test and other tests

To re-address many of the concerns in the prior two sub-sections as well as to examine if ownership is in fact causing the importance of the ownership return, we investigate whether the role of the ownership return is related to a change in ownership composition. The ownership composition of a stock often shifts around the listing of an ADR/GDR as shown by Foerster and Karolyi (1999). Therefore, we investigate the role of the ownership return for the subsample of firms that listed a new ADR/GDR during the sample period. If the explanatory power of the ownership return is driven by the ownership composition of a stock and not some omitted firm characteristic that ownership proxies for, then the stock return of these firms should become more correlated with the new ownership structure after the ADR/GDR listing.

In order to keep the same comparison set of stock returns to form the ownership return, we use the same ownership return weights in forming the ownership return both pre- and post-listing. The weights are the average ownership weights in the year after the listing. If the ownership composition shifts around the listing date, then the ownership return should be more strongly related to stock returns post-listing compared to pre-listing. We estimate pooled

[26] We calculate for each fund in the quarter the percentage of holdings that are in a country and a region. If the maximum average percentage of the holdings in a country over the previous 12 quarters is more than 80% of the funds' total holdings, the fund is classified as a country fund. Otherwise, if the maximum average percentage in a region is more than 80% it is a region fund. Otherwise, it is a global fund. Depending on country, region, or global classification, the respective monthly country, region, or global index return is selected for a fund in the following quarter.

Table 2.6: ADR and GDR Listing and Ownership Returns

The table shows the results of pooled regressions of weekly stock returns of companies that listed a depository receipt or other cross-listing on an intercept (not reported), the foreign institutional ownership return (Ownership Return), the local market index excluding own stock (Local Market), and the U.S. market index. All regressors are interacted with a dummy variable (ADR/GDR-Dummy) that takes the value 1 after the effective date of the ADR/GDR listing, and 0 otherwise. The sample period used is four quarters before and four quarters after the effective date, with the effective date between 01/01/2000-03/31/2009. The sample is limited to non-U.S. stocks. The table reports the coefficients, associated *t*-statistics, as well as the adjusted R^2. Results are shown separately for all firms, firms with an increase in foreign ownership, and firms with an increase in foreign ownership of at least 5%. The Ownership Return is calculated using average weights during the first year of the ADR/GDR listing. These fixed weights are used to calculate the Ownership Return before and after the listing. Ownership data is from LionShares, while data on returns for individual stocks and market indices is from Datastream. ADRs/GDRs are identified based on LionShares and Datastream information. Effective dates for ADRs/GDRs are identified through the Bank of New York website (http://www.adrbnymellon.com/dr_directory.jsp) as well as CRSP. We take the first listing date.

	All Firms			Firms with Increased Foreign Ownership			Firms with Increased Foreign Ownership > 5%		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Ownership Return		0.083	0.117		0.093	0.164		0.086	0.138
		(3.16)	(2.88)		(2.88)	(2.96)		(2.24)	(1.92)
Ownership Return * ADR/GDR-Dummy		0.042	0.069		0.101	0.159		0.108	0.255
		(1.22)	(1.30)		(2.41)	(2.26)		(2.19)	(2.81)
Local Market	1.032	1.016	1.016	1.060	1.040	1.039	1.056	1.042	1.039
	(61.1)	(56.7)	(56.7)	(51.4)	(46.9)	(46.8)	(46.7)	(42.3)	(41.9)
Local Market * ADR/GDR-Dummy	0.025	0.000	-0.001	0.015	-0.018	-0.020	0.006	-0.032	-0.043
	(1.11)	(0.01)	(-0.05)	(0.54)	(-0.59)	(-0.69)	(0.21)	(-0.97)	(-1.29)
U.S. Market	0.043		-0.040	0.040		-0.076	0.046		-0.051
	(1.8)		(-1.10)	(1.4)		(-1.57)	(1.4)		(-0.85)
U.S. Market * ADR/GDR-Dummy	0.018		-0.043	0.056		-0.090	0.042		-0.184
	(0.55)		(-0.84)	(1.41)		(-1.37)	(0.95)		(-2.25)
Adjusted R^2	0.250	0.252	0.252	0.275	0.276	0.276	0.277	0.278	0.278
Number of Observations	35,430			22,576			18,356		
Number of Firms	358			232			191		

regressions in a framework similar to Foerster and Karolyi (1999) except for the ownership return variable.

Table 2.6 shows that the ownership return is significant both before and after the listing, but increases largely after the ADR listing. As one would expect, the increase in the ownership beta is stronger and more than doubles for stocks that experience an increase in the level of foreign ownership along with the ADR listing. The result is robust to controlling for local and U.S. market returns (specifications 2 and 3) and subsumes the increase in global betas documented by Foerster and Karolyi (1999). Shifts in ownership linkage betas in conjunction with the shift in ownership composition around the listing dates suggests that a firm's foreign ownership drives the ownership return relation rather than just proxying for some omitted firm characteristic.

We consider whether the explanatory power of ownership returns can be explained by foreign exchange movements, the extent of foreign sales, the home country where the capital is from, the most liquid stocks, the most active markets, and aspects of data coverage as detailed in Table S2.4. None of these issues are driving the findings, as we describe in more detail in Supplemental Appendix B.

6. Investor Habitat or Wealth Effects

Having dismissed many alternative/mechanical explanations for the importance of the ownership return, there are two main possible drivers for the ownership return: habitat investing and wealth effects. We use the behavior of institutional ownership to distinguish between them. With habitat or locale investing, the ownership return reflects value fluctuations due to changing viewpoints of the shareholder base. These changing viewpoints should be captured in correlated movements of capital as an investor habitat becomes attractive or undesirable to the group of investors that trade these types of securities. Wealth effects, often known as portfolio rebalancing, predict that the returns of the actual institutions holding a stock cause price pressure that drives returns. Thus, both habitat and wealth effects provide separate predictions that center on changes in a stock's ownership.

6.1 Habitat

A stock's habitat or locale should capture the net change in investments into and out of other stocks that are linked to the stock. Intuitively, referring back to the Samsung example, if habitat is important, we expect to see investors purchasing Samsung at the same time as they purchase other stocks that have the same or similar owners. Note that the change of habitat holdings is not the change in the holdings of Samsung's owners themselves, but the change of the other holdings of all institutions that are linked to Samsung in the manner captured through Samsung's ownership composition. To directly test habitat, we construct a variable that captures the change of holdings to stocks in the same locale of stock *i* as follows:

$$Change\ of\ Holdings\ in\ Habitat_{i,t} = \sum_{n=1}^{N_i} W_{i,n,t-1} \sum_{k=1}^{K_i} V_{k,n,t-1} C_{k,t} \tag{6}$$

where $W_{i,n,t-1}$ is the percentage of market capitalization of stock *i* held by institution *n* at the end of the previous quarter. $V_{k,n,t-1}$ is the percentage of market capitalization of stock *k* in the equity portfolio that institution *n* holds at the end of the previous quarter. $C_{k,t}$ is the percentage change of equity holdings of each stock *k* in the current quarter, that is, $\frac{\sum_{n=1}^{N_i} E_{k,n,t}}{M_{k,t}} - \frac{\sum_{n=1}^{N_i} E_{k,n,t-1}}{M_{k,t-1}}$. $E_{k,n,t}$ is the dollar equity holding of stock *k* by fund *n* at time *t*. $M_{k,t}$ is the dollar market value of stock *k* at time *t*. We impose the same assumption on ownership return weights $\sum_{n=1}^{N_i} W_{i,n,t-1} = 1$ and $\sum_{n=1}^{N_i} V_{k,n,t-1} = 1$ as in equation (2).

Table 2.7 investigates the importance of habitat in three ways. First, Specification 1 shows that a one percent increase of ownership in a firm's ownership habitat is associated with a 0.241 percent increase in ownership. This cross-sectional effect is also significant with a *t*-statistic of 3.24. This indicates that stock ownership changes with changes of ownership of other stocks in the firm's habitat.

Second, we decompose the habitat ownership variable into three components. Among the stocks that have common ownership with a particular stock, we separate them into three groups, according to whether the stocks have low, medium, or high levels of common foreign ownership. We then compute an aggregate change of holdings within each group. Specifications 3-7 in Table 2.5 show that the changes in ownership of the stock vary strongly with the stocks with the highest level of common ownership habitat, but not with stocks with medium or especially low levels of common ownership.

Third, we can also divide the ownership return into components. The habitat hypothesis suggests that stocks co-move with others with high common ownership, but not with others with low levels of common ownership. One can think of this analysis as dividing the ownership return into three components in terms of their degree of common ownership. Here, one can see that when all three levels of ownership are added together, the stocks with the highest level of common ownership move together, while the others do not. Overall, the three tests in Table 2.7 are consistent with habitat patterns in ownership and returns.

Table 2.7: Investor Habitat

The table shows the results of Fama-MacBeth regressions of changes in quarterly holdings (specifications (1)-(7)) or quarterly stock returns (specifications (8)-(9)) on various measures of investor habitat and control variables. In particular, the independent variables are the value-weighted change in the other holdings of a stock's owner from the last quarter to the current quarter, using all stocks (Habitat), or, alternatively, just the stocks that are in the bottom, middle, and top tercile when ranking holdings by the number of common holders (labeled Change in Foreign Holdings of Foreign Stocks (Low Common Holders), (Medium Common Holders), and (High Common Holders), respectively). Regressions with returns use the value-weighted returns of foreign stocks with either low, medium, or high common ownership as regressors, considering stocks with no common ownership separately from those with low common ownership. Further controls are expected returns from a CAPM with local and world market index, and global industry index returns excluding the industry in the local market (Industry). Local Beta and World Beta are first estimated from rolling regressions using past two-year returns, where the returns of each stock is regressed on the returns on the value-weighted local country market returns, and on the returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_L R_{L,t} + \beta_W R_{MSCI,t} + \varepsilon_{jt}$. The Local Beta is then multiplied with the contemporaneous local market returns (Local Beta*Local Market), and the World Beta is multiplied with the contemporaneous MSCI world market returns (World Beta * World Market) to construct the CAPM expected returns. Specifications (1)-(2) are based on new and existing holders of a stock, specifications (3)-(4) are based on existing holders of a stock, and specifications (5)-(6) are based on all holders of a stock. The sample period is 01/01/2000-03/31/2009. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The table reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. Ownership data is from LionShares, and return data for individual stocks, market indices and industry indices is from Datastream.

(continued)

Table 2.7: Investor Habitat (continued)

	Change in Holdings							Returns	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Change of Holdings in Habitat	0.241	0.291							
	(3.24)	(2.72)							
Change in Holdings of Foreign Stocks (High Common Holders)			0.236			0.233	0.273		
			(4.49)			(4.47)	(4.05)		
Change in Holdings of Foreign Stocks (Medium Common Holders)				0.086		0.118	0.144		
				(1.00)		(1.35)	(1.51)		
Change in Holdings of Foreign Stocks (Low Common Holders)					-0.109	-0.084	-0.215		
					(-1.43)	(-1.23)	(-2.74)		
Returns of Foreign Stocks (High Common Holders)								0.741	0.338
								(6.75)	(6.48)
Returns of Foreign Stocks (Medium Common Holders)								-0.410	-0.036
								(-1.86)	(-0.17)
Returns of Foreign Stocks (Low Common Holders)								-0.230	-0.319
								(-2.87)	(-3.23)
Returns of Foreign Stocks (No Common Holders)								-1.701	-0.550
								(-8.73)	(-2.71)
Local Beta*Local Market		0.005					0.005		0.728
		(1.75)					(1.81)		(15.21)
World Beta*World Market		-0.004					-0.011		0.165
		(-0.40)					(-0.91)		(0.34)
Industry		0.006					0.006		0.410
		(1.27)					(1.28)		(9.67)
Adjusted R^2	0.003	0.009	0.003	0.002	0.001	0.005	0.010	0.040	0.143
Number of Firms	1,991	1,582	1,991	1,991	1,991	1,991	1,582	2,053	1,598

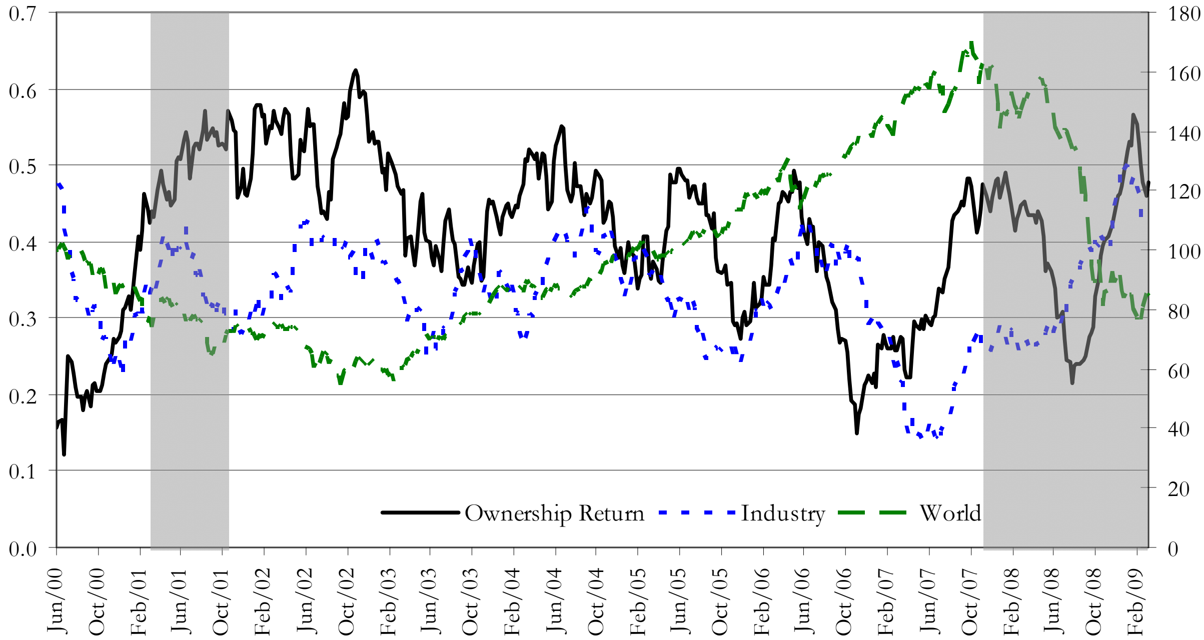
Table 2.8: Wealth Effect at the Stock-Fund Level

The table shows the results of Fama-McBeth regressions of quarterly changes in holdings at the stock-fund level. The dependent variable is the change of holdings from the previous quarter to the current quarter of a stock by a fund. The regressors include an intercept (not reported), the fund's return (Owner Fund Return), the fund's return in the previous quarter (i.e. lagged), the fund's return on foreign holdings (Owner Fund Foreign Return), the fund's return on foreign holdings in the previous quarter (i.e. lagged), the percentage change in holdings (i.e. the dependent variable) lagged by one quarter, and last quarter's fund holding of the stock as a percentage of fund's total assets minus the last quarter's average percentage holdings of the fund across stocks in the fund (Stock Holdings (lagged) – Average Stock Holdings (lagged)). All variables are standardized. Specifications (1)-(3) are based on new and existing holders of a stock, while specifications (4)-(6) are based on existing holders only. The sample period is 01/01/2000-03/31/2009. The sample is limited to non-U.S. stocks with at least 30% non-zero trading days in the previous year. The table reports the coefficients, associated *t*-statistics, as well as the average adjusted R^2. Ownership data is from LionShares. Returns data for individual stocks, market indices, and industry indices are from Datastream.

	New and Existing Holders			Existing Holders		
	(1)	(2)	(3)	(4)	(5)	(6)
Owner Fund Foreign Return	0.050			0.062		
	(0.64)			(0.72)		
Owner Fund Foreign Return (lagged)	0.136			0.141		
	(1.50)			(1.39)		
Owner Fund Return		-0.005	-0.027		0.000	-0.024
		(-0.06)	(-0.28)		(0.00)	(-0.24)
Owner Fund Return (lagged)		0.080	0.054		0.081	0.065
		(0.80)	(0.51)		(0.73)	(0.58)
Percentage Change in Holdings (lagged)			0.035			0.036
			(6.89)			(6.99)
Stock Holdings (lagged) - Average Stock Holdings (lagged)						0.024
						(2.50)
Adjusted R^2	0.000	0.001	0.006	0.000	0.001	0.006
Average Number of Firm-Fund per Quarter	2,150	2,184	2,150	2,150	2,184	2,184

Figure 2.1: Foreign Ownership Regression Coefficients over Time

The figure shows the average coefficients of Fama-MacBeth cross-sectional regressions. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The sample period is 01/01/2000-03/31/2009. A cross sectional regression is run over all firms in the sample for each week. We then take the rolling average of these coefficients in the regressions over the past 26 weeks. The figure shows the moving average. Shaded areas are NBER recession periods. Stock returns are regressed on an intercept (not reported), the foreign institutional ownership return (Ownership Return), global industry index returns excluding the industry in the local market (Industry) and world market index returns (World). Ownership data is from LionShares, while data on returns for individual stocks, market indices, and industry indices is from Datastream. Data on recession periods is from the NBER (http://www.nber.org/cycles/main.html).



6.2 Wealth Effects

We now investigate wealth effects through a direct institution-level analysis. Suppose two of Samsung's shareholders, Capital World Investors and New York Retirement Funds (in Appendix A), have very different fund returns. Capital World Investors experiences high returns on its holdings, and New York Retirement has low returns. A wealth effect implies that Capital World Investors will increase their holdings in Samsung, whereas New York Retirement will hold their position constant or sell. We test this proposition directly by testing whether quarterly changes in each institution's holdings of each stock depend on the institution's past returns. In particular, we estimate cross-sectional regressions where the dependent variable is the quarterly ownership change for each existing institutional holding of each firm.

Table 2.8 presents the regression results and shows that the contemporaneous institutional returns are statistically and economically unrelated to the institution's change in holdings. In other words, institutions that experience the largest stock returns are not increasing their institutional holdings in the stocks they already hold.[27]

Since wealth effect theories are often related to contagion and point to the effects of ownership mattering more in periods of extreme stress, we examine weekly Fama-MacBeth cross-sectional regressions and sum the coefficients over rolling 26-week periods. Figure 2.1 plots the coefficients over the January 2000 to March 2009 period. Industry and ownership coefficients are of similar magnitude and are relatively stable. The coefficients are never below zero and range between 0.10 and slightly over 0.60.[28] Hence, our results are consistent with

[27] We also sort each stock/quarter into four ownership groups according to the owner's common ownership return. In contrast to a wealth effect explanation, in Table S5 we find no net differences in the relative changes of ownership of the groups depending on the institution's past stock return.

[28] Figure S2 Panel A shows coefficients from regressions that also include the local market index and Panels B and C of Supplemental Figure S2 look at quarterly regressions. None show elevated levels in times of economic crisis.

Bekaert, Ehrmann, Fratzscher, and Mehl (2012) as they find little economic evidence of excess comovement during the financial crisis.

The contagion literature postulates that when investors face imminent financial constraints, they will sell off their other holdings. This story implies a higher correlation among stocks owned by these investors. In Panel A of Supplemental Table S2.6, we examine asymmetries by looking alternatively at the extreme bottom twenty percent and five percent of ownership returns. We find no evidence that the effect of the ownership return is stronger. Furthermore, we find that stocks experiencing large outflows do not experience a stronger ownership return.[29] Overall, our findings indicate that changes in institutional holdings are affected by changes in a stock's habitat and not wealth effects.

7. Ownership Decomposition and Habitat Channels

7.1 Decomposition

In a world with heterogeneous investors, an investor habitat captures the common investment locale in which a certain group of investors may allocate capital across the stock market. It can be decomposed into several channels. First, an investment locale may cause prices to co-move if a firm's existing holders receive correlated flows, and those investors allocate the flows to securities they already own. Second, habitat could link the returns of stocks in manners that cannot be directly traced to quarterly changes in ownership. This might be because of correlated buying of other investors who are not in our database, or prices moving due to changes in viewpoints of stocks that are commonly held together. This may be due to domestic or foreign returns. Third, the change in holdings of a habitat reflects capital moving into or out of an

[29] As explained later in equation (9), we track investors' outflows by institution and compute an aggregate measure of outflows across all institutions who invest in a given stock. We then create a dummy variable for whether a stock's investors are in the bottom 5 and 20 percentiles in terms of aggregate outflows and create a dummy variable interaction term with the ownership return.

investment habitat in a correlated fashion. For example, if investors become optimistic on global economic conditions, capital may be allocated towards large international companies with investors who hold bullish views or a mandate to purchase such securities.

To this end, the stock-level change of holdings can be decomposed into three main components: fund flows, returns to stocks in the same habitat, and change of holdings of stocks in the habitat. We decompose the change in equity holdings of stock *i* by fund *n* as follows:

$$
\begin{aligned}
&Change\ of\ Holdings_{i,n,t} = \frac{q_{i,n,t}Z_{n,t}TNA_{n,t}}{M_{i,t}} - \frac{q_{i,n,t-1}Z_{n,t-1}TNA_{n,t-1}}{M_{i,t-1}} \\
&= \left(\frac{q_{i,n,t-1}Z_{n,t-1}(TNA_{n,t} - TNA_{n,t-1}(1+R_{n,t}))}{M_{i,t-1}} \right) + \left(\frac{q_{i,n,t-1}Z_{n,t-1}TNA_{n,t-1}}{M_{i,t-1}} R_{n,t} \right) \\
&\quad + \left(\frac{q_{i,n,t}Z_{n,t}TNA_{n,t}}{M_{i,t}} - \frac{q_{i,n,t-1}Z_{n,t-1}TNA_{n,t}}{M_{i,t-1}} \right) \\
&= \left(\frac{q_{i,n,t-1}Z_{n,t-1}(TNA_{n,t} - TNA_{n,t-1}(1+R_{n,t}))}{M_{i,t-1}} \right) + \left(\frac{q_{i,n,t-1}Z_{n,t-1}TNA_{n,t-1}}{M_{i,t-1}} R_{n,t} \right) \\
&\quad + \sum_{n=1}^{N_i} W_{i,n,t-1} \sum_{k=1}^{K_i} V_{k,n,t-1} C_{k,t} + \\
&\quad \left(\frac{q_{i,n,t}Z_{n,t}TNA_{n,t}}{M_{i,t}} - \frac{q_{i,n,t-1}Z_{n,t-1}TNA_{n,t}}{M_{i,t-1}} - \sum_{n=1}^{N_i} W_{i,n,t-1} \sum_{k=1}^{K_i} V_{k,n,t-1} C_{k,t} \right) \\
&= Fund\ Flow_{i,n,t} + \text{Returns}\, in\ Habitat_{i,n,t} \\
&\quad + Change\ of\ Holdings\ in\ Habitat_{i,t} + Error_{i,n,t}
\end{aligned}
\tag{7}
$$

where $TNA_{n,t}$ is the total net asset value of fund *n* in quarter *t*, $Z_{n,t}$ is the fraction of the funds's total net asset value invested in equities in quarter *t*, $q_{i,n,t}$ is the portion of the equity holdings of fund *n* that is invested in stock *i* in quarter *t*, and $M_{i,t}$ is the market value of stock *i* in quarter *t*. Fund flows in equation (7) are defined following the standard approach in the literature, i.e. quarterly fund flows are inferred as the difference between total net assets and what assets would have been if they had simply grown passively:

Table 2.9: Decomposition of Funds' Change in Holdings

The table shows the results of Fama-MacBeth regressions of quarterly stock returns (specifications (1)-(5)) or changes in holdings (specifications (6)-(10)) on an intercept (not reported), fund flows, the returns of foreign stocks in habitat, the change in holdings for foreign stocks in habitat, the returns of domestic stocks in habitat, the change of holdings for domestic stocks in habitat, expected returns from a CAPM with local and world market index (Local Beta* Local Market and World Beta*World Market), and global industry index returns excluding the industry in the local market (Industry). Fund flows, returns, and changes of holdings for stocks in the domestic and foreign habitat are all scaled by lagged market capitalization and are standardized. The table reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The sample period is 01/01/2000-03/31/2009. Ownership data is from LionShares, while data on returns for individual stocks, market indices, and industry indices is from Datastream.

	Returns					Change of Holdings				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Flows	0.000			-0.001	-0.001	0.002			0.001	0.001
	(-0.18)			(-0.62)	(-0.28)	(2.46)			(2.34)	(1.01)
Returns of Foreign Stocks in Habitat		0.016		0.018	0.009		0.001		0.001	0.000
		(4.96)		(6.10)	(4.13)		(1.29)		(0.89)	(-0.10)
Change of Holdings for Foreign Stocks in Habitat			0.029	0.025	0.004			0.004	0.003	0.002
			(2.67)	(2.39)	(0.45)			(5.51)	(4.75)	(2.73)
Returns of Domestic Stocks in Habitat					0.016					0.001
					(5.76)					(1.52)
Change of Holdings for Domestic Stocks in Habitat					-0.003					0.002
					(-1.01)					(4.77)
Local Beta*Local Market					0.721					0.004
					(14.36)					(1.20)
World Beta*World Market					0.144					0.015
					(0.30)					(0.94)
Industry					0.373					0.004
					(9.94)					(0.86)
Adjusted R^2	0.002	0.007	0.006	0.016	0.141	0.014	0.011	0.003	0.027	0.048
Average Number of Firms per Quarter	2,262	2,262	2,009	2,009	1,536	1,991	1,991	1,916	1,916	1,512

$$Fund\ Flow_{n,t} = TNA_{n,t} - TNA_{n,t-1}\left(1 + R_{n,t}\right) \quad (8)$$

where $R_{n,t}$ is the return of fund n during quarter t, and $TNA_{n,t}$ is the total net asset value at the end of quarter t.[30]

We subsequently aggregate these components across institutional holders for a stock on a value-weighted basis according to the market capitalizations of their positions in the stock to obtain a stock-level measure in three components as follows:

$$\begin{aligned}\text{Change of Holdings}_{i,t} &= \text{Fund Flow}_{i,t} + \text{Returns in Habitat}_{i,t} \\ &+ \text{Change of Holdings in Habitat}_{i,t} + \text{Error}_{i,t}\end{aligned} \quad (9)$$

The returns in habitat component can be further split into returns from domestic stocks in the habitat (the country where stock i is located but excluding stock i itself), and returns from foreign stocks in the habitat.[31]

7.2 Decomposition Results

Table 2.9 presents cross-sectional regression results for the decomposition of stocks with high foreign ownership (> 5 percent) at the aggregate LionShares institutional level. It shows the various components of the decompositions, first for returns and then for their effect on changes in ownership. The first three specifications start off with each component of the decomposition individually and then all the components together in the fourth specification. The change of holdings in the habitat and the returns of stocks in the habitat are both linked to returns. The flow

---

[30] Our definition of the flow represents the dollar growth of a fund that is due to new investments at the end of the quarter. When we turn to the LionShares data where we do not have TNA, we approximate this with the total equity positions. We apply $Fund\ Flow_{n,t}$ for fund n proportionally to fund n's stock holdings i using the previous quarter's weights to obtain $Fund\ Flow_{i,n,t}$. We then aggregate the components across funds to create changes in the position in stock i due to fund flow and returns in habitat.

[31] The return from foreign stocks in the habitat is similar to our ownership return, except for weighting. The ownership return constrains the holding weights of all foreign owners to sum to one, while the weights in the returns from foreign stocks in habitat term sum to the actual amount of dollars invested by the funds in that particular stock. For example, if the foreign holding is just 0.5 percent of the funds' portfolios, the ownership return weights are normalized to one, while the weight of the returns from foreign stocks in habitat is 0.5 percent.

measure is insignificant and close to zero. In Specification 5 we add the change of holdings of domestic stocks in the habitat, as well as returns from domestic stocks in the habitat along with the standard local market, world market, and industry controls. With controls, the change of holdings for stocks in the domestic and foreign habitat is insignificantly related to returns. The return of stocks in the domestic habitat and the returns of stocks in the foreign habitat are both highly significant. A firm's stock price increases when the related stocks held by both domestic and foreign institutions experience increase in value.

In the second half of the table, we cross-sectionally regress stocks' changes in holdings on the elements of the decomposition. The change of holdings in both the domestic and foreign habitat is strongly related to the change in ownership. Interestingly, flow is significant in the earlier specifications, but becomes insignificant with more extensive controls for the local and global market and industry in specification 10. The other terms are largely unrelated to changes in holdings.

Overall, in terms of the relation between stock returns and cross-sectional ownership changes, Table 2.9 indicates that the patterns of stocks moving together in an investment locale are primarily due to institutions investing in stocks within the same habitat. Such patterns are not primarily driven by, and are largely distinct from, those of fund flows.

8. Diversification Implications

While most of our results are focused on linking the ownership return to stock returns, we will explore in this section the diversification implications for ownership linkages. A simple but useful practical diagnostic is to compare the return covariance of firms within a population relative to the return variance of a representative firm. Solnik (1974) uses this to compare the power of portfolio diversification in the United States and internationally. Panel A of Table 2.10

Table 2.10: Ownership Level, Ownership Beta and Portfolio Diversification

The sample consists of all non-U.S. stocks with data between 01/01/2000 and 03/31/2009 with at least 30% non-zero trading days in the previous year. Firms are also required to have at least 30 non-missing observations over the sample period. In Panels B and C firms are also required to have at least 30 non-missing observations in a rolling two-year window. Panel A shows the effect of global portfolio diversification for alternative levels of foreign institutional ownership (FO) (0%, 0%-1%, 1%-5%, >5%) measured at the beginning of a three year period. To ensure an equal number of firms across bins, for each country, year, and institutional ownership group, we restrict the number of firms to the smallest number of firms across institutional ownership groups. We compute the average stock return covariance and correlation between all pairs of stocks in the bin for each year and subsequently the average across years. Panels B and C are computed based on random draws of 1,000 of our 6,698 funds. Panel B shows the effect of alternative levels of foreign institutional ownership return betas estimated over rolling two year windows over the years 2003-2009 for firms with at least 5% lagged foreign institutional ownership. For each fund the universe of stocks is restricted to those not held by a fund. Over rolling two-year windows (always shifted by one year) we regress the foreign ownership return of each stock (not held by the institution) on the return of each LionShares institution: $R_{Ownership,t} = \alpha + \beta_{Ownership\,Beta} R_{Fund,t} + \varepsilon_t$. Subsequently, we sort the observations for each year into four groups based on the estimated ownership betas (<0.5, 0.5-0.75, 0.75-1, >1) and calculate the average beta of the stock return with the fund return (Fund Beta) in the next year: $R_{i,t} = \alpha + \beta_{Fund\,Beta} R_{Fund,t} + \varepsilon_t$. To compute averages which compare observations within the fund level, we first average by fund, country, year, and ownership beta bucket. Subsequently, we average across funds by country, year, and ownership beta bucket. We then average across countries by year and ownership beta bucket. Finally, we average across years by ownership beta bucket. The t-statistics are computed from this last cross-country average. The panel shows the average ownership beta and fund beta of stocks in each of the four ownership beta bins, as well as those of a high-low portfolio based on ownership betas, along with corresponding *t*-statistics. Panel C follows the procedure in Panel B except that it breaks out the results by both the lagged level of foreign institutional ownership (FO) and lagged ownership beta. It also shows averages across different groups, as well as values for high-low portfolios (based alternatively on FO betas or FO levels) and corresponding *t*-statistics.

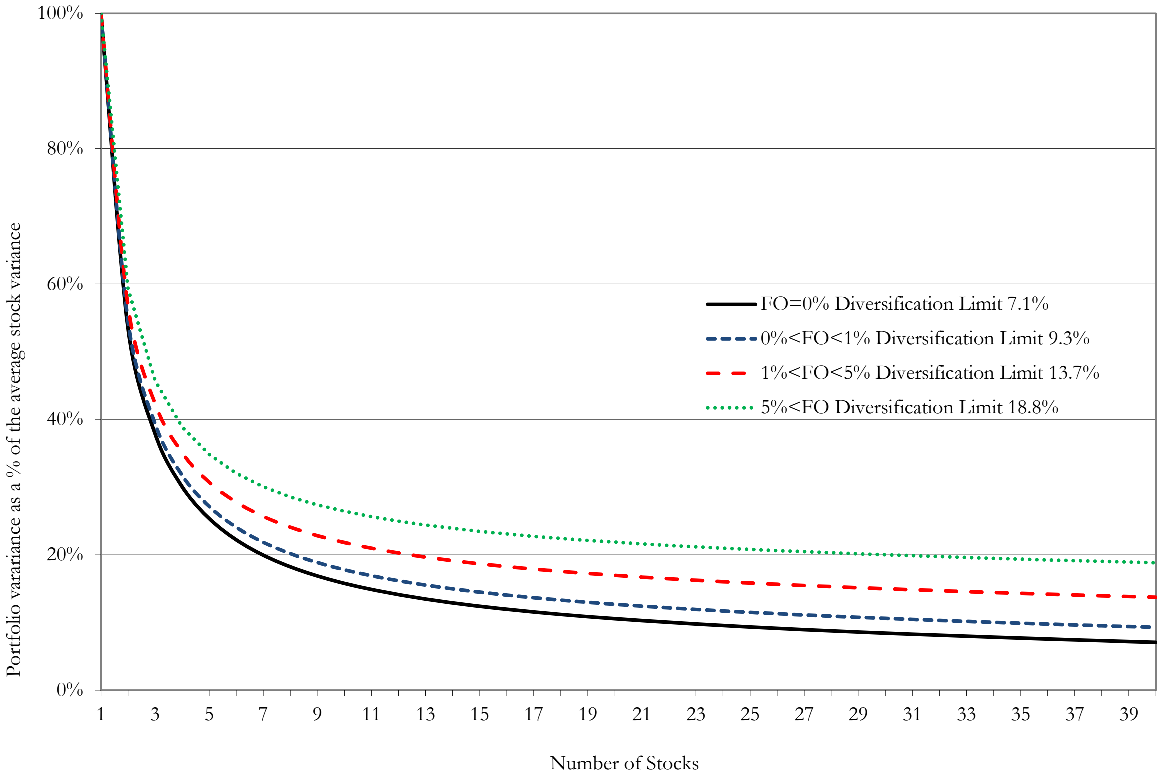
Panel A	FO=0%	0%<FO<1%	1%<FO<5%	5%<FO
Average Covariance	0.00058	0.00053	0.00062	0.00077
Average Correlation	0.103	0.128	0.162	0.210

Panel B	Ownership Beta bin					
	<0.5 (Low)	0.5-0.75	0.75-1	>1 (High)	High-Low	t-stat
Average Ownership Beta	0.380	0.648	0.867	1.080	0.699	
Average Fund Beta	0.471	0.635	0.765	0.864	0.394	5.4

Panel C	Ownership Beta bins					High – Low	
FO Level	<0.5 (Low)	0.5-0.75	0.75-1	>1 (High)	Average	Own Beta Bin	t-stat
		Fund Betas					
0%	0.34	0.45	0.53	0.58	0.48	0.24	4.1
0%-1%	0.39	0.51	0.57	0.61	0.52	0.22	4.4
1%-5%	0.45	0.56	0.66	0.75	0.60	0.30	4.4
5%-15%	0.46	0.58	0.70	0.81	0.64	0.35	6.0
>15%	0.47	0.67	0.83	0.98	0.74	0.50	5.4
Average	0.42	0.56	0.66	0.74		0.31	9.9
High - Low FO	0.12	0.21	0.27	0.34	0.23		
t-stat	9.75	6.26	14.2	6.87	11.3		

Figure 2.2: Ownership Level and Portfolio Diversification

The figure shows the effect of global, country, and industry portfolio diversification for alternative levels of foreign institutional ownership (0%, 0%-1%, 1%-5%, >5%) measured at the beginning of a three year period. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year. The sample period is 01/01/2000-03/31/2009. Firms are required to have at least 30 non-missing return observations. For each country, year, and institutional ownership groups, the number of firms is restricted to the smallest number of firms across institutional ownership groups that have the same number of stocks in each institutional ownership group. For each year the average variance and covariance is calculated for alternatively global, pure industry, or pure country diversification, as in Griffin and Karolyi (1998), and, subsequently, the average across years is calculated. Ownership data is from LionShares, while data on returns for individual stocks is from Datastream.



shows that for stocks with no foreign ownership the average correlation is 0.103, but for stocks with more than five percent foreign ownership the average correlation is 0.21.[32] In Figure 2.2, we graph the covariances as a fraction of the average variance. For stocks with no foreign ownership, the global limit of diversification is 7.1 percent of individual stock variance, whereas for stocks with more than five percent foreign ownership the limit is 18.8 percent. These findings show the importance of the level of foreign ownership, a finding recently confirmed by Faias, Ferreira, Matos, and Santa-Clara (2011).

To gauge similar implications for ownership linkages captured by the ownership return, we take the perspective of a fund manager looking to diversify into non-U.S. stocks that he does not already hold in his portfolio. In order to focus on the set of stocks that fund managers typically select, we require the level of foreign ownership in these stocks to exceed five percent. For each of the stocks meeting these requirements, we regress its foreign ownership return on the return of each fund, using weekly returns over the prior two-year rolling window. We call the estimated slope coefficient of this regression the ownership beta of a stock with respect to the fund. The ownership beta is a measure of how closely the return of a fund covaries with the return on the foreign holdings of other funds that hold a particular security.

For the year subsequent to the estimation period of the ownership betas, we regress the stock return on the fund return separately for each stock and fund. We call the estimated slope coefficient of this regression the 'fund beta' of a stock with respect to the fund. It is a measure of how strongly a stock covaries with a given fund's portfolio, or its diversification potential for the fund.

[32] Panels A and B of Supplemental Figure S3 break the global diversification limit down into the country and industry component following Heston and Rouwenhorst (1994). Supplemental Tables S7 and S8 and Supplemental Figures S4 and S5 show that global market betas are largely increasing in the level of foreign ownership.

With the ownership betas and fund betas in hand, we sort all stocks into four groups each year according to their ownership betas (<0.5, 0.5-0.75, 0.75-1, >1) and calculate the average fund beta of each group. To preserve proper weighting on a fund and country level, we first average the fund betas across stocks by fund, country, year, and ownership beta bin. Subsequently, we average across funds, across countries, and then across years for each ownership beta bin. Fund betas are related to prior estimated ownership betas and are of large size. Panel B of Table 2.10 shows that the average fund beta is 0.471, 0.635, 0.765, and 0.864 as one moves from low to high ownership betas.[33] If a fund manager adds a security with a high ownership beta to his fund, the average fund beta is 1.83 times (0.864/0.471) what the average fund beta is for a stock with a low ownership linkage.

A remaining issue is that it seems probable that the level of foreign ownership is related to the strength of the ownership linkage, i.e. the ownership beta. To address this issue we sort stocks into bins both according to the level of foreign ownership as well as their ownership betas. In particular, we define five levels of foreign ownership (0, 0-1, 1-5, 5-15, and >15 percent) and sort stocks within each group into bins based on their ownership beta (<0.5, 0.5-0.75, 0.75-1, >1). Panel C of Table 2.10 shows the average fund beta according to both its level of foreign ownership as well as the stock's ownership beta. For stocks with zero foreign ownership, the average fund beta is 0.48, but for stocks with more than 15 percent foreign ownership the average fund beta is 0.74 or 1.54 times (0.74/0.48). For stocks with low ownership linkage to a fund the average fund beta is 0.42, whereas for stocks with high ownership linkage the fund beta averages 0.74, or 1.77 times as much (0.74/0.42). This indicates that a stock with high ownership

[33] Because of computational considerations, we randomly draw one thousand of our 6,698 institutions to consider in the analysis in Panel B and C of Table 10. The analysis is computationally intensive because of the high dimensionality of the combined analysis of all permutations of the time-series data of these 6,698 institutions with the time-series stock return and ownership return data of 9,095 Non-U.S. stocks.

linkages will have considerably less diversification benefits for portfolio managers, even after controlling for the level of foreign ownership. Our findings indicate that both ownership linkages and the level of foreign ownership are economically important factors to consider in international diversification.

9. Conclusion

The traditional view of international stock market co-movement suggests that firms move together to the extent that their economic drivers are similar. In the international finance literature, this debate has been cast in terms of two components of economic fundamentals, namely industry and country factors. Although Froot and Dabora (1999), Chan, Hameed, and Lau (2003), and Foerster and Karolyi (1999) show in different contexts that covariation is related to a firm's location, we extend this intuition by developing a new measure of ownership linkages and documenting its pervasiveness and importance. Fama and French (2012) find that local factors are relatively more important than global ones, but Karolyi and Wu (2012) show that the degree to which a stock is global depends on the cross-listed trading venue. In a broadly consistent manner, we find that a more explicit measure of ownership linkages can explain return variation beyond factors.

We construct a return that is the value-weighted average of all foreign stocks held by common shareholders. We find that this very specific ownership composition measure is similar in economic importance as a stock's industry variation, both in the cross-section and in the time-series. We examine a variety of different ownership related explanations and conclude that the ownership return is proxying for a stock's related-firm habitat. More specifically, heterogeneous investors with different market perceptions influence stock prices as their holdings and preferences for stocks in an investment locale oscillate in ways that transcend borders.

Our results have important practical implications to investors: Stocks with an ownership return similar to a portfolio manager's existing portfolio provide considerably less diversification potential as compared to stocks with an unrelated ownership return. Thus, international fund managers should pay close attention both to the level of foreign ownership and to whether the stock is held by unrelated or competing shareholders. We believe these findings have broad academic and practical relevance for a variety of domestic and international portfolio and risk management applications.

REFERENCES

Ang, A., J. Liu, and K. Schwartz. 2010. Using Stocks or Portfolios in Tests of Factor Models. Working Paper, Columbia University.

Anton, M., and C. Polk. 2010. Connected Stocks. Working Paper, London School of Economics.

Bae, K. H., A. Karolyi, and R. M. Stulz. 2003. A New Approach to Measuring Financial Contagion. *Review of Financial Studies* 16:717-763.

Barberis, N., and A. Shleifer. 2003. Style Investing. *Journal of Financial Economics* 68:161-199.

Barberis, N., A. Shleifer, and J. Wurgler. 2005. Comovement. *Journal of Financial Economics* 75:283-317.

Bekaert, G., M. Ehrmann, M. Fratzscher, and A. Mehl. 2012. Global Crises and Equity Market Contagion. Working Paper, Columbia Business School.

Bekaert, G., and C. R. Harvey. 2003. Emerging Markets Finance. *Journal of Empirical Finance* 10:3-56.

Bekaert, G., C. R. Harvey, and R. Lumsdaine. 2002. Dating the Integration of World Equity Mar-kets. *Journal of Financial Economics* 65:203-47.

Bekaert, G., C. R. Harvey, and C. Lundblad. 2007. Liquidity and Expected Returns: Lessons from Emerging Markets. *Review of Financial Studies* 20:1783-1831.

Bekaert, G., R. J. Hodrick, and X. Zhang. 2009. International Stock Return Comovements. *Journal of Finance* 64:2591-2626.

Bekaert, G., and X. Wang. 2010. Globalization and Asset Prices. Working Paper, Columbia Business School.

Bohn, H., and L. L. Tesar. 1996. U.S. Equity Investment in Foreign Markets: Portfolio Rebalancing or Return Chasing? *The American Economic Review* 86:77-81.

Boyer, B., T. Kumagai, and K. Yuan. 2006. How Do Crises Spread? Evidence from Accessible and Inaccessible Stock Indices. *Journal of Finance* 61:957-1003.

Broner, F., R. G. Gelos, and C. M. Reinhart. 2006. When in Peril, Retrench: Testing the Portfolio Channel of Contagion. *Journal of International Economics* 69:203-230.

Calomiris, C., W. I. Love, and M. Peria. 2011. Crisis "Shock Factors" and the Cross Section of Global Equity Returns. Working Paper, Columbia Business School.

Calvo, G. A. 1999. Contagion in Emerging Markets: When Wall Street is a Carrier. Working Paper, University of Maryland.

Carrieri, F., V. Errunza, and S. Sarkissian. 2004. Industry Risk and Market Integration. *Management Science* 50:207-221.

Chan, K., A. Hameed, and S. Ting Lau. 2003. What If Trading Location Is Different from Business Location? Evidence from the Jardine Group. *Journal of Finance* 58:1221-1246.

Chan, K., V. Covrig, and L. Ng. 2005. What Determines the Domestic Bias and Foreign Bias? Evi-dence from Mutual Fund Equity Allocations Worldwide. *Journal of Finance* 60:1495-1534.

Choe, H., B. Kho, and R. M. Stulz. 1999. Do Foreign Investors Destabilize Stock Markets? The Korean Experience in 1997. *Journal of Financial Economics* 54:227-264.

Coval, J., and E. Stafford. 2007. Asset Fire Sales (and Purchases) in Equity Markets. *Journal of Financial Economics* 86:479–512.

Covrig, V. M., P. Fontaine, S. Jimenez-Garces, and M.S. Seasholes. 2010. Information and the Dis-persion of Cross-Border Equity Holdings. Working Paper, California State University at Northridge.

Daniel, K., D. Hirshleifer, and A. Subrahmanyam. 2001. Overconfidence, Arbitrage, and Equilibrium Asset Pricing. *Journal of Finance* 56:921-965.

Dumas, B., K. Lewis, and E. Osambela. 2011. Differences of Opinion and International Equity Markets. Working Paper, Carnegie Mellon Tepper School of Business.

Ellul, A., C. Jotikasthira, and C. Lundblad. 2011. Regulatory Pressure and Fire Sales in the Corporate Bond Market. *Journal of Financial Economics* 101:596-620.

Errunza, V., and E. Losq. 1985. International Asset Pricing Under Mild Segmentation: Theory and Test. *Journal of Finance* 40:105-124.

Fama, E. F., and J. MacBeth. 1973. Risk, Return, and Equilibrium: Empirical Tests. *Journal of Political Economy* 81:607-636.

Fama, E. F., and K. R. French. 2012. Size, Value, and Momentum in International Stock Returns. Working Paper, University of Chicago.

Ferreira, M., and P. Matos. 2008. The Colors of Investors' Money: The Role of Institutional Inves-tors Around the World. *Journal of Financial Economics* 88:499–533.

Ferreira, M., and P. Matos. 2009. Do Foreigners Know Better? A Comparison of the Performance of Local and Foreign Mutual Fund Managers. Working Paper, Universidade Nova de Lisboa.

Faias, J., M. A. Ferreira. P.P. Matos and P. Santa-Clara. 2011. Does Institutional Ownership Matter for International Stock Return Comovement? Working Paper, University of Virginia.

Foerster, S., and G. A. Karolyi. 1999. The Effects of Market Segmentation and Investor Recognition on Asset Prices: Evidence from Foreign Stocks Listing in the U.S. *Journal of Finance* 54:981-1014.

Forbes, K., and M. Chinn. 2004. A Decomposition of Global Linkages in Financial Markets Over Time. *The Review of Economics and Statistics* 86:705-722.

Frazzini, A., and O. Lamont. 2008. Dumb Money: The Fund Flows and the Cross-Section of Stock Returns. *Journal of Financial Economic* 88:299-322.

Froot, K., and E. Dabora. 1999. How Are Stock Prices Affected by the Location of Trade? *Journal of Financial Economics* 53:189-216.

Froot, K., and T. Ramadorai. 2008. Institutional Portfolio Flows and International Investments. *Review of Financial Studies* 21:937-972.

Froot, K., P. O'Connell, and M. Seasholes. 2001. The Portfolio Flows of International Investors. *Journal of Financial Economics* 59:151-193.

Goldstein, I., and A. Pauzner. 2004. Contagion of Self-fulfilling Financial Crises Due to Diversification of Investment Portfolios. *Journal of Economic Theory* 119:151–183.

Green, C., and B. Hwang. 2009. Price-Based Return Comovement. *Journal of Financial Economics* 93:37-50.

Greenwood, R. 2005. Short and Long-term Demand Curves for Stocks: Theory and Evidence on the Dynamics of Arbitrage. *Journal of Financial Economics* 75:607-649.

Greenwood, R. 2008. Excess Comovement of Stock Returns: Evidence from Cross-sectional Variation in Nikkei 225 Weights. *Review of Financial Studies* 21:1153-1186.

Greenwood, R., and D. Thesmar. 2011. Stock Price Fragility. *Journal of Financial Economics* 102:471–490.

Griffin, J. 2002. Are the Fama and French Factors Global or Country Specific? *Review of Financial Studies* 15:783-803.

Griffin, J., and A. Karolyi. 1998. Another Look at the Role of the Industrial Structure of Markets for International Diversification Strategies. *Journal of Financial Economics* 50:351-373.

Griffin, J., F. Nardari, and R. Stulz. 2004. Daily Cross-border Equity Flows: Pushed or Pulled? *The Review of Economics and Statistics* 86:642-657.

Griffin, J., P. Kelly, and F. Nardari. 2010. Are Emerging Markets More Profitable? Implications for Comparing Weak and Semi-Strong Form Efficiency. *Review of Financial Studies* 23:3225-3277.

Hau, H., and H. Rey. 2009. Global Portfolio Rebalancing Under the Microscope. Working Paper, London Business School.

Hau, H., and S. Lai. 2012. The Role of Equity Funds in the Financial Crisis Propagation. Working Paper, University of Geneva.

Hirshleifer, D. and D. Jiang. 2010. A Financing-Based Misvaluation Factor and the Cross-Section of Expected Returns. *Review of Financial Studies* 23:3401-3436.

Heston, S., and G. Rouwenhorst. 1994. Does Industrial Structure Explain the Benefits of International Diversification? *Journal of Financial Economics* 36:3-27.

Jorion, P. 1990. The Exchange Rate Exposure of US Multinationals. *Journal of Business* 63:331-345.

Jotikasthira, P., C. T. Lundblad, and T. Ramadorai. 2011. Asset Fire Sales and Purchases and the International Transmission of Financial Shocks. Forthcoming in the Journal of Finance.

Kaminsky, G., R. Lyons, and S. Schmukler. 2004. Managers, Investors, and Crises: Mutual Fund Strategies in Emerging Markets. *Journal of International Economics* 64:113– 134.

Karolyi, G. A., and Y. Wu. 2012. The Role of Investability Restrictions on Size, Value, and Momentum in International Stock Returns. Working Paper, Cornell University.

Karolyi, G. A., and R. M. Stulz. 2003. Are Financial Assets Priced Locally or Globally? *Handbook of the Economics of Finance* 1:975-1020.

Kodres, L. E., and M. Pritsker. 2002. A Rational Expectations Model of Financial Contagion. *Journal of Finance* 57:769-799.

Kumar, A., J. Page, and O. Spalt. 2010. Investor Clienteles and Habitat-Based Return Comovements. Working Paper, University of Texas at Austin.

Kyle, A. S., and W. Xiong. 2001. Contagion as a Wealth Effect. *Journal of Finance* 56:1401-1440.

Lesmond, D. A., J. P. Ogden, and C. A. Trzcinka. 1999. A New Estimate of Transaction Costs. *The Review of Financial Studies* 12:1113-1141.

Ng, D. T. 2004. The International CAPM when Expected Returns are Time-Varying. *Journal of International Money and Finance* 23:189-230.

Nofsinger, J. and R. Sias. 1999. Herding and Feedback Trading by Institutional and Individual Investors. *Journal of Finance* 54:2263-2295.

Pirinsky, C., and Q. Wang. 2004. Institutional Investors and Comovement of Equity Prices. Working Paper, George Washington University.

Roll, R. 1992. Industrial Structure and the Comparative Behavior of International Stock Market

Indices. *Journal of Finance* 47:3-41.

Solnik, B. 1974. An Equilibrium Model of the International Capital Market. *Journal of Economic Theory* 8:500-524.

Stulz, R. 1981. A Model of International Asset Pricing. *Journal of Financial Economics* 9:383-406.

Stulz, R. 1999. International Portfolio Flows and Security Markets. Edited by M. Feldstein. University Chicago Press 257-293.

Sun, Z. 2008. Clustered Institutional Holdings and Stock Comovement. Working Paper, New York University.

Wei, C. 2011. Do Foreign Institutions Improve Stock Liquidity? Working Paper, Nanyang Techno-logical University.

Wermers, R. 1999. Mutual Fund Herding and the Impact on Stock Prices. *Journal of Finance* 2:581-622.

Yuan, K. 2005. Asymmetric Price Movements and Borrowing Constraints: A Rational Expectations Equilibrium Model of Crisis, Contagion, and Confusion. *Journal of Finance* 50:379-411.

Appendix 1: Example of Ownership Linkage

As an example of the foreign ownership return, consider the Korean stock Samsung, where Capital World Investor is the largest foreign shareholder. We calculate the value-weighted return each peri-od to Capital World Investor due to all of its positions outside of Korea. Capital World Investor's foreign return is then weighted by the proportion of its position in Samsung relative to all other foreign holders. Since Capital World Investor is the largest foreign holder of Samsung, it will take the largest weight in Samsung's ownership return. After performing the same calculation for all other foreign investors in Samsung and aggregating across investors, we obtain Samsung's foreign ownership return, Ri,F, which captures the return on the portfolio holdings of institutional shareholders of Samsung outside of Korea.

Figure 2.3 illustrates a hypothetical example of a stock (Samsung) which is held by two shareholders (Capital World Investors and New York Retirement Fund). The drawing demonstrates how Samsung is linked to other securities through the common shareholders.

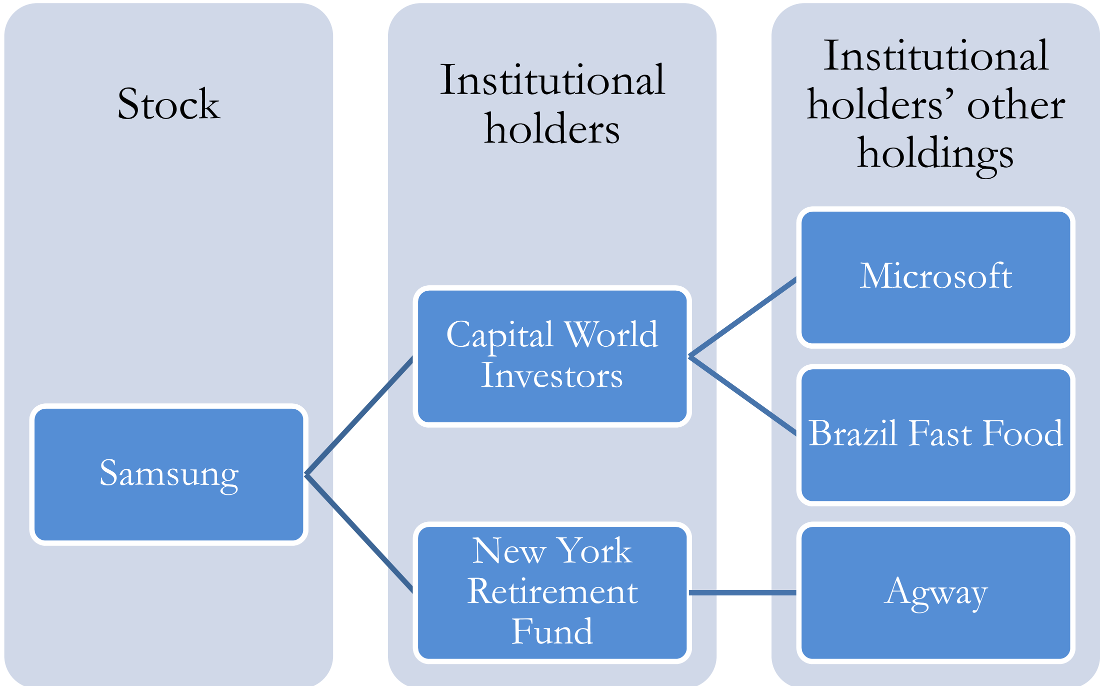


Figure 2.3

Appendix 2

Table A2.1: Summary Statistics on Update Frequency of Ownership Data

The table shows the percentage of institutions by country and data source in LionShares, i.e. institutional level data (13F in the US and its equivalent in other countries), the mutual funds database (MF), and the merged dataset (13F+MF). Results are split by updating frequency, i.e. annual, biannual, triannual, and quarterly frequency. The last column shows the total percentage of institutions across the years 2000-2009. The total percentage can add up to above 100 if an institution appears in both 13F and MF. Ownership data is from LionShares.

	Annual			Biannual			Triannual			Quarterly			Total	
	13F	MF	13F+MF	13F	MF	13F+MF	13F	MF	13F+MF	13F	MF	13F+MF	13F	MF
Australia	7	62	63	2	28	27	1	4	5	2	3	6	12	98
Austria	2	22	22	8	58	59	1	4	4	2	15	15	13	99
Belgium	3	20	19	8	58	60	0	4	4	0	17	17	11	100
Canada	10	25	26	17	50	49	2	6	6	13	11	19	42	91
Denmark	3	35	36	3	46	45	1	9	9	3	8	10	10	99
Finland	1	37	37	7	54	56	0	3	3	0	3	3	9	98
France	4	54	55	2	16	16	1	14	14	6	12	15	13	95
Germany	2	22	22	2	39	40	0	7	7	2	31	31	7	99
Ireland	8	24	23	21	61	65	1	4	4	3	6	8	33	95
Italy	10	83	85	0	13	13	0	2	2	0	1	1	10	98
Japan	12	46	48	3	15	14	2	2	3	33	1	35	50	64
Luxembourg	4	20	20	9	62	63	1	5	6	2	10	11	17	98
Netherlands	7	30	30	4	50	46	2	2	4	14	6	20	26	88
New Zealand	0	89	89	0	11	11	0	0	0	0	0	0	0	100
Norway	1	40	37	4	44	44	1	11	12	2	4	6	9	100
Portugal	3	27	28	2	26	26	0	6	6	5	38	41	9	97
Spain	1	12	12	0	13	13	0	14	14	1	60	60	2	99
Sweden	3	30	29	4	41	42	1	11	11	3	15	17	12	97
Switzerland	4	23	25	5	51	53	1	4	4	9	11	18	19	89
United Kingdom	9	23	26	9	38	38	1	6	7	17	19	29	36	86
United States	17	6	18	2	9	6	4	3	5	67	12	71	89	31
Developed	**5**	**35**	**36**	**5**	**37**	**37**	**1**	**6**	**6**	**9**	**14**	**21**	**20**	**91**
Developed ex US	**5**	**36**	**37**	**6**	**39**	**39**	**1**	**6**	**6**	**6**	**14**	**18**	**17**	**94**

(continued)

Table A2.1: Summary Statistics on Update Frequency of Ownership Data (continued)

	Annual			Biannual			Triannual			Quarterly			Total	
	13F	MF	13F+MF	13F	MF	13F+MF	13F	MF	13F+MF	13F	MF	13F+MF	13F	MF
Andorra	0	67	67	0	33	33	0	0	0	0	0	0	0	100
Argentina	0	0	0	0	33	33	0	33	33	0	33	33	0	100
Bahamas	22	28	50	0	0	0	0	0	0	50	0	50	72	28
Bahrain	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Barbados	50	0	50	0	0	0	0	0	0	50	0	50	100	0
Bermuda	9	34	38	0	24	23	0	6	4	32	2	34	41	67
Brazil	75	0	75	0	0	0	25	0	25	0	0	0	100	0
British Virgin Islands	26	50	58	4	39	41	0	1	1	0	0	0	30	91
Cayman Islands	3	49	49	4	47	47	0	2	2	0	2	2	7	100
Chile	0	100	100	0	0	0	0	0	0	0	0	0	0	100
China	0	25	25	0	74	74	0	2	2	0	0	0	0	100
Cook Islands	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Croatia	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Cyprus	25	0	25	25	0	25	0	0	0	50	0	50	100	0
Czech Republic	0	38	38	0	62	62	0	0	0	0	0	0	0	100
Estonia	0	35	35	0	53	53	0	12	12	0	0	0	0	100
Gibraltar	0	0	0	0	100	100	0	0	0	0	0	0	0	100
Greece	0	32	32	0	68	68	0	0	0	0	0	0	0	100
Hong Kong	13	13	26	4	46	46	0	0	0	27	0	27	45	59
Hungary	0	32	32	0	68	68	0	0	0	0	0	0	0	100
Iceland	33	67	100	0	0	0	0	0	0	0	0	0	33	67
India	0	45	45	0	37	37	0	4	4	0	15	15	0	100
Latvia	0	67	67	0	33	33	0	0	0	0	0	0	0	100
Liechtenstein	1	32	32	2	67	67	0	0	0	0	1	1	3	100
Lithuania	0	83	83	0	17	17	0	0	0	0	0	0	0	100
Malaysia	0	27	27	0	31	31	0	14	14	0	28	28	0	100
Malta	0	0	0	0	33	33	0	67	67	0	0	0	0	100
Mauritius	0	43	43	0	57	57	0	0	0	0	0	0	0	100
Monaco	60	0	60	0	0	0	0	0	0	40	0	40	100	0
Namibia	0	47	47	0	33	33	0	20	20	0	0	0	0	100
Netherlands Antilles	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Pakistan	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Philippines	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Poland	0	36	35	4	64	65	0	0	0	0	0	0	4	100
Romania	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Saudi Arabia	0	100	100	0	0	0	0	0	0	0	0	0	0	100
Singapore	6	18	23	6	71	65	0	1	1	10	2	12	22	91
Slovakia	0	25	25	0	75	75	0	0	0	0	0	0	0	100
Slovenia	0	52	52	0	47	47	0	2	2	0	0	0	0	100
South Africa	2	43	43	2	40	40	0	15	15	0	2	2	4	100
South Korea	100	0	100	0	0	0	0	0	0	0	0	0	100	0
Taiwan	31	38	69	0	0	0	0	0	0	31	0	31	62	38
Thailand	0	38	38	0	27	27	0	10	10	0	25	25	0	100
Turkey	0	50	50	0	50	50	0	0	0	0	0	0	0	100
Virgin Islands	13	0	13	0	0	0	6	0	6	81	0	81	100	0
Emerging	**10**	**45**	**54**	**1**	**30**	**30**	**1**	**4**	**5**	**8**	**2**	**11**	**21**	**81**
All countries	**9**	**42**	**48**	**2**	**32**	**32**	**1**	**5**	**5**	**8**	**6**	**14**	**20**	**84**

Table A2.2: Number of Institutions and Mutual Funds by Year and Country

The table shows the number of institutions and mutual funds that come from a particular country by year and country in LionShares. Results are split by data source, i.e. institutional level data (13F in the US and its equivalent in other countries) and the mutual funds database (MF). Coverage is from 2001 to 2009. In order to keep the table brief we report the coverage in three years: 2001, 2005, and 2008. The last column (Total) shows the total number of fund-years. Ownership data is from LionShares.

	2001		2005		2008		Total Fund Years (01-09)	
	13F	MF	13F	MF	13F	MF	13F	MF
Australia	1	10	1	55	4	83	17	380
Austria		29		43		55		379
Belgium		22		31	1	31	3	244
Canada	20	146	44	164	69	173	428	1,365
Denmark		18	1	33	2	35	10	232
Finland		18		32		31		248
France	4	53	13	159	14	135	88	1,152
Germany	2	107	4	144	5	205	36	1,349
Ireland	3	9	2	13	5	17	36	118
Italy		35		58	1	59	3	454
Japan	8	37	12	70	12	76	109	607
Luxembourg		34	1	64	3	58	9	452
Netherlands	3	11	9	28	11	27	77	225
New Zealand				4		3		18
Norway	1	18	1	25	1	24	9	192
Portugal		3		24		28		215
Spain	1	100	1	123	2	127	14	964
Sweden	1	20	1	58	1	74	11	429
Switzerland	4	56	13	163	14	205	92	1,218
United Kingdom	36	168	71	268	108	299	693	2,293
United States	1,924	845	2,424	845	2,892	899	25,060	8,796
Developed	**2,008**	**1,739**	**2,598**	**2,404**	**3,145**	**2,644**	**26,695**	**21,330**
Developed ex US	**84**	**894**	**174**	**1,559**	**253**	**1,745**	**1,635**	**12,534**

(continued)

	2001		2005		2008		Fund Years (01-09)	
	13F	MF	13F	MF	13F	MF	13F	MF
Andorra				3		3		17
Argentina		1		3		3		17
Bahamas	1	2	2	3	4	1	24	25
Bahrain						1		2
Barbados			1	1	1		6	2
Bermuda	4	1	4	6	5	6	43	43
Brazil		4		4	3	8	7	44
British Virgin Islands				1	1		2	4
Cayman Islands				1		1		10
Chile				1		1		11
China		1		1		54		64
Cook Islands								
Croatia						5		12
Cyprus					1	1	4	3
Czech Republic		1		7		8		41
Estonia		1		3		7		31
Gibraltar				1				5
Greece				4		16		109
Hong Kong	2	35	5	41	5	51	39	387
Hungary				8		5		36
Iceland				2		2	1	13
India		3		28		38		221
Latvia						3		6
Liechtenstein		1		13		19		102
Lithuania						3		6
Malaysia				14		21		97
Malta								
Mauritius				1				3
Monaco			1		1		5	
Namibia				1		2		8
Netherlands Antilles								2
Pakistan						16		30
Philippines				1				6
Poland				16		29		139
Romania				6		19		49
Saudi Arabia						5		8
Singapore		38	2	43	3	44	15	393
Slovakia				6		6		34
Slovenia				13		13		66
South Africa		3		30		69	1	353
South Korea		2		4	1	4	2	29
Taiwan		1	1	1	2	3	8	15
Thailand		1		8		19		92
Turkey				3		4		19
Virgin Islands	1		2		2		17	
Emerging	**8**	**95**	**18**	**278**	**29**	**490**	**174**	**2,554**
All countries	**2,016**	**1,834**	**2,616**	**2,682**	**3,174**	**3,134**	**26,869**	**23,884**

Table A2.3: Descriptive Statistics

The table shows descriptive statistics on the percentage of local institutional ownership and market capitalization of firms in the sample. To be included in the sample firms are required to have non-missing data on lagged foreign ownership and at least 30% non-zero trading days in the previous year. Panel A shows statistics for Developed Markets, while Panel B shows results for Emerging Markets (based on the MSCI classification as of June 2006). In each panel results are broken down by country, region, and by size quintiles (small to large, using common U.S. breakpoints), where size is measured by market capitalization in U.S. Dollars. The first column shows the average percentage of (free-float adjusted) local institutional ownership. Ownership is free-float adjusted by dividing it by 1 minus the percentage of closely held shares, where missing values of closely held shares are set to zero. The second column shows the average market capitalization (in millions of U.S. Dollars). Averages are first taken by year and are subsequently taken across time. The sample period is 01/01/2000-03/31/2009. Ownership data is from LionShares, market capitalization data is from Datastream, and data on closely held shares is from Worldscope.

Panel A: Developed Markets

	Local Institutional Ownership (%)					Market Capitalization (USD)				
	Small	2	3	4	Large	Small	2	3	4	Large
Australia	2.0	2.6	2.8	2.6	2.5	34	110	294	911	8,879
Austria	1.5	2.9	2.2	1.7	1.1	29	95	499	879	5,650
Belgium	2.3	5.5	11.7	9.5	6.3	34	98	263	895	10,565
Canada	6.0	13.3	18.9	25.3	27.8	28	108	291	884	8,982
Denmark	12.4	16.8	16.7	15.1	13.0	35	108	275	1,008	6,324
Finland	7.1	15.5	10.4	11.6	9.2	30	106	281	903	12,514
France	4.5	8.0	8.6	10.4	9.9	27	98	275	829	16,294
Germany	4.1	7.3	8.5	8.9	10.7	23	94	295	884	14,319
Ireland	0.7	1.6	1.9	2.0	0.8	42	75	242	900	6,884
Italy	1.4	2.2	2.5	2.1	2.2	42	99	280	849	11,257
Japan	0.7	0.9	1.7	2.2	1.5	37	100	263	814	7,568
Luxembourg	1.5	1.7	1.4	1.8	2.0	43	95	374	1,275	14,614
Netherlands	7.9	13.3	15.2	5.0	1.8	29	108	302	907	16,538
New Zealand	0.3	1.3	2.7	1.3	2.3	33	98	260	966	3,318
Norway	5.3	12.7	24.2	25.2	14.2	42	108	339	792	9,055
Portugal	5.6	13.4	16.3	11.6	3.0	20	112	254	1,030	5,353
Spain	2.7	6.0	10.1	7.6	5.2	46	128	305	994	14,049
Sweden	6.1	18.3	26.1	28.9	25.3	28	95	254	822	8,768
Switzerland	12.6	11.5	12.1	9.1	4.6	42	114	287	896	7,444
United Kingdom	17.2	25.4	26.2	23.0	11.2	27	97	258	795	13,913
United States	27.8	49.4	79.7	99.7	92.3	29	98	269	831	12,763
Developed	**14.4**	**23.9**	**37.4**	**51.0**	**49.1**	**30**	**100**	**270**	**835**	**11,584**
Developed ex US	**5.7**	**7.6**	**8.7**	**9.0**	**7.5**	**30**	**101**	**271**	**839**	**10,439**

(continued)

Panel B: Emerging Markets

	Local Institutional Ownership (%)					Market Capitalization (USD)				
	Small	2	3	4	Large	Small	2	3	4	Large
Argentina	0.0	0.0	0.0	0.1	0.2	24	128	288	814	5,239
Bangladesh	0.0	0.0	0.0	0.0		43	147	512	484	
Bermuda		0.0	0.0	0.0	0.0		236	579	1,074	2,329
Brazil	2.3	0.1	0.3	0.3	0.2	42	164	373	1,043	7,531
Bulgaria	0.0	0.0	0.0	0.0		62	37	501	138	
Chile	0.0	1.4	1.1	1.1	0.8	93	117	332	922	3,922
China	0.0	0.6	2.0	2.2	5.1	68	181	463	1,278	7,669
Colombia		0.0	0.0	0.0	0.0		306	279	1,131	2,616
Croatia		0.0	0.3	0.1	0.0		167	292	1,347	1,705
Cyprus	0.3	0.4	0.2	0.0	0.0	24	193	357	1,110	3,613
Czech Republic	0.4		0.9	2.8	1.1	56		325	1,184	7,195
Egypt	0.4	0.5	0.4	0.2	0.1	69	171	348	1,166	4,352
Estonia	0.4	1.4	0.4	0.9		88	1,033	124	402	
Greece	0.1	0.2	0.4	0.4	0.6	30	107	277	777	5,262
Hong Kong	0.9	3.7	5.2	6.5	6.1	39	100	271	836	10,364
Hungary	3.1	2.6	1.2	1.2	0.4	52	96	258	661	5,061
Iceland				0.0	0.0				250	1,609
India	3.7	4.8	6.0	5.1	3.3	40	130	325	1,116	6,230
Indonesia	0.0	0.0	0.0	0.0	0.0	41	100	313	947	4,300
Israel	0.0	0.0	0.0	0.0	0.0	34	91	261	900	5,485
Kenya	0.0	0.0	0.0	0.0	0.0	92	140	430	848	877
Korea, Republic Of	0.2	0.4	0.3	0.1	0.1	44	105	309	979	7,483
Latvia	0.0	0.1	0.1	0.0		45	111	353	536	
Lithuania	0.2	0.1	0.1	0.1	0.0	37	104	466	772	2,742
Malaysia	1.1	1.6	1.6	0.8	0.7	36	103	265	844	4,509
Malta		0.0	0.0	0.0			149	247	869	
Mauritius		0.0	0.0	0.0			97	238	133	
Mexico	0.0	0.0	0.5	0.6	0.6	36	124	362	973	4,703
Morocco	0.0	0.0	0.0	0.0	0.0	52	831	499	1,038	5,037
Pakistan	0.2	0.9	0.6	0.6	0.9	42	91	304	784	2,621
Peru	0.0	0.0	0.0	0.0	0.0	63	151	338	723	3,242
Philippines	0.0	0.0	0.2	0.4	0.4	32	138	311	686	2,914
Poland	11.2	25.7	19.9	15.7	13.6	36	111	309	969	5,142
Romania	1.8	1.1	2.2	0.5	1.3	33	205	433	954	5,919
Singapore	0.7	1.7	4.1	3.8	6.7	36	88	262	885	7,206
Slovakia	0.0	0.0	0.3	0.1	0.0	95	95	504	1,443	1,699
Slovenia	12.0	11.1	6.5	4.5	5.3	435	86	267	717	1,400
South Africa	5.1	21.4	10.9	6.5	4.7	43	102	299	962	5,791
Sri Lanka	0.0	0.0	0.0	0.0		17	85	261	739	
Taiwan	0.0	0.0	0.1	0.1	0.1	49	107	259	786	5,440
Thailand	0.6	0.8	1.4	0.9	1.4	33	96	287	861	3,912
Turkey	0.0	0.3	0.3	0.3	0.2	40	103	279	843	3,878
United Arab Emirates			0.0	0.1	0.0			602	1,866	1,155
Venezuela	0.0	0.0	0.0	0.0	0.0	282	628	425	834	931
Emerging	**1.6**	**2.8**	**2.8**	**2.7**	**3.1**	**42**	**107**	**289**	**909**	**6,103**
All countries	**12.1**	**18.8**	**29.0**	**40.5**	**41.9**	**33**	**103**	**276**	**852**	**10,698**

Appendix 3

Supplemental Appendix A: Data sample cleaning

For the main part of the analysis we use two datasets: a) LionShares holdings data and b) returns and market values data from CRSP and Datastream. Holdings data is from LionShares and structured using three identifiers describing who owns what and when. There are two unadjusted datasets within LionShares, namely FUND and 13F. FUND is fund level holding data where holders are identified as funds. 13F is institution level data. We use the merged data of the two.

Stocks in LionShares data are identified by CUSIP, ISIN and SEDOL. CUSIP is the main identifier for assets that funds and institutions hold. Other identifiers, such as ISIN and SEDOL are also available for each CUSIP. ISIN is later used to link DSCD to CUSIP.[34] LionShares records how many shares a fund or an institution holds. From this number we construct the percentage of ownership by dividing by the number of shares outstanding. The number of shares is provided in a separate dataset offered by LionShares. When the number of shares outstanding is missing or zero, we use the number of shares outstanding on the closest future date (provided that the stock price has not changed substantially). ADR and GDRs and their parent firms are identified using classifiers obtained from both Datastream and LionShares. For ADRs and GDRs we calculate the ownership in a stock as the combined ownership of the ADR/GDR and the home country stock, and use the returns from the parent firm.

U.S. stock returns and market values are from CRSP. International stock returns and market values are from Datastream. We use exchange rates downloaded from Datastream to

[34] In most countries, LionShares covers companies with a market capitalization of more than $50 million and account for all positions equal to or larger than 0.1 percent of the issued shares. The coverage threshold for Latin American and some Asian (Indian, Chinese, South Korean, Philippines and Indonesian) companies are between $100 and $200 million. There is no coverage threshold for U.K., U.S., and Japan companies.

convert the local currency stock returns into U.S. dollar terms. U.S. stocks are identified by CRSP's PERMNO, while International stocks are identified by Datastream codes (DSCD).

For U.S. stocks, we use CRSP's event table to map CUSIP to PERMNO. For non-U.S. stocks, we use the aforementioned ISIN to get DSCD for each firm. Datastream provides a mapping between DSCD and ISIN. In case of depository receipts, Datastream also provides a mapping between DSCD of the underlying home listing and the ISIN. Using the two datasets above, we map each firm in LionShares to CRSP for U.S. stocks and to DSCD for non-U.S. stocks. In case of depository receipts, we use the DSCD for its underlying stock.

LionShares provides institution-level data as well as fund-level data. To utilize all of the holding data available, we make the two datasets institutional-level by aggregating the fund-level data at the institution level. We then merge these two datasets.[35] When there is overlap of the holding information, we prefer 13F data to FUND data.

There is a mismatch of reporting frequency and dates of the two datasets. The reporting frequency and dates of institution-level data (13F) are usually fixed and quite regular; reports are made at the end of each quarter and are in quarterly frequency. Fund level data does not have a fixed frequency, and it is not necessarily reported at the end of each quarter. For example, a fund could be reporting semi-annually at the end of April and October. When there is a mismatch of reporting frequency and dates of the two datasets, we interpolate missing holding information in the fund level data before aggregating the fund level data to the institutional level. We merge the

[35] If we only have institutional holding data on a stock in a quarter but no holding data by any of its funds on that stock, we use the institution data. Similarly, if we only have fund holding data on a stock in a quarter but not the fund's institution holding data, we take the fund data. When we have both institution and fund holding data on the stock in a quarter, we use the institution level observation. Ferreira and Matos (2008) also make the same assumptions in preferring institutional holding records to fund holdings. In the case that a stock holding only appears in the fund holding but not in the institutional holding record, we retain that stock holding record by the fund. To illustrate, if Fidelity (e.g. Magellan, International Discovery, etc.) held stocks X and Y in the fund dataset and Fidelity held stocks X and Y in the institution dataset, we would use Fidelity's holdings of X and Y. However, if the fund record showed various Fidelity funds owning stocks X and Y, and the institutional record showed Fidelity owning stock X only, then we would use Fidelity's holding of stock X and sum up various Fidelity funds' holding of stock Y.

institution level holdings data and mutual fund holdings in the last month of each quarter. If the holdings data is missing, we fill in the holding data in the mutual fund dataset using the latest holding information. We carry the holdings information forward to the next available report date for up to three quarters.[36]

We use two data screens for returns on stocks. First, to screen for common equities, we use the filters from Griffin, Kelly, and Nardari (2010) which eliminate preferred stocks, warrants, unit trusts, investment trusts, duplicates, and other non-common equities. Second, we use filters following Griffin, Kelly, and Nardari (2010) with some modification to account for varying data frequencies. The screen for quarterly data is as follows. If returns are greater than 1000 percent, we exclude returns from -1 to +1 quarter around the extreme event. We exclude returns <-98 percent if the extreme return event occurs more than 30 days from the end of the time series available. If one quarter's return is greater than 500 percent but the cumulative return in the current and next quarter is less than 20 percent, we assume a data error and delete the return in both quarters. The screen for weekly data is as follows. If returns are greater than 500 percent, we exclude returns from -12 to +12 weeks around the extreme event. We take out returns <-98 percent if the extreme return event occurs more than 30 days from the end of the time series available. If one week's return is greater than 300 percent, but the cumulative return over the current and next week is less than 50 percent, i.e. R_t or $lag_1(R_t)> 3.00$ and $(1+R_t)*(1+ lag_1(R_t))<1.5$, then we assume a data error and delete the return in both weeks. The exception is in the United States, where the data is from the Center for Research in Security Prices (CRSP) and where we restrict our sample to common equities with CRSP share codes of 10 or 11.

---

[36] For the last holding report, we carry the holdings information over by the same number of months as there are between the last two holdings observations. We use holdings data for the last month within a quarter.

Third, we apply a liquidity filter. We require a stock to have more than 30 percent trading days of non-zero return in the previous year for cross-sectional regressions. For time-series regressions, we use three years of holding data and further require the stock to have at least 100 weeks of observations within the three year regression window.

The percentage of closely held shares and the percentage of foreign sales are from the Worldscope database, and missing observations of both variables are set to zero. The classification of emerging countries/markets is based on the Morgan Stanley Capital Index (MSCI) classification in 2006. For the global return we use the MSCI world index. In order to exclude own stock returns in the construction of local country returns, we build the value-weighted local returns using the Datastream sample.

In terms of coverage, Panel A of Table 2.1 shows that developed countries outside of the United States have, on average, foreign ownership coverage in LionShares for 40.9 percent of firms in the smallest market capitalization quintile. From the second quintile to the largest quintile, the average percentages of firms with foreign ownership coverage are 74.7, 87.1, 88.3, and 91.8 percent. Across countries, in the largest size quintile, the LionShares foreign ownership coverage is above 80 percent in all countries except Spain and Switzerland. In the emerging markets in Panel B, the percentage of firms with some foreign ownership coverage ranges from 26.8, 45.0, 53.6, 59.5, and 86.0 percent as one moves from the smallest to the largest quintile. In the largest quintile, coverage is above 80 percent in all countries except China, Croatia, Cyprus, Iceland, Indonesia, Morocco, and South Africa.

Supplemental Appendix B: Alternative Explanations of the Ownership Linkage

The ownership return may simply be capturing the relation between changes in ownership and returns as found in the U.S. by Wermers (1999) and by Nofsinger and Sias (1999). Table 2.5 also shows that contemporaneous changes in foreign ownership are strongly related to a stock's quarterly return consistent with the U.S. evidence. Interestingly, the coefficient on the foreign ownership return is not affected by the inclusion of quarterly ownership changes – the quarterly ownership return is doing much more than capturing changes in institutional ownership.

Liquidity

We also investigate whether our results can be explained by illiquidity when focusing only on the most liquid stocks. In Panel B of Table S2.4, we compare our main findings (with the 30 percent trading filter) to a more stringent 50 and 75 percent filter. For stocks that trade 50 percent of the time the results are similar, and they strengthen slightly with the filter that they trade 75 percent or more of the time. We also consider other possible explanations such as whether the explanatory power of ownership returns can be explained by foreign exchange movements, the extent of foreign sales, or the home country where the capital is from. In Table S2.4 we find no support for these explanations.

To address the issue that data coverage may increase over time for some countries but not others, we limit our data sample to a subset of countries where data coverage is better. In particular, we limit our data sample to those from countries where there are more than 500 firm-quarters so that we are not focusing on countries with only a small number of firms. This limits our sample to the top 36 countries with the highest foreign ownership level. In another test we further limit our analysis to the top 20 countries with the highest country-aggregate foreign ownership level. The result, as shown in Table S2.4 Panel B, shows that foreign ownership returns remain significant.

Institutional Ownership

Since the impact of ownership should be larger when foreigners hold a greater fraction of the security, we expect the impact of ownership returns and changes in ownership to increase with the level of foreign ownership. For stocks with low foreign ownership (0-1 percent), a one percent increase in the ownership return is associated with a 21.7 basis point increase in the stock's return (Table S2.1). If the ownership return enters by capturing returns in other stocks, it may proxy for how the investors in a stock will change their ownership. Hence, we include the change in foreign ownership in the cross-sectional regressions. The second specification shows that contemporaneous changes in foreign ownership are strongly related to a stock's quarterly return, similar to U.S. findings of a strong contemporaneous relation between quarterly institutional ownership and returns by Wermers (1999) and Nofsinger and Sias (1999). Interestingly, the coefficient on the foreign ownership return is not affected by the inclusion of quarterly ownership changes, indicating that the quarterly ownership return is doing much more than capturing changes in institutional ownership.

After controlling for returns on local and global costs of capital as well as industry indices, the coefficient on the ownership return is only 0.090. However, as expected, for stocks with one to five percent foreign ownership the size of this coefficient strengthens to 0.223 and then to 0.395 for stocks with over five percent foreign ownership. For changes in foreign ownership, the *t*-statistic strengthens substantially for the higher institutional ownership bins, yet the coefficient itself falls. One possible explanation for this effect is that a one percent increase in foreign ownership impacts the stock more if one moves from zero to one percent foreign ownership than it does from 20 to 21 percent foreign ownership. We will later examine the importance of the components of the change in ownership in more detail, but we now turn to further examination of the relation between ownership returns and stock returns.

Sorts

As another gauge of the economic importance of a stock's ownership return, we sort all stocks over a given quarter into those with ownership returns above (below) a given threshold. We start by examining all stocks with more than five percent foreign ownership and with ownership returns above 2.5 percent as compared to those with returns below -2.5 percent in a quarter. Supplemental Table S2.9 shows that stocks with high ownership returns exhibit an excess return of 3.3 percent on average versus -2.1 percent for stocks with low ownership returns. Interestingly, the effect is rather symmetric. Despite only 17 quarters, the differences are highly significant.

Style

The category-based view of Barberis and Shleifer (2003) suggests that comovement is driven because investors classify stocks into bins, such as value and growth. LionShares has seven style types: Aggressive, Deep Value, GARP, Growth, Index, Value, and Yield. We compute style returns as a value-weighted average of all the funds in a particular style. We then use the owners of each stock to construct its stock-specific style return. For example, if a stock is 40 percent owned by a value fund and 60 percent owned by a growth fund, we construct the style return to be: 0.4*global average value fund return + 0.6*global average growth fund return. Specifications (5), (6) and (12) in Panel A of Table S2.4 show that style returns are important for explaining cross-sectional return variation. However, the size of the coefficients on the ownership return and changes in ownership is largely unaffected, indicating that the importance of the ownership return is not from simple style investing.

We now turn to our list of possible explanations as to why ownership is important.

Country of Origin

We first ask which part of the ownership return matters. Does the ownership return matter because of the specific composition of the stocks that the manager holds, or does it matter due to the fact that a shareholder is domiciled in a particular country? If a U.S. institutional investor is influenced by its views of the world from U.S. news and market conditions, then the manager may be pushing or pulling capital abroad based on U.S. market returns. Similar to our ownership return, we compute an owner's home market return that is based not on the holdings, but rather the country where the institution is domiciled (not where the capital is deployed). The home market returns are calculated as the weighted sum of index returns of the home country where the funds are incorporated; the weights are based on the relative size of the funds' holdings in the stock.

Results of cross-sectional regressions are shown in Panel A of Table S2.4 for all stocks with more than five percent foreign ownership. The owners' home market return has some ability to explain returns with no controls (specification (1)), but has no explanatory power in the presence of the ownership return (specification (2)) and other important variables (specification (12)). More importantly, specification (2) shows that the coefficients on the ownership return and changes in ownership are unaffected by the owners' home market return.

Foreign Exchange Returns and Foreign Sales

Since the foreign ownership return may capture variation related to foreign exchange or operations, in specification (3) and (4) of Panel A in Table S2.4 we include the return on a trade-weighted currency index for the country in which the stock is incorporated. The currency index is in terms of local currency relative to a trade-weighted basket of foreign currencies computed by J.P. Morgan. Specifications (3) and (4) show that changes in trade-weighted currency indices are largely unimportant and unrelated to the ownership return.

It is also possible that the level of foreign ownership is simply a proxy for the extent to which a stock has operations abroad, and this could be why the importance of the ownership return increases with the level of foreign ownership. To investigate this possibility, we interact the level of foreign sales with the ownership return. Since firms with high foreign ownership may have varying degrees of foreign sales, it allows us to see if foreign operations are important beyond ownership levels. Specifications (5) and (6) show that foreign operations are not driving the importance of the ownership return.

Emerging and Developed Markets, Size, and Liquidity

Table S2.10 first examines our quarterly cross-sectional regression results (for stocks with more than 5 percent foreign ownership) separately for emerging and developed markets (except for the United States). Interestingly, the ownership return coefficient is highly significant in developed markets but not in emerging markets. The lack of statistical significance in emerging markets could simply be due to lack of power with the smaller sample, but the coefficient is much smaller as well. This result is opposite to theories such as Kodres and Pritsker (2002) which call for the effect to concentrate in emerging markets.

We also examine if the effect is greater for smaller stocks, or for those with less liquidity. Like most other tables, we require a minimum of trading on 30 percent of the days in the previous year. Surprisingly, the effect is greater in larger stocks. Similarly, when we sort our sample into those stocks with trading on more than 50 percent of the days in the previous year (and those with 30-50 percent of days traded), we find that our results are much more pronounced among more liquid stocks. This finding suggests that ownership returns are an important facet of international portfolio diversification for most investors.

Table S2.1: Cross-Sectional Regressions with Ownership Returns and Ownership Change

The table shows the results of Fama-MacBeth regressions of stock returns on an intercept (not reported), the foreign institutional ownership return (Ownership Return), the change in foreign ownership (Ownership Change), expected returns from a CAPM with local and world market index (Local Beta*Local Market and World Beta*World Market), and global industry index returns excluding the industry in the local market (Industry). The table shows results for stocks with alternative levels of foreign institutional ownership of 0%-1%, 1%-5%, and >5% (in Panel A) and foreign institutional ownership above 10% and 20% (in Panel B) using quarterly returns. The sample period is 01/01/2000-03/31/2009. The sample is limited to non-U.S. stocks with at least 30% non-zero trading days in the previous year. The table reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. Ownership data is from LionShares, and return data for individual stocks, market indices, and industry indices is from Datastream.

Panel A: Alternative Levels of Foreign Institutional Ownership

	0-1%						1%-5%						>=5%					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Ownership Return	0.217	0.217	0.132	0.203	0.197	0.090	0.259	0.257	0.272	0.361	0.376	0.223	0.710	0.705	0.553	0.653	0.591	0.395
	(5.40)	(5.39)	(2.94)	(4.27)	(5.28)	(2.43)	(6.29)	(6.23)	(4.60)	(5.06)	(5.26)	(3.54)	(7.11)	(7.15)	(5.14)	(6.17)	(6.83)	(4.76)
Ownership Change		1.781	2.316	2.371	1.762	2.150		1.315	1.140	1.279	1.124	1.028		0.451	0.500	0.515	0.427	0.455
		(5.35)	(2.77)	(2.79)	(5.69)	(2.65)		(6.77)	(4.52)	(5.69)	(6.50)	(4.45)		(9.78)	(6.82)	(6.81)	(9.68)	(6.66)
Local Beta*Local Market			0.726			0.795			0.763			0.792			0.731			0.764
			(9.81)			(10.1)			(11.0)			(11.0)			(14.6)			(15.3)
World Beta*World Market				-0.108		0.181				-0.408		-0.153				0.000		0.209
				(-0.23)		(0.40)				(-0.75)		(-0.35)				(-0.00)		(0.42)
Industry					0.325	0.235					0.303	0.270					0.505	0.399
					(6.52)	(4.98)					(5.81)	(8.23)					(13.0)	(10.0)
Average Adjusted R^2	0.006	0.009	0.067	0.020	0.024	0.091	0.006	0.009	0.098	0.029	0.037	0.126	0.015	0.020	0.094	0.039	0.052	0.137
Average Number of Firms per Quarter	2,020	2,020	1,091	1,091	2,015	1,091	3,627	3,627	1,226	1,226	1,606	1,226	1,981	1,981	1,524	1,524	1,979	1,524

Panel B: Foreign Institutional Ownership above 10% and 20%	>=10%		>=20%	
	(1)	(2)	(1)	(2)
Ownership Return	0.758	0.529	0.706	0.526
	(8.94)	(6.46)	(7.2)	(4.40)
Local Beta*Local Market		0.681		0.644
		(12.8)		(8.83)
World Beta*World Market		0.16		0.124
		(0.28)		(0.20)
Industry		0.435		0.449
		(9.97)		(8.54)
Adjusted R^2	0.016	0.131	0.013	0.132
Average Number of Firms	1,221	928	550	381

Table S2.2: Panel Regressions

Panel A shows the results of panel regressions, with standard errors clustered by firm and with quarter fixed effects, of stock returns on an intercept (not reported), the contemporaneous and lagged foreign institutional ownership return (Ownership Return), the change in foreign ownership (Ownership Change), expected returns from a CAPM with local and world market index (Local Beta*Local Market and World Beta*World Market), and global industry index returns excluding the industry in the local market (Industry). Panel B shows the results of panel estimations with firm and quarter fixed effects. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The sample period is 01/01/2000-03/31/2009. The table reports the coefficients, associated *t*-statistics, as well as the adjusted R^2 and the number of observations. Ownership data is from LionShares, and return data for individual stocks, market indices, and industry indices is from Datastream.

Panel A: Panel Regressions with Clustered Standard Errors and Quarter Fixed Effects

	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Ownership Return	0.801	(15.3)	0.559	(10.6)	0.353	(5.96)	0.732	(10.7)	0.705	(8.33)	0.768	(14.8)	0.313	(5.35)
Ownership Return (lagged)							-0.021	(-0.52)	-0.241	(-5.11)				
Ownership Return (lagged, avg. of 2, 3, 4)							0.236	(3.61)	0.249	(2.74)				
Ownership Change											0.409	(7.36)	0.455	(6.53)
Local Beta*Local Market					0.529	(20.0)			0.565	(21.6)			0.524	(19.9)
World Beta*World Market					0.035	(0.82)			0.044	(0.96)			0.029	(0.66)
Industry			0.542	(21.9)	0.489	(19.0)							0.483	(18.8)
Adjusted R^2	0.27		0.30		0.35		0.28		0.33		0.28		0.35	
Observations	37,154		37,154		30,120		36,479		29,939		37,154		30,120	

Panel B: Panel Regressions with Firm and Quarter Fixed Effects

	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Ownership Return	0.815	(17.3)	0.662	(14.2)	0.677	(12.6)	0.813	(17.0)	0.803	(14.8)	0.811	(17.3)	0.670	(12.6)
Ownership Return (lagged)							0.127	(2.68)	0.012	(0.23)				
Ownership Return (lagged, avg. of 2, 3, 4)							0.363	(6.07)	0.459	(6.06)				
Ownership Change											0.395	(11.6)	0.484	(12.4)
Local Beta*Local Market					0.555	(39.2)			0.581	(40.4)			0.550	(38.9)
World Beta*World Market					0.042	(1.88)			0.016	(0.69)			0.040	(1.77)
Industry			0.533	(32.1)	0.493	(27.6)							0.490	(27.5)
Adjusted R^2	0.30		0.32		0.38		0.30		0.36		0.30		0.38	
Observations	37,154		37,154		30,120		36,479		29,939		37,154		30,120	

Table S2.3: Ownership Return and Non-Ownership Return with Simulation

The table shows results from the following simulation exercises. In simulation exercise 1 (Panel A), for each stock held by a foreign investor, we randomly draw another stock from the same country, industry, and size bin that is not held by any of the stock's shareholders. We then create a non-ownership return. This non-ownership return is added to an artificial data set that also includes the original ownership returns and other control variables. We create 200 such datasets based on alternative random draws of non-ownership returns. We then estimate the following univariate regression: R_i = a + b*R_nonown_i + c*R_own_i + e_i. We generate regression coefficients for each of the datasets to obtain an empirical distribution of regression statistics. Size groups are defined using cut off points among U.S. stocks. Non-ownership linked firms must have market cap greater than 100 million. In simulation exercise 2 (Panel B), we conduct a bootstrap. For each stock, we have the Ownership Return (R_own_i) and the Non-Ownership Return (R_nonown_i) based on the value-weighted mean returns of the largest non-owned stock in the same industry and country as the linked stocks. For each quarter we run a cross-sectional regression of the stock return (R_i) on the Ownership Return and the Non-Ownership Return: (1) R_i = a + b*R_nonown_i + c*R_own_i + e_i. We keep the parameter estimates for a, b, and c, as well as the residuals. We take the time-series average of a, b, and c to get the Fama-MacBeth estimates and associated standard errors (corrected with Newey West (1987)). Under the null hypothesis, the ownership linkage is not a driver of stock returns. Therefore, we set the coefficient c estimated in (1) to zero, i.e. c=0. Subsequently, we perform the following steps 1,000 times: For each firm in each quarter, we take a random draw (with replacement) from the residuals for that quarter. We impose the null hypothesis and create returns for each firm and quarter by multiplying the estimated coefficients (b and c, with c set to zero) with the Non-Ownership Return and the Ownership Return and adding the intercept, a, as well as the residual (from the prior step). Using these constructed return series instead of the actual returns, we estimate regression (1) for each quarter. We take the time-series average of a, b, and c to get the Fama-MacBeth estimates and associated standard errors (corrected with Newey West (1987)). From each of the 1,000 iterations we obtain a time-series average of a, b ,and c, as well as associated *t*-statistics/standard errors, which yield an empirical distribution. We calculate *p*-values as the proportion of *t*-statistics that are greater than the *t*-statistic from the original Fama-MacBeth regression.

Panel A: Simulation exercise 1

	Mean Coef.	Min Coef.	Min Coef.	Iterations
Non-Ownership Return	0.003	0.0018	0.061	200

Panel B: Simulation exercise 2

	Coef.	*p*-value	Iterations
Ownership Return	0.850	0.00	1,000
Non-Ownership Return	-0.086	0.40	1,000

Table S2.4: Alternative Explanations

The table shows the results of Fama-MacBeth regressions of quarterly stock returns on various ownership variables and control variables. It shows results with an intercept (not reported), the owners' home market return (Owners' Home Market Return), returns on the multilateral exchange rate index of the country of incorporation (Foreign Exchange Return), the interaction between the percentage of foreign sales and the ownership return (Foreign Sales*Ownership Return), investment style returns (Style Return), the foreign institutional ownership return (Ownership Return), the change in foreign ownership (Ownership Change), expected returns from a CAPM with local and world market index (Local Beta*Local Market and World Beta*World Market), and global industry index returns excluding the industry in the local market (Industry). The owners' home market return is a weighted average of the home market index returns where the owners are incorporated; the weights are based on the relative size of the funds' holdings of the stock. Foreign exchange returns are the returns on a trade-weighted currency index for the country in which the stock is incorporated. The currency index is in terms of the local currency relative to a trade-weighted basket of foreign currencies. In the LionShares database each fund is classified as one of the following styles: Aggressive, Deep Value, GARP, Growth, Index, Value, or Yield. To construct style returns, we first create fund style returns in each quarter by computing the value weighted return of its holdings. We then construct style index returns as the value-weighted average return of all funds in each style. Then, for each stock, we construct its stock specific style return as the holdings-weighted average of the returns of the styles into which its owners are classified. In Panel A the sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. Panel B shows subsample results around liquidity and coverage. In Panel B the sample consists of non-U.S. stocks with more than 30%, more than 50%, or more than 75% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. Columns 1 to 6 show the results for weekly regressions, while columns 7 to 15 show the results for quarterly regressions. Columns 13 and 14 of Panel B shows results for non-U.S. stocks with at least 30% non-zero trading days in the previous year, at least 5% lagged foreign institutional ownership, and from countries where there are more than 500 firm-quarters or the top 20 countries with the highest country-aggregate foreign ownership level. Column 15 shows results for a sample where we only include institutions that report their holdings on a quarterly basis. The sample period is 01/01/2000-03/31/2009. The table reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with three lags.

(continued)

Table S2.4: Alternative Explanations (continued)

Panel A: Additional Control Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Owners' Home Market Return	0.319	0.039										0.039
	(3.40)	(0.51)										(0.55)
Foreign Exchange Return			0.026	0.015								-0.083
			(0.24)	(0.31)								(-1.15)
Style Return					2.474	0.826						0.997
					(6.14)	(3.12)						(2.96)
Foreign Sales*Ownership Return							0.571	0.177				0.179
							(4.34)	(1.84)				(2.08)
Ownership Return		0.372		0.409		0.373		0.382			0.395	0.323
		(4.54)		(4.73)		(5.04)		(4.17)			(4.76)	(3.18)
Ownership Change		0.460		0.459		0.458		0.624			0.455	0.636
		(6.76)		(6.80)		(7.01)		(6.35)			(6.66)	(6.82)
Local Beta*Local Market		0.763		0.751		0.759		0.748	0.802	0.785	0.764	0.717
		(15.72)		(15.42)		(16.05)		(13.04)	(15.93)	(14.96)	(15.30)	(11.97)
World Beta*World Market		0.190		0.206		0.205		0.142	0.160	0.179	0.209	0.117
		(0.38)		(0.42)		(0.40)		(0.31)	(0.23)	(0.35)	(0.42)	(0.25)
Industry		0.397		0.407		0.389		0.380		0.411	0.399	0.385
		(10.28)		(10.39)		(9.97)		(10.74)		(9.55)	(10.00)	(11.34)
Adjusted R^2	0.004	0.138	0.010	0.139	0.011	0.139	0.013	0.146	0.109	0.126	0.137	0.152
Average Number of Firms per Quarter	2,072	1,607	2,056	1,595	2,066	1,606	1,420	1,136	1,611	1,611	1,607	1,131

(continued)

Table S2.4: Alternative Explanations (continued)

Panel B: Liquidity and Coverage

	Weekly Regression					
	Percent of Trading Days					
	>30%	>30%	> 50%	>50%	>75%	>75%
Ownership Ret	0.224	0.215	0.241	0.231	0.259	0.248
	(13.56)	(12.63)	(13.38)	(12.25)	(14.00)	(12.41)
Ownership Ret		0.097		0.096		0.097
(lag)		(5.64)		(5.28)		(4.92)
Ownership Ret		0.080		0.084		0.078
(lag avg. of 2, 3, 4)		(2.54)		(2.45)		(2.09)
Loc Beta*Loc Mkt	0.784	0.782	0.788	0.786	0.801	0.798
	(81.32)	(82.22)	(83.57)	(84.10)	(86.51)	(87.45)
Wld Beta*Wld Mkt	1.354	1.347	1.363	1.337	1.374	1.341
	(2.33)	(2.39)	(2.18)	(2.23)	(2.15)	(2.20)
Industry	0.256	0.255	0.257	0.255	0.264	0.264
	(25.39)	(25.68)	(25.81)	(25.81)	(27.65)	(27.59)
Adjusted R^2	0.105	0.108	0.110	0.113	0.122	0.124
Avg. No. of Firms	2,159	2,150	2,090	2,083	1,882	1,877

(continued)

Quarterly Regression

	Percent of Trading Days							
	>30%	> 50%	>50%	>75%	>75%	No Obs > 500	Top 20 cty	Qtr obs only
Ownership Ret	0.358	0.395	0.352	0.464	0.366	0.227	0.290	0.407
	(3.71)	(4.76)	(3.51)	(5.83)	(3.70)	(3.56)	(2.99)	(5.14)
Ownership Ret	-0.069		-0.065		-0.029			
(lag)	(-1.01)		(-1.00)		(-0.59)			
Ownership Ret	0.376		0.418		0.412			
(lag avg. of 2, 3, 4)	(3.07)		(3.51)		(3.01)			
Loc Beta*Loc Mkt	0.746	0.768	0.748	0.770	0.749	0.790	0.636	0.770
	(15.27)	(15.56)	(15.38)	(15.59)	(15.67)	(9.87)	(8.72)	(15.51)
Wld Beta*Wld Mkt	0.223	0.204	0.223	0.133	0.161	-0.149	-0.374	0.185
	(0.47)	(0.42)	(0.48)	(0.27)	(0.34)	(-0.33)	(-0.74)	(0.37)
Industry	0.408	0.399	0.406	0.390	0.399	0.278	0.332	0.402
	(10.21)	(9.72)	(10.40)	(8.84)	(9.71)	(8.07)	(5.46)	(9.64)
Adjusted R^2	0.138	0.134	0.141	0.145	0.150	0.120	0.095	0.133
Avg. No. of Firms	1,441	1,580	1,420	1,470	1,331	1,279	343	1,588

Table S2.5: Sorting Results for Wealth Effect

The table shows sorting results for the wealth effect. For each stock, we sort each stock's institutional owners into five quintiles according to the institutions' average holding returns. In each quintile we report the average change of holdings of the stock by the institutions in the current and over the next four quarters. Panel A shows results for the average change of holdings by the institutions. Panel B shows results for the relative average change of holdings by the institutions as a percentage of the average level of holdings of stocks held by institutions within the quintile. The sample period is 01/01/2000-03/31/2009. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. Ownership data is from LionShares, and return data for individual stocks is from Datastream.

Panel A: Change of Holdings

	Average Return (x100)	Change of holdings at t (x10000)	at t+1 (x10000)	at t+2 (x10000)	at t+3 (x10000)	at t+4 (x10000)
1 (Low)	-3.952	23.917	-24.571	-20.942	-16.484	-13.086
		(4.060)	(-3.847)	(-3.881)	(-3.104)	(-2.846)
2	-1.465	19.699	-23.286	-18.488	-16.020	-12.875
		(3.344)	(-3.645)	(-3.427)	(-3.017)	(-2.800)
3	-0.276	16.538	-22.809	-18.770	-17.653	-14.061
		(2.808)	(-3.571)	(-3.479)	(-3.324)	(-3.058)
4	1.083	18.649	-24.400	-18.566	-17.433	-14.545
		(3.166)	(-3.820)	(-3.441)	(-3.283)	(-3.163)
5 (High)	4.033	26.981	-24.099	-16.675	-13.349	-15.299
		(4.581)	(-3.773)	(-3.091)	(-2.514)	(-3.327)
High-Low		3.064	0.472	4.267	3.135	-2.213
		(0.520)	(0.074)	(0.791)	(0.590)	(-0.481)

Panel B: Change of Holdings Relative to Average Level of Holdings within Quintile

	Average Return (x100)	Relative Change of Holdings at t	at t+1	at t+2	at t+3	at t+4
1 (Low)	-3.952	0.924	-0.199	-0.110	-0.151	-0.103
		(3.185)	(-5.963)	(-2.621)	(-4.169)	(-2.234)
2	-1.465	0.106	-0.192	-0.178	-0.163	-0.162
		(0.365)	(-5.749)	(-4.242)	(-4.504)	(-3.498)
3	-0.276	0.123	-0.202	-0.182	-0.174	-0.154
		(0.423)	(-6.053)	(-4.328)	(-4.811)	(-3.324)
4	1.083	0.091	-0.189	-0.179	-0.172	-0.140
		(0.312)	(-5.661)	(-4.259)	(-4.745)	(-3.030)
5 (High)	4.033	0.477	-0.160	-0.145	-0.146	-0.128
		(1.643)	(-4.787)	(-3.456)	(-4.027)	(-2.769)
High-Low		-0.447	0.039	-0.035	0.005	-0.025
		(-1.542)	(1.176)	(-0.835)	(0.142)	(-0.535)

Table S2.6: Asymmetries in Ownership Returns

Panel A of the table shows the results of Fama-MacBeth regressions of quarterly stock returns on an intercept (not reported), the foreign institutional ownership return (Ownership Return), dummy variables for the stocks with the lowest 20% (or alternatively 5%) Ownership Returns, dummy variables for the stocks with the lowest 20% (or alternatively 5%) outflows interacted with the Ownership Return as explained below, the change in foreign ownership (Ownership Change), expected returns from a CAPM with local and world market index (Local Beta*Local Market and World Beta*World Market), and global industry index returns excluding the industry in the local market (Industry). To construct firm-level outflows, we track investors' outflows by institution and compute an aggregate measure of outflows across all institutional investors in a given stock. We then create a dummy variable for whether a stock's institutional investors are in the bottom 20% (or alternatively 5%) percentile aggregate outflows and create a dummy variable interaction term with the ownership return. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The sample period is 01/01/2000-03/31/2009. The table reports the average coefficients, associated t-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. Panel B table shows the results of time-series regressions of stock returns on an intercept (not reported), the local market index excluding own stock (Local Market), negative observations of the local market index excluding own stock (Local Market (negative)), the foreign institutional ownership return (Ownership Return), and negative observations of the foreign institutional ownership return (Ownership Return (negative)). The sample is limited to non-U.S. stocks with foreign ownership above 5% in the beginning of 3 year periods. Results are shown for the subperiods 01/01/2001-12/31/2002, 01/01/2003-12/31/2005 and 01/01/2006-03/31/2009. The regression models are as follows:

$$(1)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \delta_j R_{Ownership,t} + \varepsilon_{jt}$$

$$(2)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \delta_j R_{Ownership,t} + \phi_j R_{OwnershipNegative,t} + \varepsilon_{jt}$$

$$(3)\, R_{jt} = \alpha_j + \beta_j R_{LocalMarket,t} + \chi_j R_{LocalMarketNegative,t} + \delta_j R_{Ownership,t} + \phi_j R_{OwnershipNegative,t} + \varepsilon_{jt}$$

The table reports the mean and median coefficients and adjusted R^2s, as well as the number of firms. The panel also shows the average Mean Squared Error (MSE) following Bekaert, Hodrick and Zhang (2009) for models (1) and (2), as well as the difference in the MSE. Tests of significance of differences in MSE are based on bootstrapped standard errors using 1,000 randomly drawn samples with replacement. Ownership data is from LionShares, while data on returns for individual stocks, market indices, and industry indices is from Datastream.

(continued)

Table S2.6: Asymmetries in Ownership Returns (continued)

Panel A: Cross-sectional Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ownership Return	0.694	0.372	0.765	0.410	0.691	0.352	0.690	0.388
	(7.22)	(4.39)	(7.21)	(5.06)	(6.09)	(3.72)	(6.63)	(4.56)
Lowest 20% Ownership Return	-0.154	-0.066						
	(-1.42)	(-0.52)						
Lowest 5% Ownership Return			-0.144	0.870				
			(-0.60)	(1.75)				
Lowest 20% flows * Ownership Return					0.014	0.108		
					(0.18)	(1.43)		
Lowest 5% flows * Ownership Return							0.061	0.080
							(0.94)	(1.22)
Ownership Change		0.453		0.458		0.452		0.457
		(6.52)		(6.68)		(6.42)		(6.48)
Local Beta*Local Market		0.762		0.763		0.763		0.765
		(15.28)		(15.25)		(15.20)		(15.30)
World Beta*World Market		0.220		0.213		0.212		0.204
		(0.43)		(0.42)		(0.42)		(0.41)
Industry		0.399		0.400		0.399		0.400
		(10.00)		(10.06)		(10.00)		(9.98)
Average Adjusted R^2	0.017	0.137	0.016	0.137	0.017	0.138	0.016	0.137
Average Number of Firms per Quarter	2,088	1,607	2,088	1,607	2,088	1,607	2,088	1,607

(continued)

Table S2.6: Asymmetries in Ownership Returns (continued)

Panel B: Time-series Regressions

		2001Q1-2002Q4			2003Q1-2005Q4			2006Q1-2009Q1		
		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Local Market	Mean	0.60	0.60	0.61	0.78	0.77	0.72	0.82	0.82	0.82
	Median	0.56	0.55	0.56	0.76	0.76	0.70	0.80	0.80	0.80
Local Market (negative)	Mean			-0.03			0.13			-0.01
	Median			0.00			0.08			0.01
Ownership Return	Mean	0.31	0.21	0.20	0.21	0.17	0.19	0.21	0.21	0.20
	Median	0.21	0.15	0.14	0.13	0.12	0.14	0.14	0.14	0.11
Ownership Return (negative)	Mean		0.20	0.22		0.11	0.04		-0.003	0.02
	Median		0.18	0.19		0.09	0.03		0.003	0.01
Adjusted R^2	Mean	0.18	0.18	0.19	0.35	0.23	0.23	0.35	0.35	0.36
	Median	0.14	0.14	0.14	0.35	0.20	0.21	0.35	0.36	0.36
Number of Firms		233	233	233	3,126	1,408	1,408	3,126	3,126	2,316

	Regression #	MSE
Incremental Contribution of Negative Ownership Return		
Base Model	(1)	0.026
Base Model with Negative Ownership Return	(2)	0.025
Difference		*0.002*
p-value		*<.0001*

Table S2.7: Equally-Weighted World Market Betas and Explanatory Power of Ownership Portfolios

The table shows regression results using portfolios of stocks with different degree of foreign institutional ownership. In particular, stocks with at least 30% non-zero trading days in the previous year are sorted into 4 portfolios, depending on whether lagged foreign institutional ownership is equal to 0%, between 0% and 1%, between 1% and 5%, or larger than 5%. Equally-weighted portfolios of weekly USD returns are formed by foreign institutional ownership, country, and date, requiring at least 10 stocks per country and ownership group on a given date. Moreover, for a given window of weekly observations within rolling 24 months, non-missing observations in each of the four ownership groups are required for each day and country, each country/ownership portfolio has to have at least 30 weekly observations, and there have to be non-missing observations for each ownership group for at least 5 countries. We also form a High-Low ownership portfolio as the difference between the returns of the high foreign ownership portfolio and the low foreign ownership portfolio for each country. For a given window of weekly observations within rolling 24 months, the returns of these portfolios are regressed on an intercept (not reported) and the USD returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_j R_{WorldMarket,t} + \varepsilon_{jt}$. Results across countries are aggregated using equal weights. The table shows the average world market beta estimates and R^2s for the respective portfolio, as well as the t-statistics of tests that the average world market beta and R^2, respectively, of the high minus low ownership portfolio is different from zero. T-statistics are corrected for autocorrelation and heteroskedasticity with the Newey-West (1987) procedure with 3 lags. Panel A shows results for Developed Countries, while Panel B shows results for Emerging Markets (based on the MSCI classification as of June 2006). The sample period is 01/01/2000-03/31/2009. Ownership data is from LionShares, while data on returns for individual stocks and the world market index is from Datastream.

Panel A: Developed Countries

	World Market Beta						R^2					
	0%	0%-1%	1%-5%	>5%	High-Low	t-stat	0%	0%-1%	1%-5%	>5%	High-Low	t-stat
Australia	0.75	0.80	0.88	1.06	0.31	7.3	0.26	0.28	0.31	0.33	0.12	5.32
Canada	0.84	0.94	1.01	1.11	0.27	11.1	0.24	0.34	0.38	0.47	0.11	8.90
Denmark	0.59	0.69	0.97	1.31	0.72	14.1	0.29	0.34	0.44	0.68	0.41	19.7
France	0.46	0.57	0.77	1.03	0.57	20.7	0.20	0.29	0.38	0.58	0.46	13.5
Germany	0.57	0.63	0.95	1.16	0.59	19.5	0.24	0.33	0.43	0.59	0.34	9.48
Hong Kong	0.66	0.73	0.83	0.98	0.32	13.9	0.21	0.30	0.37	0.50	0.12	6.02
Italy	0.68	0.47	0.64	0.61	-0.07	-3.28	0.09	0.13	0.20	0.23	0.00	2.70
Japan	0.42	0.54	0.63	0.73	0.31	20.7	0.10	0.15	0.22	0.30	0.18	6.99
Norway	0.82	0.87	0.97	1.17	0.35	6.62	0.23	0.28	0.33	0.41	0.14	4.18
Singapore	1.13	0.95	0.93	1.02	-0.11	-2.06	0.31	0.32	0.36	0.45	0.02	3.99
Sweden	0.95	0.98	1.19	1.22	0.27	19.9	0.39	0.44	0.50	0.60	0.08	11.5
Switzerland	0.39	0.44	0.63	0.85	0.46	10.4	0.08	0.17	0.21	0.36	0.17	6.80
United Kingdom	0.50	0.56	0.71	0.93	0.43	19.0	0.21	0.30	0.39	0.55	0.28	9.33
United States	0.63	1.03	1.22	1.20	0.58	31.4	0.48	0.72	0.79	0.78	0.39	18.4
Developed	**0.64**	**0.73**	**0.89**	**1.04**	**0.40**	**49.5**	**0.25**	**0.33**	**0.40**	**0.51**	**0.23**	**14.9**
Developed ex US	**0.64**	**0.70**	**0.86**	**1.02**	**0.38**	**40.9**	**0.22**	**0.29**	**0.36**	**0.48**	**0.21**	**12.8**

(continued)

Table S2.7: Equally-Weighted World Market Betas and Explanatory Power of Ownership Portfolios (continued)

Panel B: Emerging Markets

	World Market Beta						R^2					
	0%	0%-1%	1%-5%	>5%	High-Low	t-stat	0%	0%-1%	1%-5%	>5%	High-Low	t-stat
China	0.26	0.44	0.55	1.01	0.75	24.7	0.01	0.04	0.08	0.35	0.16	7.97
India	1.38	1.31	1.40	1.33	-0.05	-1.02	0.24	0.26	0.30	0.35	0.02	4.15
Korea	0.88	0.96	1.07	1.11	0.23	7.30	0.22	0.24	0.26	0.34	0.11	4.88
Malaysia	0.52	0.57	0.65	0.65	0.13	7.92	0.17	0.19	0.23	0.25	0.06	3.82
Poland	1.26	1.08	1.18	1.20	-0.06	-1.35	0.32	0.29	0.35	0.35	0.03	4.75
South Africa	0.62	0.71	0.94	1.11	0.49	12.5	0.21	0.25	0.32	0.35	0.15	6.23
Thailand	0.55	0.53	0.61	0.73	0.18	12.9	0.36	0.30	0.30	0.39	0.11	7.11
Emerging	**0.74**	**0.76**	**0.90**	**0.95**	**0.21**	**13.0**	**0.18**	**0.19**	**0.24**	**0.28**	**0.07**	**6.66**
All countries	**0.67**	**0.74**	**0.89**	**1.02**	**0.35**	**36.7**	**0.23**	**0.29**	**0.35**	**0.45**	**0.18**	**15.2**

Table S2.8: Value-Weighted World Market Betas and Explanatory Power of Ownership Portfolios

The table shows rolling regression results using portfolios of stocks with different degree of institutional ownership. In particular, stocks with at least 30% non-zero trading days in the previous year are sorted into 4 portfolios, depending on whether lagged foreign institutional ownership is equal to 0%, between 0% and 1%, between 1% and 5%, or larger than 5%. Value-weighted portfolios of weekly USD returns are formed by foreign institutional ownership, country, and date, requiring at least 10 stocks per country and ownership group on a given date. Moreover, for a given window of weekly observations within rolling 24 months, non-missing observations in each of the four ownership groups are required for each day and country, each country/ownership portfolio has to have at least 30 weekly observations, and there have to be non-missing observations for each ownership group for at least 5 countries. We also form a High-Low ownership portfolio as the difference between the returns of the high foreign ownership portfolio and the low foreign ownership portfolio for each country. For a given window of weekly observations within rolling 24 months, the returns of these portfolios are regressed on an intercept (not reported) and the USD returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_j R_{WorldMarket,t} + \varepsilon_{jt}$. Results across countries are aggregated using lagged USD country market capitalization as weights. The table shows the world average market beta estimates and R^2s for the respective portfolio, as well as the t-statistics of tests that the average world market beta and R^2, respectively, of the high minus low ownership portfolio is different from zero. T-statistics are corrected for autocorrelation and heteroskedasticity with the Newey-West (1987) procedure with 3 lags. Panel A shows results for Developed Countries, while Panel B shows results for Emerging Markets (based on the MSCI classification as of June 2006). The sample period is 01/01/2000-03/31/2009. Ownership data is from LionShares, while data on returns for individual stocks and the world market index is from Datastream.

Panel A: Developed Markets

	World Market Beta						R^2					
	0%	0%-1%	1%-5%	>5%	High-Low	t-stat	0%	0%-1%	1%-5%	>5%	High-Low	t-stat
Australia	0.72	0.67	0.84	0.99	0.27	11.5	0.24	0.27	0.35	0.40	0.08	4.21
Canada	0.86	0.76	0.81	1.00	0.14	7.94	0.32	0.45	0.45	0.59	0.04	4.27
Denmark	0.56	0.93	1.03	1.31	0.75	10.6	0.27	0.35	0.53	0.64	0.34	17.5
France	0.41	0.54	1.03	1.17	0.76	19.9	0.16	0.31	0.46	0.67	0.38	10.7
Germany	0.22	0.50	1.09	1.37	1.15	17.6	0.12	0.29	0.50	0.71	0.55	18.2
Hong Kong	0.62	0.85	0.84	1.19	0.57	12.4	0.19	0.25	0.45	0.58	0.18	10.1
Italy	0.66	0.51	0.71	0.66	0.00	-0.03	0.13	0.13	0.25	0.23	0.01	2.48
Japan	0.42	0.54	0.71	0.87	0.45	22.8	0.11	0.17	0.28	0.39	0.22	6.96
Norway	0.72	0.81	1.09	1.13	0.41	5.83	0.21	0.28	0.38	0.35	0.13	4.50
Singapore	1.12	0.83	1.01	0.97	-0.15	-3.82	0.29	0.30	0.34	0.45	0.01	4.04
Sweden	0.96	1.00	1.22	1.44	0.48	7.94	0.40	0.45	0.51	0.64	0.23	6.80
Switzerland	0.24	0.37	0.89	1.48	1.24	13.9	0.05	0.11	0.27	0.49	0.41	12.1
United Kingdom	0.51	0.73	0.95	1.01	0.49	14.1	0.24	0.42	0.57	0.64	0.26	8.06
United States	0.62	1.07	1.00	1.00	0.39	15.2	0.57	0.76	0.85	0.82	0.25	9.11
Developed	**0.56**	**0.86**	**0.95**	**1.03**	**0.47**	**23.0**	**0.39**	**0.55**	**0.65**	**0.69**	**0.26**	**10.9**
Developed ex US	**0.49**	**0.62**	**0.89**	**1.06**	**0.57**	**31.7**	**0.18**	**0.30**	**0.42**	**0.54**	**0.27**	**12.4**

(continued)

Table S2.8: Value-Weighted World Market Betas and Explanatory Power of Ownership Portfolios (continued)

Panel B: Emerging Markets

	World Market Beta						R^2					
	0%	0%-1%	1%-5%	>5%	High-Low	t-stat	0%	0%-1%	1%-5%	>5%	High-Low	t-stat
China	0.24	0.43	0.67	0.54	0.30	10.0	0.01	0.04	0.13	0.06	0.03	5.13
India	1.38	1.40	1.42	1.37	-0.01	-0.32	0.25	0.29	0.33	0.40	0.01	4.57
Korea	0.93	1.13	1.14	1.18	0.25	4.32	0.24	0.24	0.30	0.40	0.05	5.43
Malaysia	0.56	0.49	0.59	0.63	0.07	3.71	0.18	0.22	0.28	0.26	0.03	3.17
Poland	1.21	0.95	1.16	1.42	0.21	2.51	0.25	0.31	0.35	0.36	0.06	3.08
South Africa	0.63	0.78	0.99	1.15	0.52	9.13	0.21	0.26	0.29	0.34	0.16	6.18
Thailand	0.56	0.58	0.71	0.96	0.40	26.8	0.34	0.26	0.30	0.41	0.19	15.2
Emerging	**0.80**	**0.87**	**0.94**	**1.00**	**0.20**	**8.38**	**0.19**	**0.21**	**0.25**	**0.29**	**0.05**	**7.86**
All countries	**0.57**	**0.86**	**0.96**	**1.04**	**0.46**	**23.0**	**0.38**	**0.54**	**0.64**	**0.68**	**0.25**	**10.9**

Table S2.9: Portfolio Sorts

The table shows the stock return performance and change in ownership of stocks as a function of their ownership return. Stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership are sorted into high and low ownership return groups depending on whether their foreign ownership return in the period is above 2.5% (5%, 7.5%) ("High") or below -2.5% (-5%, -7.5%) ("Low"). For stocks in each group, we calculate the average change in ownership (ownership at end of quarter minus ownership at beginning of quarter), the average USD return, and the average USD return in excess of the local market index excluding the respective stock. Each ownership return portfolio is required to have at least 10 stocks on a given date. We also form a High-Low portfolio as the difference between the values for the high foreign ownership return portfolio and the low foreign ownership return portfolio (requiring at least 10 observations in each portfolio). The table reports the time-series average (Mean), corresponding t-statistic (t-stat), and number of observations (N) of the USD returns and change in foreign ownership. T-statistics are corrected for autocorrelation and heteroskedasticity with the Newey-West (1987) procedure with 3 lags. Results for the USD returns of the high and the low foreign ownership return portfolios are based on USD returns in excess of the local market index excluding the respective stock, while results for the High-Low foreign ownership return portfolio are based on raw USD returns. The sample period is 01/01/2000-03/31/2009. Ownership data is from LionShares, while data on returns for individual stocks and market indices is from Datastream.

		Returns (USD)			**Change in Foreign Ownership**		
Ownership Return		Mean	t-stat	N	Mean	t-stat	N
>2.5%	High	0.033	(2.10)	23	-0.0027	(-1.57)	23
<-2.5%	Low	-0.021	(-1.58)	22	-0.0054	(-3.14)	22
	High-Low	0.059	(2.55)	17	0.0025	(1.17)	17
>5%	High	0.030	(1.37)	17	-0.0008	(-0.59)	17
<-5%	Low	-0.029	(-1.75)	18	-0.0065	(-3.60)	18
	High-Low	0.069	(1.43)	10	0.0079	(2.79)	10
>7.5%	High	0.031	(1.00)	12	-0.0028	(-2.91)	12
<-7.5%	Low	-0.021	(-0.97)	16	-0.0101	(-5.92)	16
	High-Low	0.120	(1.85)	6	0.0083	(2.31)	6

Table S2.10: Illiquid and Emerging Market Stocks

The table shows the results of Fama-MacBeth regressions of stock returns on an intercept (not reported), the foreign institutional ownership return (Ownership Return), the change in foreign ownership (Ownership Change), expected returns from a CAPM with local and world market index (Local Beta*Local Market and World Beta*World Market), and global industry index returns excluding the industry in the local market (Industry). The table shows results for the full sample (All), as well as results broken down by degree of market development (Emerging, Developed), market capitalization size (Small, Medium, Large), and trading activity (High, Medium, Low). Stocks are classified into emerging and developed markets based on the MSCI classification as of June 2006. Stocks are classified into market capitalization buckets on the basis of lagged market capitalization in U.S. dollars, where small is the bottom 40%, medium is the next 30%, and large is the top 40%. Stocks are classified according to trading activity on the basis of the number of trading days in the prior year as liquid (stocks with more trading days, i.e. top half) or illiquid (stocks with few trading days, i.e. bottom half). The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The sample period is 01/01/2000-03/31/2009. The table reports the average coefficients, associated *t*-statistics, as well as the average adjusted R^2. Standard errors are corrected with the Newey-West (1987) procedure with 3 lags. Ownership data and information on investment styles is from LionShares, while data on returns for individual stocks, market indices, and industry indices is from Datastream.

		Market Development		Market Capitalization			Trading	
	All	Emerging	Developed	Small	Medium	Large	Illiquid	Liquid
Ownership Return	0.395	0.150	0.436	0.115	0.334	0.413	0.184	0.629
	(4.76)	(1.26)	(4.44)	(0.66)	(3.38)	(4.24)	(2.19)	(6.78)
Ownership Change	0.455	0.457	0.463	0.579	0.504	0.536	0.325	0.588
	(6.66)	(4.21)	(5.96)	(2.45)	(4.73)	(5.28)	(4.04)	(5.80)
Local Beta*Local Market	0.764	0.813	0.676	0.761	0.779	0.783	0.693	0.785
	(15.3)	(21.3)	(8.32)	(5.94)	(14.2)	(20.6)	(10.5)	(15.5)
World Beta*World Market	0.209	-0.634	0.245	0.270	0.160	0.168	0.397	-0.009
	(0.42)	(-1.56)	(0.47)	(0.53)	(0.30)	(0.31)	(0.71)	(-0.02)
Industry	0.399	0.471	0.398	0.658	0.285	0.394	0.442	0.386
	(10.0)	(5.88)	(9.92)	(5.13)	(5.47)	(8.75)	(8.16)	(10.06)
Average Adjusted R^2	0.137	0.221	0.113	0.081	0.130	0.188	0.098	0.172
Average Number of Firms per Quarter	1,607	272	1,335	192	427	988	706	901

Figure S2.1: Ownership Returns Coefficient over the Quarter

This figure documents the ownership returns coefficient over the quarter. A cross-sectional regression is run where weekly stock returns are regressed on foreign ownership returns. The regression is rerun every week at the beginning of each week and then subsequent weeks over the quarter. We average such coefficients from the weekly regressions across the weeks that arethe same number of weeks away from previous quarter end. The x-axis shows the number of weeks from the previous quarter end (from 1 to 14). The y-axis shows the ownership return coefficients over the 14 weeks within each quarter. The sample period is 01/01/2000-03/31/2009. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership.

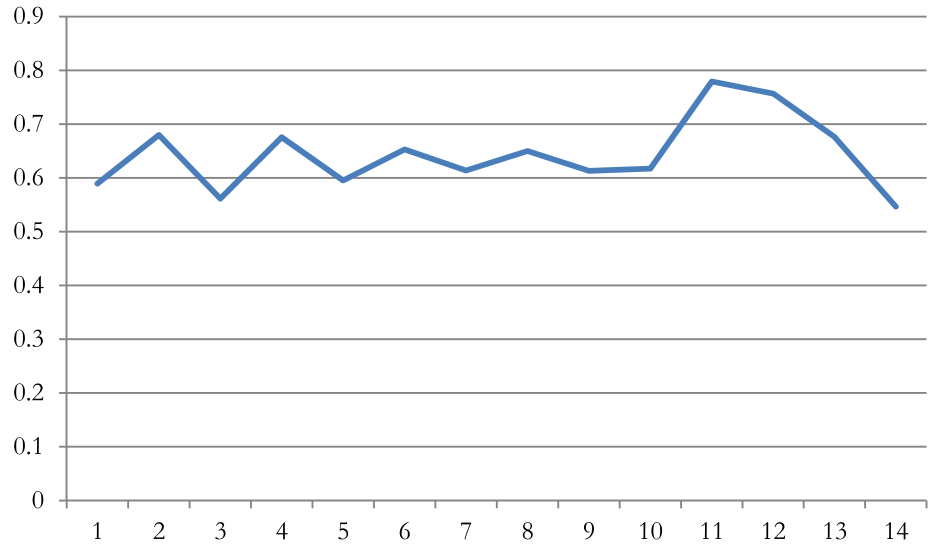
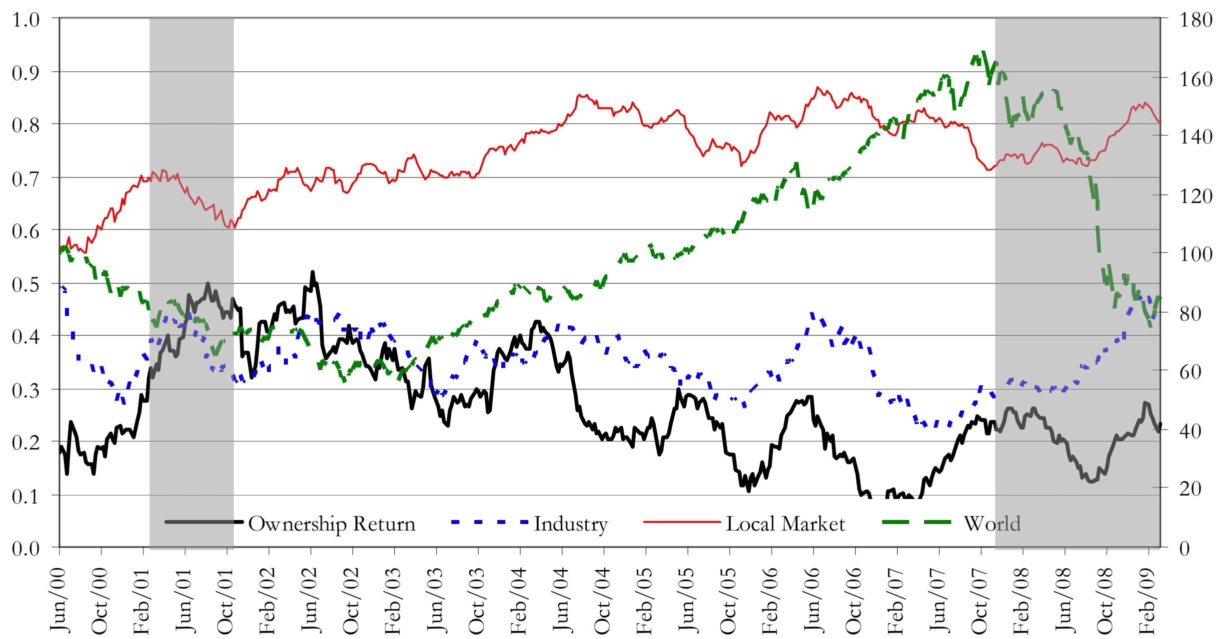


Figure S2.2: Foreign Ownership Regression Coefficients over Time

The figure shows the average coefficients of Fama-MacBeth cross-sectional regressions. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year as well as at least 5% lagged foreign institutional ownership. The sample period is 01/01/2000-03/31/2009. Each week (Panel A) or quarter (Panels B and C), a cross sectional regression is run over all firms in the sample. We then take the rolling average of these coefficients in the regressions over the past 26 weeks (7 quarters). The figure shows the moving average. Shaded areas are NBER recession periods. In Panel A stock returns are regressed on an intercept (not reported), the foreign institutional ownership return (Ownership Return), global industry index returns excluding the industry in the local market (Industry), local market index returns (Local Market) and world market index returns (World). In Panel B stock returns are regressed on an intercept (not reported), the foreign institutional ownership return (RtO_F), and global industry index returns excluding the industry in the local market (Industry ex loc). In Panel C stock returns are regressed on an intercept (not reported), the foreign institutional ownership return (RtO_F), global industry index returns excluding the industry in the local market (Industry ex loc) and local market index returns (Local). Ownership data is from LionShares, while data on returns for individual stocks, market indices and industry indices is from Datastream. Data on recession periods is from the NBER (http://www.nber.org/cycles/main.html).

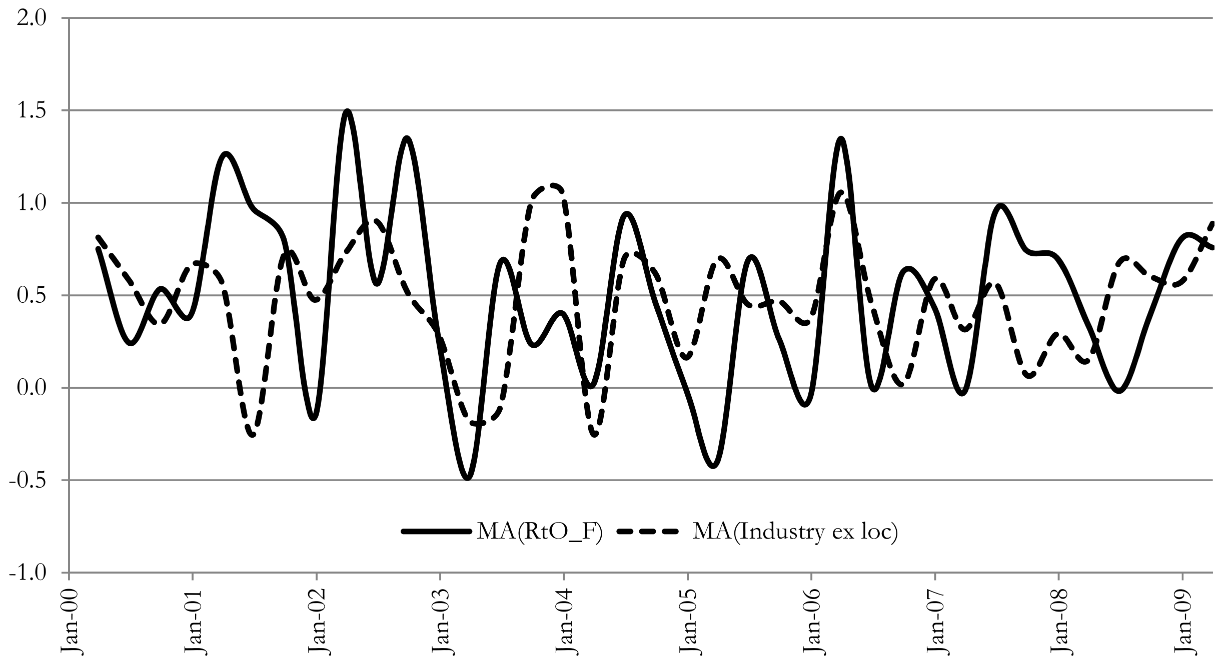
Panel A: Model with Weekly Data and Local Market



(continued)

Figure S2.2: Foreign Ownership Regression Coefficients over Time (continued)

Panel B: Model with Quarterly Data without Local Market Index



Panel C: Model with Quarterly Data and Local Market Index

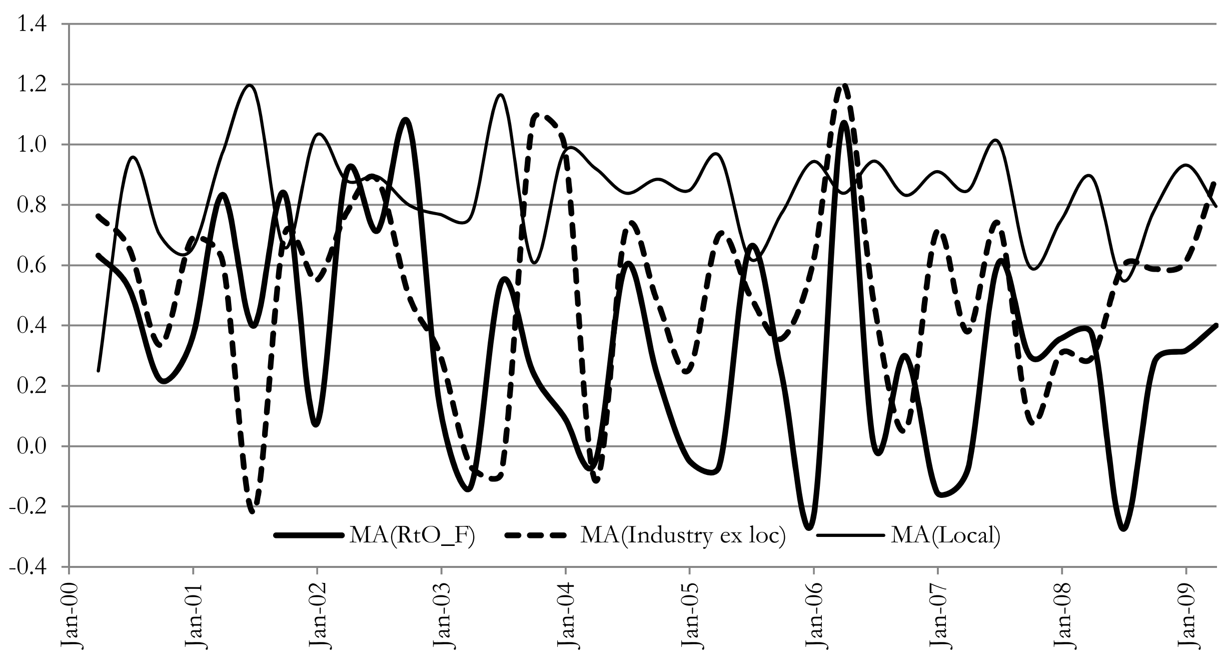
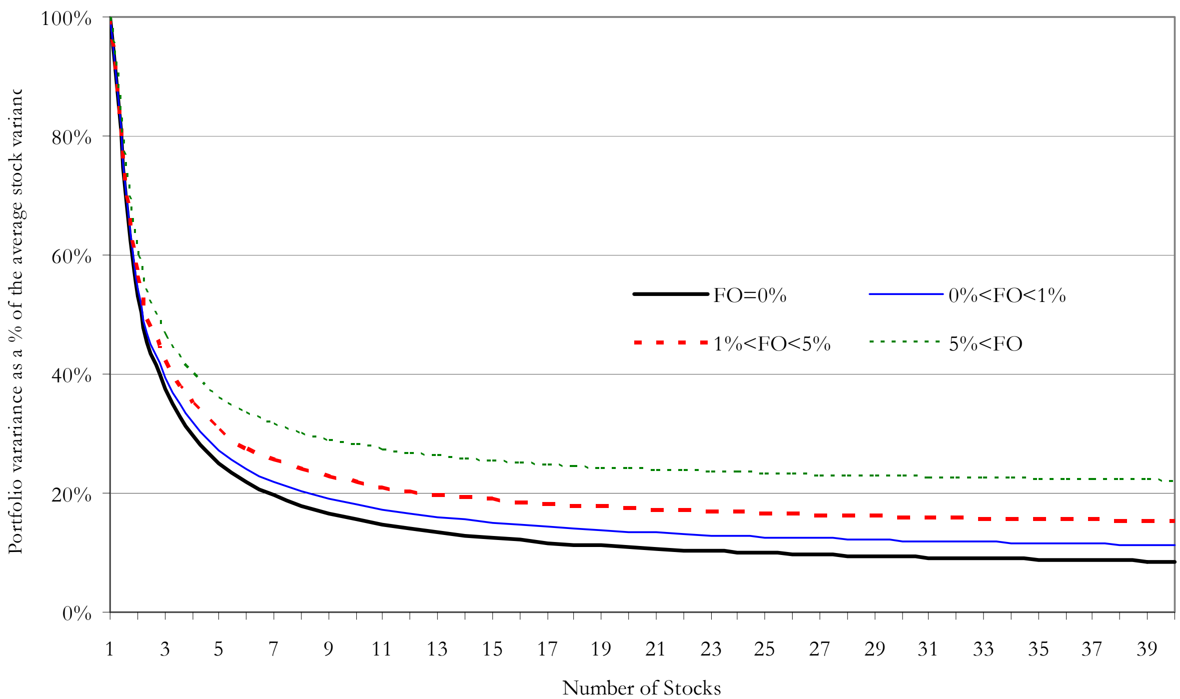


Figure S2.3: Ownership Level and Portfolio Diversification

The figure shows the effect of country and industry portfolio diversification for alternative levels of foreign institutional ownership (0%, 0%-1%, 1%-5%, >5%) measured at the beginning of a three year period. The sample consists of non-U.S. stocks with at least 30% non-zero trading days in the previous year. The sample period is 01/01/2000-03/31/2009. Firms are required to have at least 30 non-missing return observations. For each country, year, and institutional ownership groups, the number of firms is restricted to the smallest number of firms across institutional ownership groups to have the same number of stocks in each institutional ownership group. For each year, the average variance and covariance is calculated for alternatively pure country or pure industry diversification, as in Griffin and Karolyi (1998), and subsequently the average across years is calculated. Panel A shows country portfolio diversification, and Panel B shows industry portfolio diversification. Ownership data is from LionShares, while data on returns for individual stocks is from Datastream.

Panel A: Country Portfolio Diversification



(continued)

Figure S2.3: Ownership Level and Portfolio Diversification (continued)

Panel B: Industry Portfolio Diversification

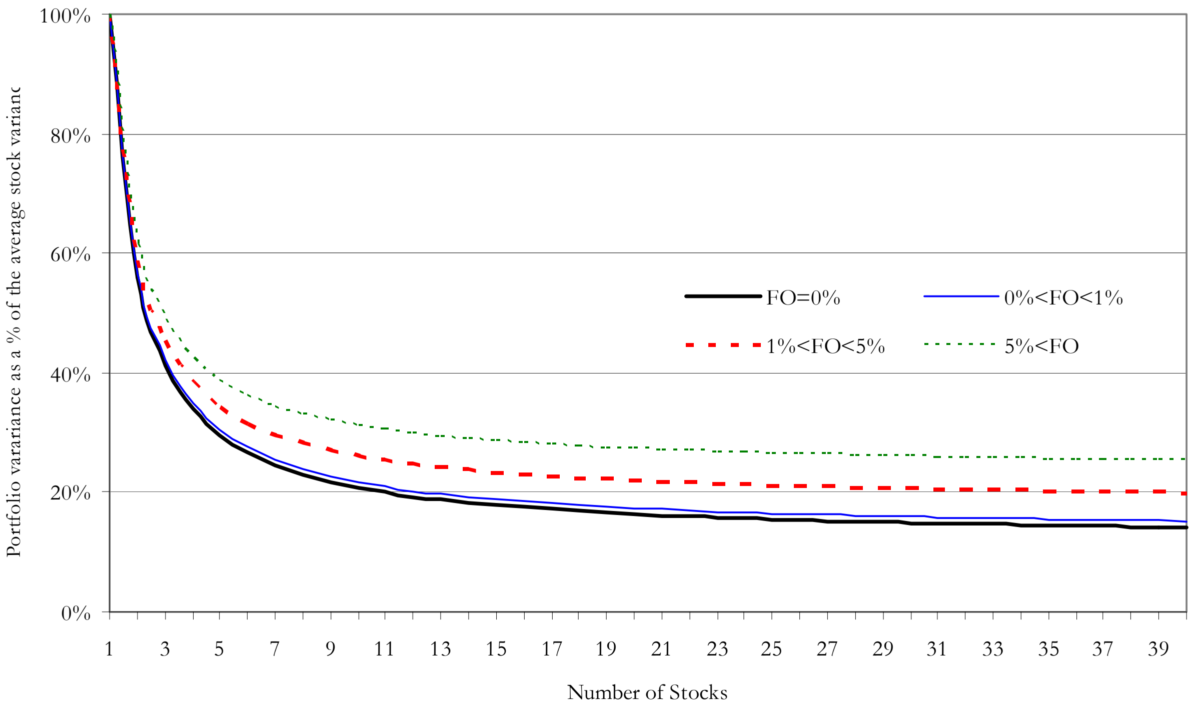
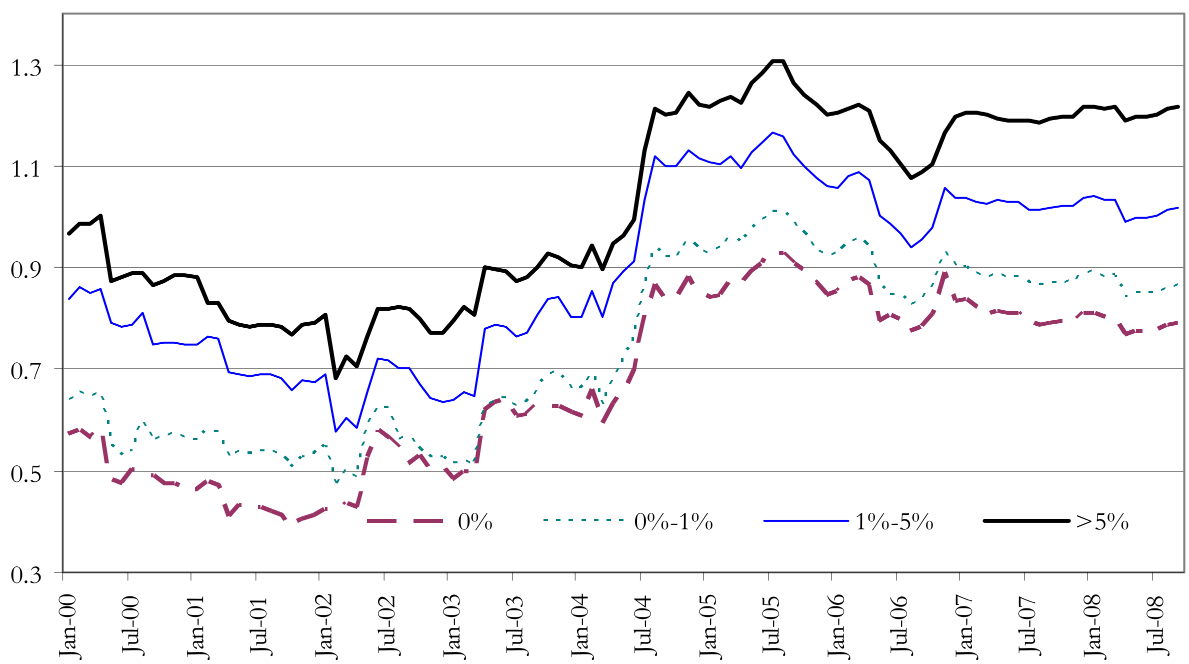


Figure S2.4: Equally-Weighted Market Sensitivity and Explanatory Power of Ownership Portfolios

The figure shows rolling regression results using portfolios of stocks with different degrees of institutional ownership. In particular, stocks with at least 30% non-zero trading days in the previous year are sorted into 4 portfolios, depending on whether lagged foreign institutional ownership is equal to 0%, between 0% and 1%, between 1% and 5%, or larger than 5%. Equally-weighted portfolios of weekly USD returns are formed by foreign institutional ownership, country, and date, requiring at least 10 stocks per country and ownership group on a given date. Moreover, for a given window of weekly observations within rolling 24 months, non-missing observations in each of the four ownership groups are required for each day and country, each country/ownership portfolio has to have at least 30 weekly observations, and there have to be non-missing observations for each ownership group for at least 5 countries. For a given window of weekly observations within rolling 24 months over the period is 01/01/2000-03/31/2009, the returns of these portfolios are regressed on an intercept and the USD returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_j R_{WorldMarket,t} + \varepsilon_{jt}$ Results across countries are aggregated using equal weights. Panel A shows the time-series of the average world market betas, while Panel B shows the time-series of the average R^2 for the four ownership portfolios. Figure C shows rolling regression results using iShares. For a given window of daily observations within rolling 24 months over the period 1/1996-6/2009, the returns of all iShares on CRSP are regressed on the value-weighted U.S. market index. Results across iShares are aggregated using equal weights. The figure shows the time-series of the average of market betas and R^2. Ownership data is from LionShares, while data on returns for individual stocks and the world market index is from Datastream. Data on iShares is from CRSP.

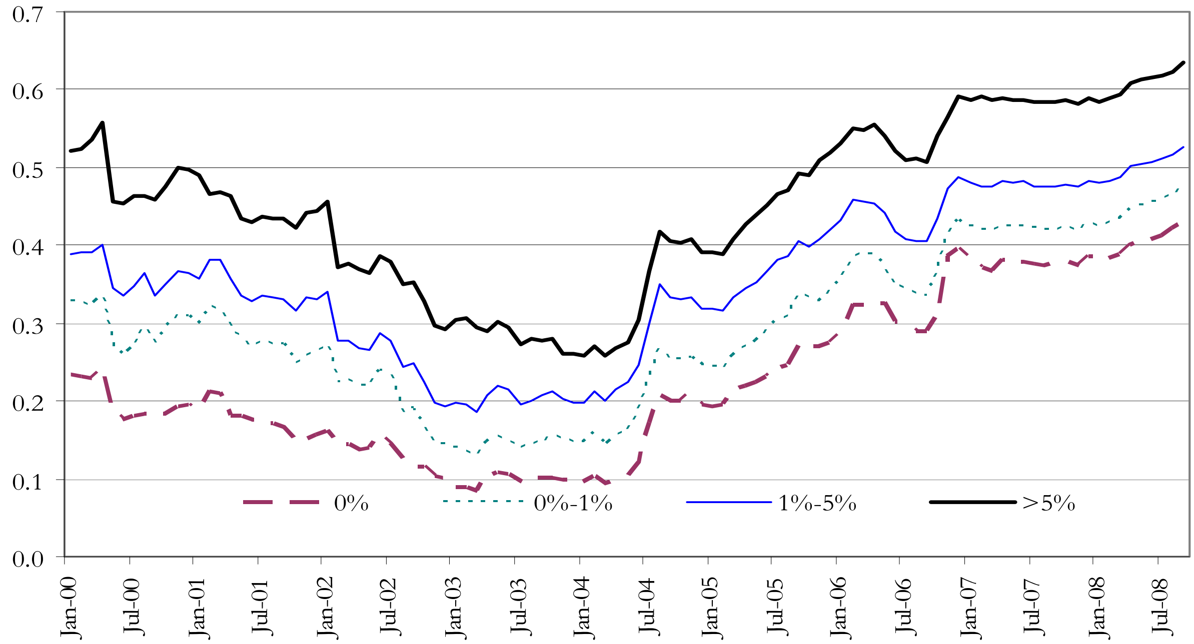
Panel A: Equally-Weighted World Market Betas



(continued)

Figure S2.4: Equally-Weighted Market Sensitivity and Explanatory Power of Ownership Portfolios (continued)

Panel B: Equally-Weighted R^2



Panel C: U.S. Market Sensitivity and Explanatory Power of Ownership Portfolios of iShares

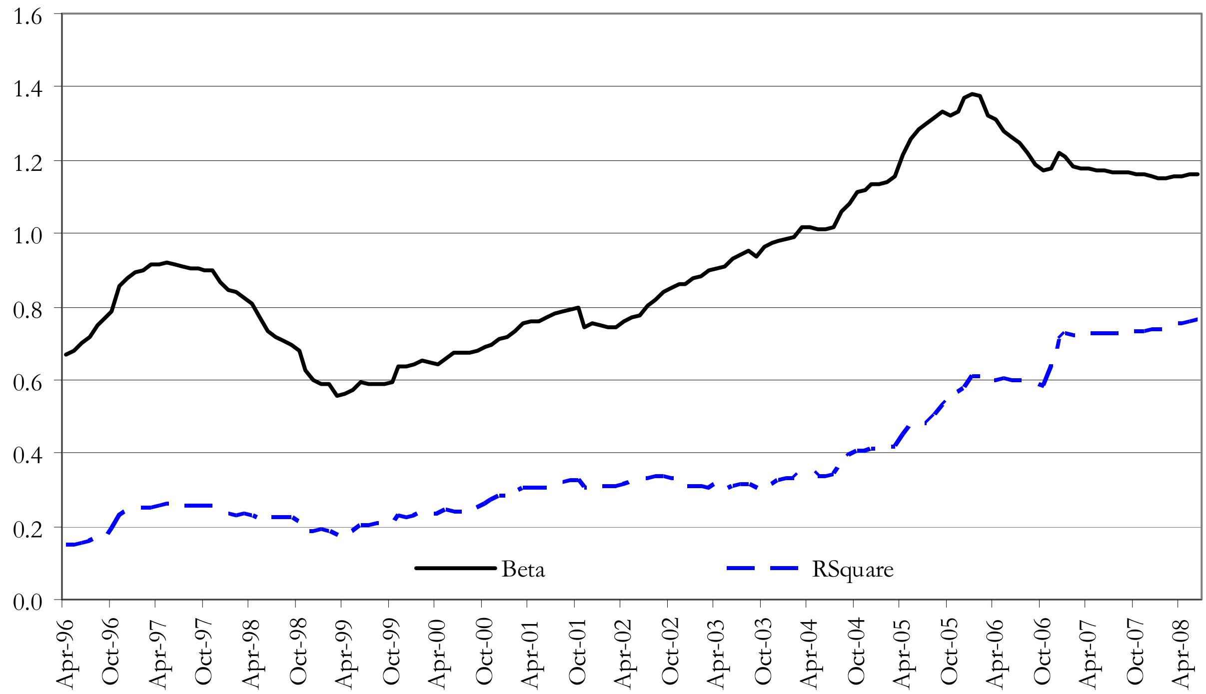
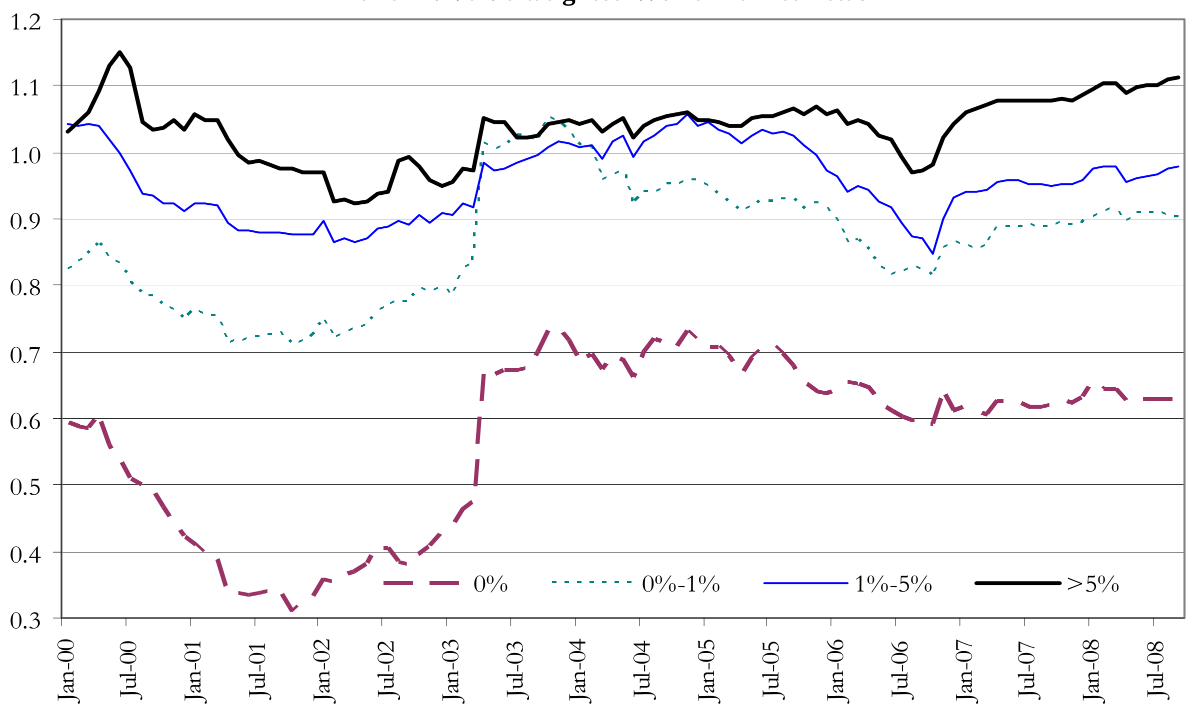


Figure S2.5: Value-Weighted Market Sensitivity and Explanatory Power of Ownership Portfolios

The figure shows rolling regression results using portfolios of stocks with different degree of institutional ownership. In particular, stocks with at least 30% non-zero trading days in the previous year are sorted into 4 portfolios, depending on whether lagged foreign institutional ownership is equal to 0%, between 0% and 1%, between 1% and 5%, or larger than 5%. Value-weighted portfolios of weekly USD returns are formed by foreign institutional ownership, country, and date, requiring at least 10 stocks per country and ownership group on a given date. Moreover, for a given window of weekly observations within rolling 24 months, non-missing observations in each of the four ownership groups are required for each day and country, each country/ownership portfolio has to have at least 30 weekly observations, and there have to be non-missing observations for each ownership group for at least 5 countries. For a given window of weekly observations within rolling 24 months over the period is 01/01/2000-03/31/2009, the returns of these portfolios are regressed on an intercept and the USD returns of the MSCI world market index: $R_{jt} = \alpha_j + \beta_j R_{WorldMarket,t} + \varepsilon_{jt}$ Results across countries are aggregated using lagged USD country market capitalization as weights. Panel A shows the time-series of the average world market betas, while Panel B shows the time-series of the average R^2 for the four ownership portfolios. Ownership data is from LionShares, while data on returns and market capitalization for individual stocks, as well as data on the world market index, is from Datastream.

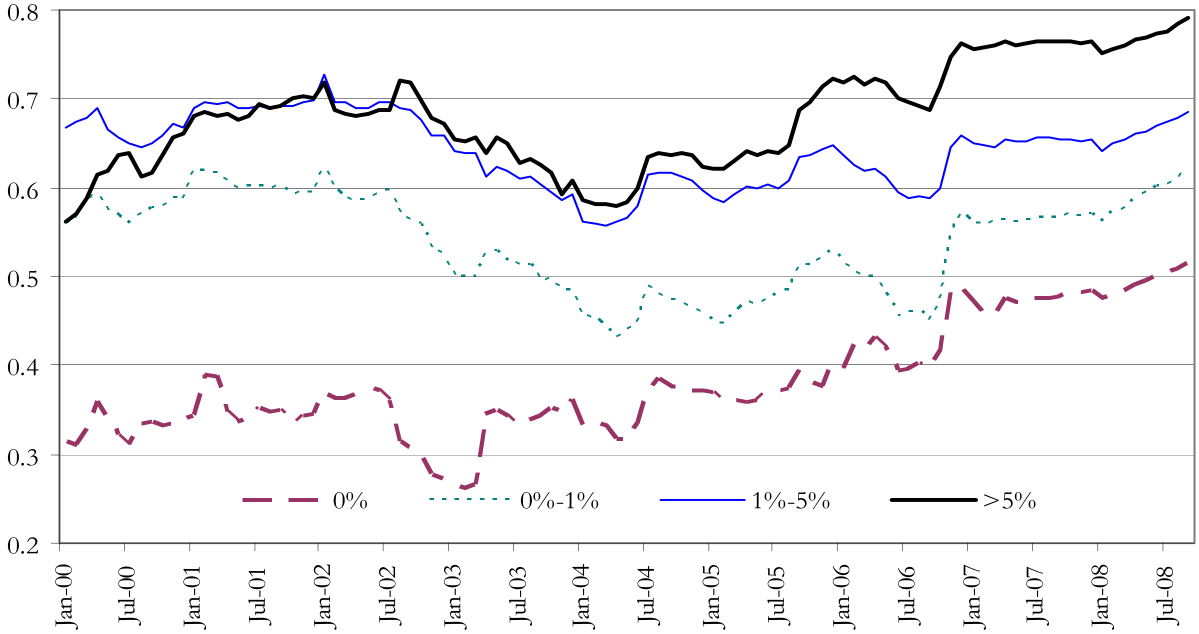
Panel A: Value-weighted World Market Betas



(continued)

Figure S2.5: Value-Weighted Market Sensitivity and Explanatory Power of Ownership Portfolios (continued)

Panel B: Value-weighted R^2



CHAPTER 3

TRADE LINKAGE AND CROSS-COUNTRY STOCK RETURN PREDICTABILITY

1. Introduction

International trade volume and shares of exports in the GDP of many countries have been growing steadily over the past few decades[37]. This increase in trade activity has served to strengthen economic linkages between industries and countries. In this environment, it is possible that information originating with trade partners within an industry can predict future returns of that industry. In this paper, I am going to test whether future returns of industry portfolios can be predicted using past information from trading partners. Moreover, I am going to characterize cross-predictability and explore possible explanations for it utilizing trading partner relationships between industries.

Researchers have documented some evidence of cross-industry predictability in the United States. Menzly and Ozbas (2010) show that stock returns of economically related industries can cross-predict each other's returns in US stock markets. Similarly, Cohen and Frazzini (2008) investigate whether firm level public information on customer and supplier relationships can be used to obtain abnormal returns. So far, such evidence has focused almost exclusively on the domestic US market. However, as inter-industry relationships extend beyond national borders, international interdependence of industries warrants further investigation of this issue in a more global setting.[38] In this paper, I will bring in a new data source, the GTAP (Global Trade Analysis Project), to address this issue.

[37] The World Bank (http://data.worldbank.org/): Export volume index, Exports of goods and services(% of GDP)

[38] A recent paper by Rizova (2011) examines the interdependence of country-level trade relationships and country-level equity market performance.

The GTAP provides data on cost spent on imported and exported goods by industries around the world. This data, widely used in international trade literature but never in finance literature, enables us to look not only at the breakdown of exported and imported goods and services, but also dependences of industries on particular imported goods. For example, the data describes quantities of iron and steel products imported from Japan to Korea. Moreover, the data reports amounts of this iron and steel consumed by Korean industries. The rich structure of the data helps us understand relationships among industries across countries. More importantly, such a broad cross section of economically linked industries enables us to relate sources of cross-predictability to their customers and suppliers.

To quantify degrees of international linkages between industries, I consider international trade flows and imported goods usage by industries. Based on such linkages, I can quantify how an industry in a country is related to other industries around the world. I construct related industry portfolios and examine whether industry portfolio returns can be predicted by past returns of internationally related industries. Also, bilateral relationships between related industries allow for new possibilities for testing existing theories. In particular, we have access to a cross section of related industries with varying levels of international trade relationships, which can be used along with other relationships between two industries, such as institutional co-ownership and analyst co-coverage. This data structure enables us to break down the predictor variable into several pieces and analyze whether there is varying level of predictability along certain criteria, such as co-ownership or co-coverage, on top of the international trade link.

Overall, I find strong evidence for cross-border stock return predictability among trade-linked industries. A trading strategy of buying industry portfolios whose trade-linked industries had high returns, and shorting industry portfolios whose trade-linked industries had low returns, yields annualized returns of 12%. Such returns cannot be explained by known risk factors, and are different from industry momentum. I find some evidence against the leading explanation that posits information segmentation as the only reason for this cross-predictability, and find support for illiquidity as a new channel of explanation.

My paper makes the following three contributions to the literature. First, I uncover effects on returns of industry-level trade linkages across the world. Second, I test whether relative information is efficiently priced across countries and industries and decouple effects of within-country predictability and across-country predictability. Third, by selecting an international setting in which there is natural information segmentation across countries and great variability of liquidity, I obtain a better testing ground for these theories.

I find the following four empirical results. First, as noted above, I find that self-financing trading strategies based on past information from economically related industries yield significant premiums.

Second, I analyze the characteristics of past returns that are most powerful in predicting an industry's return. If information segmentation is the main explanation of cross-predictability, then returns from obscure or ignored stocks are more likely to carry more weight in predicting related industry returns in foreign countries. In contrast, I find that the strongest predictive power comes from past returns of economically linked industries that (1) share greater degrees of institutional ownership, and that (2) share more analyst coverage. Such industries are likely more well-known and familiar among investors. This suggests that information segmentation does not fully explain cross-predictability.

Third, I test whether liquidity can explain the observed cross-predictability and compare this with the information explanation. If equities of certain industries are highly illiquid, this will result in slow price adjustments. Utilizing double-sort results, I find evidence in favor of the illiquidity explanation, which, unlike information segmentation, can explain cross-predictability among economically linked industries.

Finally, I find that institutional investors increase their holdings quickly in response to positive news, but do not decrease their holdings quickly after negative return news. This is in line with the fact that most excess return gains from cross-predictability come from the long side of the long-short portfolio. Moreover, the responsiveness of portfolio rebalancing in light of positive news increases as liquidity of stocks increases, while responsiveness to negative return news is about the same across different liquidity levels.

The rest of the paper proceeds as follows: Section 2 describes data used, Section 3 present empirical findings, and Section 4 concludes.

2. Data

Data used in this paper comes from a number of sources. Bilateral trade data of disaggregated commodities and services and use of imported goods and services by disaggregated industries comes from the GTAP. This data provides bilateral trade of various goods and services and cost structures of industries for each country as snapshots of the world economy. In this paper, GTAP versions 5 and 6 were used, representing 1997 and 2001, respectively. Only with disaggregated trade data and interdependence of industries within countries may we establish industry relationships between countries. Description of reorganized GTAP industries can be found in the Appendix, Table A3.1.

I merge these GTAP industries with corresponding industry classifications provided by Professor

Ken French.[39] Correspondences between the GTAP and French's industrial classifications are also described in the Appendix, Table A3.1.

Menzly and Ozbas (2010) identify customer and supplier relationships of US industries using Benchmark Input-Output Surveys of the Bureau of Economic Analysis (BEA).[40] The BEA surveys document amounts of goods from an industry used across all industries. One potential downside of GTAP data, compared to the BEA Use table, is that it comprises only 56 industries, whereas the BEA tables include more than 400 industries, though exact numbers vary depending on publication year. Moreover, many GTAP industries are related to agriculture; thus, if we group them into one industry, the total number of industries is reduced further to 23. Since customer-supplier relationships may weaken following aggregation, this higher level of aggregation likely biases against finding any cross-sectional predictability, given such a small number of industries. Despite such limitations, I still find a strong level of cross-sectional predictability across countries.

Returns of international stocks are from Datastream. I use the same data filter as Griffin, Kelly, and Nadari (2009), which involves screening non-common equity. The data error

---

[39] Industry classification is obtained from Ken French's data library, at his web site http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[40] Cohen and Frazzini (2008) utilize public information of major customers, which firms are required to report under Regulation SFAS No. 131, as obtained from Compustat. But this approach means that results are mostly driven by relatively small stocks whose customers are concentrated and not diversified. In contrast, input-output relationships across industries are relatively free of small stock problems. In the input-output table, supplier and customer industries are well identified and there is no asymmetry of identifying suppliers, as is seen in the Compustat data.

screening of Ince and Porter (2006) is also applied to the returns data. Numbers of firms and average market capitalization of firms in each country-industry group are reported in Table A3.2 and Table A3.3, respectively. The sample period for the returns data is from 1990 to 2009. I only include countries in the Morgan Stanley Capital Index (MSCI) World Index or MSCI Emerging Markets Index as of 2010, and countries available in the GTAP database. [41]

Institutional ownership data for international stocks is from the Lionshares database. The sample period for the ownership data is from March 1999 to March 2009. The ownership data is, at most, quarterly and contains holdings reports of institutions comparable to those of 13F in the US. Detailed data description of Lionshares can be found in Ferreira and Matos (2008) and Bartram, Griffin, and Ng (2012).

3. Empirical results

In order to test the hypothesis of slow diffusion of information or slow reaction of prices from economically linked industries, I construct a portfolio of economically linked industries for each industry in question. Economic links considered in this study are customer and supplier relationships across countries and industries. Under the null hypothesis of immediate information diffusion of economically relevant information and price adjustments, the portfolio returns of linked industries should not lead returns of the industry. In contrast, when there is slow diffusion of information or sluggish price adjustments, we should be able to predict an industry's returns from returns of economically linked industries, where the returns are used as proxies for news from linked industries. The next section describes the construction of the customer and supplier

[41] I drop Russia due to low data coverage in Datastream.

industry portfolios.

3.1 Portfolio returns of international customer and supplier industries

I follow procedure similar to that of Menzly and Ozbas (2010) and Cohen and Frazzini (2008), in that I use lagged returns of economically related industries to predict a particular industry's returns. What is different from their approach is that I am focusing on international linkages of industries across the world, rather than industry interdependence within one country. For this purpose, I construct two portfolios for each country-industry, namely international customer and supplier portfolios. These portfolios consist of foreign industries that are customers or suppliers of the industry in the country.

The customer portfolio is first weighted by trade flows between countries and, secondly, by intra-country dependences of industries. In particular, return of customer portfolio of industry i in country c is constructed as

$$R_{ic,t}^{customer} = \sum_{d \in C} w_{ic,d} \sum_{j \in J_d} v_{ijd} R_{jd} \tag{1}$$

where $w_{ic,d}$ is proportion of exported good i to country d from country c to all of exported good i from country c, and v_{ijd} is proportion of cost spent by industry j in country d on imported good i to cost spent on imported good i by all industries in country d, and R_{jd} is value-weighted portfolio return of stocks industry j in country d. For example, Chinese electronic equipment is exported to multiple countries; 35% of these exports go to the US, 15% to Japan, 50% to other countries across the world. Imported electronic equipment is used in many industries in each country. In the US, for instance, 50% of imported electronic equipment is used in the electronic equipment industry, 14% in the fabricated products and machinery industry, 12% in the service industry, and 24% in other industries. Weight $w_{ic,d}$ describes how important country d is to industry i of country c as a customer country, and v_{ijd} describes how important industry j of country d is as a customer industry of imported goods produced by industry i.

The supplier portfolio for industry i of country c is constructed similarly as

$$R_{ic,t}^{supplier} = \sum_{j \in J_d} v'_{jic} \sum_{d \in C} w'_{jd,c} R_{jd,t} \tag{2}$$

where v'_{jic} is proportion of cost spent on imported good j by industry i of country c to costs spent on all imported goods by industry i of country c, and $w'_{ic,d}$ is proportion of imported good j from country d to country c. In the electronic equipment industry in the US, for example, out of all costs of imported goods used in the industry, 86% was spent on imported electronic equipment, 5% on imported fabricated products and machinery, and the rest on imported goods and services. There are many imported goods used in the electronic equipment industry in the US and these come from different countries: 22% from Japan, 10% from Singapore, 10% from Taiwan, and 58% from the rest of the world. Weight v'_{jic} describes how important imported good j is to industry i in country c, and $w'_{jd,c}$ describes how important country d is as a supplier country of good j in country c.

3.2 Abnormal returns of portfolios sorting on lagged customer and supplier industry returns

For a first piece of evidence for cross-predictability of returns, I investigate whether abnormal returns could be obtained from a trading strategy utilizing available information of economically linked industries. At the beginning of every month, value-weighted industry portfolios are sorted on the basis of the returns of a portfolio of its international customers and suppliers at the end of the previous month. These sorted industry portfolios are assigned to one of five quintile portfolios. These quintile portfolios are equal-weighted. Reported in Table 3.1 are quintile portfolio returns sorted according to previous month customer and supplier industry returns. Portfolio returns of long top quintile and short bottom quintile sorting on customer and supplier returns are also considered. See Figures 3.1 and 3.2 for long-short portfolio return sorting on customer and supplier industry returns. Excess returns of portfolios are calculated by subtracting risk free rates for the US, value-weighted returns for our sample firms are used as world market returns in calculating world CAPM alphas, and global size, value, momentum factors used in Fama and French (2012) are used to obtain global Fama-French 4 factor alpha.

The long-short portfolio gives monthly excess returns of 1.09% when sorted on customer industry returns, and 1.06% when sorted on supplier industry returns. The fact that the excess returns of the top quintile portfolio turn out to be the most significant suggests two interesting points. First, profit from the trading strategy doesn't depend crucially on short positions. Hence, the trading strategy may have less difficulty in real world applications due to restrictions on short sales. Second, it suggests that good news tends to travel more slowly or is priced more slowly than bad news.

To test and to further investigate whether industry-level returns are cross-predictable based on past returns of supplier and customer industries, I conduct the following regression using Fama-MacBeth (1973) methodology:

$$r_{ci,t} = \alpha_t + \lambda_{1,t}^{related} r_{ci,t-1}^{related} + \lambda_{2,t}^{related} r_{ci,t-2:t-12}^{related} + \Lambda_t Z_{ci,t-1} + e_{ci,t} \quad (3)$$

Table 3.1: Portfolio returns sorted based on lagged customer or supplier industry return

This table reports excess returns and abnormal returns of five portfolios and a long-short portfolio of the top and bottom portfolios. At the beginning of every month, each country-industry portfolio is sorted into five quintile groups based on its customer/supplier industry portfolio returns at the end of the previous month. Quintile portfolios are formed by putting equal weight on country-industry portfolios within the quintile group, and these are rebalanced every month. Average excess returns of portfolios are reported in the first column. World CAPM alpha is the intercept on a regression on world market returns constructed from value-weighted returns in our sample. Third column reports estimated intercept using world market returns, and global size, value, momentum factors used in Fama and French (2012). All returns are monthly returns in percentage. Numbers in parentheses are t-statistics. Statistically significant estimates at the 5% significance level are bold faced.

Panel A: sample period from 1990 to 2009

	Sorting on customer return			Sorting on supplier industry return		
	Excess return	World CAPM alpha	Global FF4 factor alpha	Excess return	World CAPM alpha	Global FF4 factor alpha
Low 1	0.004	-0.147	-0.189	-0.069	-0.219	-0.225
	(0.01)	(-0.69)	(-0.92)	(-0.20)	(-0.99)	(-1.05)
2	0.288	0.147	0.055	0.338	0.208	0.125
	(0.95)	(0.85)	(0.35)	(1.10)	(1.15)	(0.76)
3	**0.573**	**0.438**	**0.322**	**0.581**	**0.446**	**0.329**
	(1.88)	(2.60)	(2.10)	(1.94)	(2.65)	(2.15)
4	**0.628**	**0.489**	**0.407**	**0.748**	**0.608**	**0.481**
	(2.03)	(2.83)	(2.45)	(2.41)	(3.44)	(2.87)
High 5	**1.099**	**0.950**	**0.780**	**0.993**	**0.834**	**0.662**
	(3.41)	(4.96)	(4.25)	(2.95)	(4.20)	(3.39)
High-Low	**1.095**	**1.097**	**0.969**	**1.062**	**1.054**	**0.887**
	(6.03)	(6.04)	(5.03)	(4.84)	(4.79)	(3.79)

Panel B: sample period from 1997 to 2009

	Excess return	World CAPM alpha	Global FF4 factor alpha	Excess return	World CAPM alpha	Global FF4 factor alpha
Low 1	-0.174	-0.216	-0.269	-0.305	-0.346	-0.382
	(-0.36)	(-0.79)	(-1.03)	(-0.63)	(-1.21)	(-1.39)
2	0.227	**0.188**	0.086	0.238	**0.198**	0.100
	(0.54)	(0.87)	(0.46)	(0.55)	(0.88)	(0.49)
3	0.583	**0.544**	**0.375**	0.668	**0.629**	**0.486**
	(1.37)	(2.64)	(2.13)	(1.61)	(3.18)	(2.90)
4	0.737	**0.696**	**0.567**	0.813	**0.774**	**0.598**
	(1.72)	(3.45)	(3.07)	(1.90)	(3.63)	(3.10)
High 5	**1.316**	**1.274**	**1.103**	**1.273**	**1.230**	**1.057**
	(2.90)	(5.41)	(5.04)	(2.68)	(4.96)	(4.48)
High-Low	**1.489**	**1.490**	**1.372**	**1.578**	**1.576**	**1.439**
	(6.16)	(6.14)	(5.39)	(5.38)	(5.36)	(4.64)

Table 3.2: Fama-MacBeth regressions (Robustness checks and different markets)

Dependent variables are industry returns. Explanatory variables are past returns of own industry returns, customer industry returns, and supplier industry returns. Regressions are run using all samples (ALL), excluding the bottom 20% in market cap size (EX20), emerging markets (EMR), and advanced economies (ADV). Explanatory variables are lagged returns of customer (CR) and supplier (SR) portfolio returns and lagged returns of own industry returns (RI). Sample periods are from Jan 1990 to Mar 2009 for results in Panel A, and from Jan 1997 to Mar 2009 for Panel B. Statistically significant estimates at the 5% significance level are bold faced.

Panel A: sample period from 1990 to 2009

Variable	ALL	ALL	EX20	EMR	ADV	ALL	ALL	EX20	EMR	ADV
Intercept	**0.008**	0.005	0.004	**0.007**	0.003	**0.008**	0.004	0.003	0.006	0.003
	(2.80)	(1.88)	(1.50)	(2.04)	(1.08)	(2.68)	(1.58)	(1.01)	(1.57)	(0.99)
CR (t-1)	**0.160**	**0.132**	**0.117**	**0.121**	**0.139**					
	(6.26)	(5.89)	(5.18)	(3.25)	(5.29)					
CR (t-2:t-12)		**0.149**	**0.159**	0.051	0.136					
		(2.48)	(2.57)	(0.52)	(1.95)					
SR (t-1)						**0.141**	**0.101**	**0.107**	0.107	**0.107**
						(4.57)	(3.70)	(3.99)	(1.73)	(3.98)
SR (t-2:t-12)							**0.149**	**0.162**	0.108	0.065
							(2.13)	(2.40)	(0.85)	(0.84)
IR (t-1)		**0.028**	**0.026**	**0.031**	**0.031**		**0.026**	**0.025**	**0.032**	**0.031**
		(2.68)	(2.27)	(2.19)	(2.74)		(2.58)	(2.14)	(2.26)	(2.74)
IR (t-2:t-12)		**0.084**	**0.080**	0.039	**0.156**		**0.087**	**0.082**	0.038	**0.160**
		(3.31)	(2.69)	(1.06)	(5.84)		(3.50)	(2.78)	(1.07)	(6.04)
Adjusted R squared	0.0063	0.0474	0.0624	0.0682	0.0646	0.0086	0.0502	0.0664	0.0733	0.0675
NOB	168776	164090	132682	64426	99664	168776	164090	132682	64426	99664
Avg NOB	730.6	710.3	574.4	278.9	431.4	730.6	710.3	574.4	278.9	431.4

Panel B: sample period from 1997 to 2009

Variable	ALL	ALL	EX20	EMR	ADV	ALL	ALL	EX20	EMR	ADV
Intercept	0.008	0.004	0.003	0.004	0.003	0.007	0.003	0.001	0.002	0.003
	(1.86)	(1.18)	(0.77)	(1.01)	(0.75)	(1.78)	(0.86)	(0.35)	(0.51)	(0.72)
CR (t-1)	**0.225**	**0.182**	**0.155**	**0.181**	**0.174**					
	(7.11)	(7.25)	(5.84)	(5.10)	(5.35)					
CR (t-2:t-12)		**0.152**	**0.165**	0.164	0.067					
		(2.09)	(2.07)	(1.76)	(0.73)					
SR (t-1)						**0.218**	**0.160**	**0.155**	**0.199**	**0.125**
						(6.10)	(5.52)	(5.21)	(4.99)	(3.72)
SR (t-2:t-12)							**0.201**	**0.195**	**0.276**	0.067
							(2.30)	(2.36)	(2.22)	(0.69)
IR (t-1)		**0.035**	**0.035**	**0.031**	**0.041**		**0.034**	**0.033**	0.030	**0.042**
		(2.90)	(2.67)	(2.03)	(3.16)		(2.82)	(2.54)	(1.95)	(3.26)
IR (t-2:t-12)		**0.098**	**0.096**	0.029	**0.165**		**0.102**	**0.099**	0.031	**0.164**
		(2.96)	(2.35)	(0.61)	(4.50)		(3.14)	(2.44)	(0.68)	(4.51)
Adjusted R squared	0.0080	0.0506	0.0681	0.0626	0.0729	0.0104	0.0535	0.0711	0.0658	0.0770
NOB	116273	115049	92611	49954	65095	116273	115049	92611	49954	65095
Avg NOB	791.0	782.6	630.0	339.8	442.8	791.0	782.6	630.0	339.8	442.8

where $r_{ci,t}$ is the return of the value-weighted portfolio of stocks in industry i of country c in month t and $Z_{ci,t-1}$ is a vector of lagged control variables known to predict country-industry portfolio return. $r_{ci,t-1}^{related}$ is either customer or supplier country-industry portfolio return as described above. Table 3.2 reports regression results. Coefficients on lagged customer industry portfolio returns are significant and robust across different subsamples. The magnitude of the coefficients is many times greater than the coefficient on lagged industry portfolio returns, which are known factors to predict industry returns, as in Moskowitz and Grinblatt (1999).

To check whether cross-predictability is not driven by the smallest and most neglected stocks, I conduct the same regression for different subsamples. I get robust results in the following samples: excluding industries in the bottom 20 percentile in market capitalization, industries from emerging economies, and industries from advanced economies.

Since the economic relationships used in this paper are coming from two snapshots of the world economy, one taken in 1997 and the other in 2001, it would be interesting to see the performance of the predictor using samples after the snapshots. Panel B of Table 3.1 and Table 3.2 report excess returns from the long-short portfolio, and regression results from samples after 1997. We find greater predictability both in terms of magnitude of excess returns and Fama-MacBeth coefficient size. Using later data samples, the long-short portfolio yields an even greater excess return. The excess return is close to a monthly return of 1.5% or annualized return of 18%. Coefficients of Fama-MacBeth regressions also show increased magnitude when the later sample is used. It is interesting to see that the predictability of past supplier industry returns improved when we used the later sample.

In an unreported table, where only one GTAP snapshot is used to determine customers and suppliers, the excess return and the coefficients were smaller compared to results where we utilize two snapshots. From the results we have seen so far, we can deduce that a more accurate description of the world economy relationship would allow us to predict future industry returns with greater precision.

3.3 Can cross-predictability better explained by liquidity than information coverage?

Information segmentation and investor inattentiveness are the dominant explanations of the cross-predictability of economically linked stocks [Cohen and Frazzini (2008); Menzly and Ozbas (2010)]. In the literature, information coverage and institutional ownership are generally used as proxies for information coverage and the level of investor attention stocks receive. However, the same variable could be a proxy for liquidity, because illiquid stocks generally get less analyst coverage and are owned less by institutional investors. Because of this close correlation, it is often difficult to discern the two effects from the proxies.

Analyst coverage and institutional ownerships were used as proxies for information coverage in previous literature. However, in this exercise, I am going to use only analyst coverage as a proxy for information coverage because it is direct measure of the information coverage an industry gets, and indirect measures, such as institutional ownership levels, can contain mixed information about preferences of institutional investors. For each month, I counted the number of analyst forecasts for each firm in an industry during past 6 months and took value weighted average of this number to proxy information coverage. Since I am aggregating all firms in an industry to get this measure, there sporadic analyst coverage is less of an issue.

As for the liquidity measure, I use the percentage of observed zero daily returns in the previous month and aggregate this number for all firms in each industry. The liquidity measure was first proposed in Lesmond, Ogden, and Trzcinka (1999) and is widely used in international finance [Lesmond (2005), Bekaert, Harvey, and Lundblad (2007), and Bartram, Griffin, and Ng (2010)].

In this section, I try to compare the information and liquidity explanations of cross-predictability among economically linked stocks. First, I try to characterize excess returns from long-short portfolios. If level of predictability has anything to do with information coverage or liquidity, we should see meaningful differences in excess returns along different levels of information coverage or liquidity. I investigate returns of long-short portfolios formed from subsets of the industry portfolio pool where subsets are divided according to liquidity and information coverage measures. First, I separately analyze the effects of liquidity and information coverage on cross-predictability. Industries are sorted according to information coverage or liquidity measures and grouped into three subgroups. Within each subgroup, I form a long-short portfolio and report average returns from each. Second, I do a double sort as a preliminary comparison between the information and liquidity explanations.

Returns from each subgroup and each double sort group are reported in Table 3.3. Panel A divides industries according to the information coverage measure, and finds very little difference between returns of portfolios formed from the least coverage group and the most analyst coverage group. If information coverage mostly explains cross-predictability, we should see greater returns from a portfolio formed from industries with less analyst coverage. However, the results in Panel A provides only very weak evidence. Panel B reports analogous results where industries are sorted according to liquidity levels. The difference is significant at the conventional 5% significant level and the magnitude of the difference is larger than we saw in Panel A.

Table 3.3: Long-short portfolio returns from subgroups of industries

Reported in this table are average returns of the long-short portfolio formed from subgroups of industries. Long short portfolios are formed using industry portfolios in each subgroup. In Panel A, subgroups are divided by analyst coverage level measured by the number of analysts covering an industry. In Panel B, the liquidity of an industry is used to form subgroups. Liquidity of an industry is measured using a value-weighted average of the number of non-zero return days in the previous month. In Panel C, pools of industries are sorted independently according to analyst coverage and liquidity. Reported returns are in monthly percentage. t-statistics are shown in parentheses. Estimates with 5% statistical significance are in bold face.

Panel A:	Least coverage	Moderate coverage	Most coverage	Difference
	0.012	**0.009**	**0.012**	0.000
	(4.81)	(4.09)	(5.41)	(0.06)
Panel B:	**Least liquid**	**Moderately liquid**	**Most liquid**	**Difference**
	0.015	**0.011**	**0.009**	**0.006**
	(6.57)	(4.40)	(3.99)	(2.32)
Panel C:	**Least liquid**	**Moderately liquid**	**Most liquid**	**Difference**
Least analyst coverage	**0.018**	0.005	0.002	**0.015**
	(5.73)	(1.25)	(0.47)	(2.95)
moderate analyst coverage	**0.011**	**0.008**	**0.007**	0.004
	(3.82)	(2.94)	(2.24)	(1.21)
Most analyst coverage	**0.014**	**0.014**	**0.010**	0.003
	(4.06)	(4.79)	(4.25)	(0.98)
Difference	0.004	**-0.009**	-0.008	
	(0.89)	(-2.04)	(-1.79)	

Table 3.4: Fama-MacBeth regresisons (subgroup of industries)

Fama-MacBeth regression coefficients on corresponding interaction terms are reported in this table. The dependent variable is industry returns. The product of two dummy variables and customer industry portfolio returns are used to form interaction terms. The interaction terms and industry returns of previous months are included in the regression; however only coefficients to the interaction terms are reported. In Panel A and B, the following Fama-MacBeth regression was estimated:

$$r_{i,t} = \alpha_t + \sum_{k=1}^{3} \lambda_t^k A_{i,t-1}^k r_{i,t-1}^{customer} + \Lambda_t Z_{i,t-1} + e_{i,t}$$

where $r_{i,t}$ is industry return, $A_{i,t-1}^k$ is dummy variable for analyst coverage in Panel A and for liquidity in Panel B, and $Z_{i,t-1}$ is a vector of industry's own past return. Only averages of λ_t^k are reported

In Panel C, the following Fama-MacBeth regression was estimated, and only averages of λ_t^{jk} are reported:

$$r_{i,t} = \alpha_t + \sum_{k=1}^{3} \sum_{j=1}^{3} \lambda_t^{jk} A_{i,t-1}^j A_{i,t-1}^k r_{i,t-1}^{customer} + \Lambda_t Z_{i,t-1} + e_{i,t}$$

where $A_{i,t-1}^j$ and $A_{i,t-1}^k$ are respectively dummy variables for liquidity and analyst coverage. t-statistics are shown in parentheses. Estimates with 5% statistical significance are in bold face.

Panel A:	Least coverage	Moderate coverage	Most coverage
	0.154	**0.112**	**0.096**
	(4.79)	(3.94)	(3.13)
Panel B:	Least liquid	Moderately liquid	Most liquid
	0.180	**0.115**	**0.079**
	(5.73)	(4.07)	(2.62)
Panel C:	Least liquid	Moderately liquid	Most liquid
Least analyst coverage	**0.200**	0.088	0.107
	(5.14)	(1.76)	(1.73)
Moderate analyst coverage	**0.152**	**0.090**	0.074
	(3.90)	(2.54)	(1.67)
Most analyst coverage	**0.144**	**0.159**	0.051
	(2.58)	(4.31)	(1.50)

Further dissecting the industries using finer subgroups, we see more interesting results. Panel C reports average returns from long-short portfolios in each double-sort industry group and differences in returns between top and bottom tertiles. Among the industries with least analyst coverage, we see significant differences between returns from most liquid and most illiquid industries. On the other hand, return differences among the analyst coverage portfolios are either non-existent or show signs that are the opposite of the difference expected from the information theory.

In support of the double sort analysis, I conducted additional regression analysis controlling for known factors of cross-predictability. Results are reported in Table 3.4. The additional regression analysis confirms what we found in the double sort analysis. The least liquid industries show predictability in all groups while most liquid industries show little predictability. It is interesting to see that Fama-MacBeth regression results in Panel A are in line with the results in existing literature. However, I interpret this result a little differently that analyst coverage alone could be picking up variations in liquidity levels of industries. Once we considered liquidity as well as analyst coverage, I see in Panel C that most of the variation in predictability can be explained with the different levels of liquidity.

3.4 What type of information is most useful in cross-predictability?

Previous literature focused on characteristics of industries whose returns were to be predicted. Such characteristics are useful in exploring the underlying reason for the cross-predictability, but only shed lights on one side of a two sided problem. If one industry's returns can be predicted, analysis of the information that enables the cross-prediction would complete the picture. Up to this point, I have established that economically linked industries' past returns cross-predict an industry's returns, and that certain industries are more predictable than others, but haven't said anything about which economically linked industry provides the most valuable information on future returns.

To answer this question, I dissect the customer industry returns into several parts in a meaningful way. As a first step, I separate the economically linked industries into five groups according to their economic dependence. Since the customer returns are basically an economic link weighted average of customer industry returns and a successful predictor of future return, it is expected and confirmed that we see the most useful information from industries with greater linkages.

Now, we take the analysis a step further, in a more meaningful way, by looking at characteristics within the group of industries with the most significant economic linkages. In this analysis, we look at two aspects, namely analyst co-coverage and institutional co-ownership. This type of analysis is not possible with the major customer data of Cohen and Frazzini (2008) because there is not large enough number of customers to conduct such analysis. BEA's Use table used in Menzly and Ozbas (2010) was more suitable for this type of analysis, but such was never carried out in their paper. The advantage of this data is that there are large numbers of linked industries across different countries with varying levels of interesting characteristics.

By dissecting and sorting the past information, we should be able to answer more questions about how and why we see cross-predictability, because we will be able to distinguish information that is useful from that which is not if there is meaningful variation among the measures used.

Table 3.5 reports Fama-MacBeth regression results where analyst co-coverage is used to group economically linked industries. In the first column of Table 3.5, we see that most of the

Table 3.5: Source of cross-predictability and analyst co-coverage

Dependent variables are industry returns. Explanatory variables are decomposed international customer portfolio returns in the previous month. Explanatory variables are constructed using past month stock returns of trade-linked industries similar to the construction of the customer return, however the linked industries are now decomposed into several groups and explanatory variables are created for each group of linked industries. In regression specifications (1), (2), and (3), international customers are divided into ten groups: five groups by trade links, with each trade link group divided into two groups, one with common analyst house coverage and the other without. In specification (4), I further divide the high trade linked customer industry group into five sub groups according to number of co-covering analyst houses. Previous month industry stock returns of each subgroup of customer industries are averaged and are used as explanatory variables.

	(1)	(2)	(3)	(4)
Constant	**0.024**	**0.020**	**0.011**	**0.039**
	(3.89)	(3.39)	(2.73)	(3.54)
CR Q1 Low trade link, w/o common coverage	**-0.271**	**-0.489**		**-0.310**
	(-2.97)	(-4.41)		(-2.94)
CR Q2 trade link, w/o common coverage	-0.015	-0.012		-0.027
	(-1.11)	(-0.77)		(-1.68)
CR Q3 trade link, w/o common coverage	0.004	-0.009		0.005
	(0.28)	(-0.64)		(0.33)
CR Q4 trade link, w/o common coverage	-0.004	-0.002		-0.011
	(-0.32)	(-0.17)		(-0.75)
CR Q5 High trade link, w/o common coverage	**0.027**	**0.041**		
	(2.08)	(2.91)		
CR Q1 Low trade link, w/ common coverage	-0.029		-0.028	**-0.161**
	(-0.92)		(-0.92)	(-2.07)
CR Q2 trade link, w/ common coverage	0.022		0.030	0.011
	(1.33)		(1.71)	(0.38)
CR Q3 trade link, w/ common coverage	-0.025		-0.020	-0.014
	(-1.48)		(-1.19)	(-0.45)
CR Q4 trade link, w/ common coverage	0.015		0.027	0.047
	(0.89)		(1.51)	(1.53)
CR Q5 High trade link, w/ common coverage	**0.113**		**0.135**	
	(4.55)		(5.07)	
CR Q5 High trade link, Low common coverage				0.019
				(1.12)
CR Q5 High trade link, 2 common coverage				**0.028**
				(2.48)
CR Q5 High trade link, 3 common coverage				0.031
				(1.87)
CR Q5 High trade link, 4 common coverage				**0.045**
				(2.16)
CR Q5 High trade link, High common coverage				**0.048**
				(2.06)
Avg adj R2	0.0333	0.0143	0.0201	0.0525
Number of obs	115826	168230	115900	70090

Table 3.6: Source of cross-predictability and co-ownership

Dependent variables are industry returns. Explanatory variables are decomposed international customer portfolio returns in the previous month. Explanatory variables are constructed using past month stock returns of trade-linked industries similar to the construction of the customer return, however the linked industries are now decomposed into several groups and explanatory variables are created for each group of linked industries. In regression specifications (1), (2), and (3), international customers are divided into ten groups: five groups by trade links, with each trade link group divided into two groups, one with common institutional ownership and the other without. In specification (4), I further divide the high trade linked customer industry group into five sub groups according to number of common institutional ownership measures. Previous month industry stock returns of each subgroup of customer industries are averaged and are used as explanatory variables.

	(1)	(2)	(3)	(4)
Constant	**0.040**	**0.023**	**0.030**	**0.048**
	(3.52)	(3.26)	(3.25)	(2.92)
CR Q1 Low trade link, w/o common ownership	-0.136	**-0.296**		-0.135
	(-1.54)	(-2.48)		(-1.46)
CR Q2 trade link, w/o common ownership	-0.014	-0.014		-0.020
	(-1.02)	(-0.87)		(-1.25)
CR Q3 trade link, w/o common ownership	-0.012	-0.027		0.003
	(-0.84)	(-1.83)		(0.21)
CR Q4 trade link, w/o common ownership	-0.019	0.002		-0.013
	(-1.39)	(0.13)		(-0.99)
CR Q5 High trade link, w/o common ownership	0.001	**0.038**		
	(0.04)	(2.07)		
CR Q1 Low trade link, w/ common ownership	-0.093		-0.143	-0.196
	(-0.70)		(-1.10)	(-1.00)
CR Q2 trade link, w/ common ownership	0.055		0.045	0.044
	(1.65)		(1.39)	(1.12)
CR Q3 trade link, w/ common ownership	0.034		0.025	0.011
	(0.94)		(0.74)	(0.25)
CR Q4 trade link, w/ common ownership	0.008		0.017	0.037
	(0.24)		(0.52)	(0.93)
CR Q5 High trade link, w/ common ownership	**0.195**		**0.195**	
	(4.67)		(4.51)	
CR Q5 High trade link, Low common ownership				-0.007
				(-0.36)
CR Q5 High trade link, 2 common ownership				0.015
				(1.02)
CR Q5 High trade link, 3 common ownership				**0.055**
				(2.85)
CR Q5 High trade link, 4 common ownership				**0.051**
				(2.14)
CR Q5 High trade link, High common ownership				**0.086**
				(2.82)
Avg adj R2	0.0249	0.0100	0.0172	0.0350
Number of obs	73315	95616	74901	67340
Avg NOB	632.0	783.7	645.7	580.5

predictions are coming from industries with high trade links, whether the industries are co-covered by analyst houses or not. Interestingly, the magnitude of the coefficient to the past return of industries that are commonly covered by at least one analyst house is greater than that of the coefficient to industries that are not covered. The second and third columns demonstrate again that high trade link industries are the most important predictor. The fourth and fifth columns use a group of industry returns sorted according to the co-coverage measure, which is the number of analyst houses covering both the predicted industry and the linked industries. In line with what we find in the first column, we see monotone increasing importance of past returns of linked industries as levels of co-coverage increase. This result, however, is not in line with the existing information explanation of cross-predictability, because information for the connected industries is likely to be known by investors since it is covered by the same analyst houses.

I do a similar analysis on the level of institutional co-ownership and report results in Table 3.6. For pairs of industries, institutional co-ownership is measured as the sum of the product of portfolio weights of the first industry and second industries in an institution's equity portfolio. The sum is taken for all of the institutions that hold both industries. This measure is designed to reflect connectedness via institutional ownership and is greater as more institutions hold both industries in their portfolios, and as the industries' weights are larger in their portfolio. Varying levels of predictability across the co-ownership measure may also serve as a proxy for the level of informational barriers between industries. Institutional investors pay attention to and act upon what is happening in parts of their portfolios; hence there would be much less of an informational barrier between industries in their portfolios.

The results in Table 3.6 are in line with what we found using co-coverage of industries by analysts. Past return information for industries with the largest economic linkages, and that are commonly owned by institutional investors, is the most relevant information in predicting future returns of industries. These results lend themselves to the following interpretations. First, the most useful predictors are known by investors. Second, institutional investors are slow to react to useful information at hand.

Under the slow diffusion of information theory, the most useful predictor would be information from industries that are most economically dependent, yet not likely followed by investors. However, regression results in Table 3.5 and Table 3.6 suggest otherwise. These results open a new possible explanation involving institutional investors, which we are going to explore in the sections that follow.

3.5 Institutional investor trading, illiquidity, and cross-predictability

In previous sections I have established that the most useful information is likely to be already known by institutional investors and that liquidity of an industry may play a more important role than the level of attention an industry receives or level of segmentation. In this section, I am going to present evidence of slow reactions by the most sophisticated investor group, namely institutional investors trading illiquid industry portfolios.

It is generally accepted that institutional investors are sophisticated investors and that, most of the time, they make informed decisions. In previous literature on cross-predictability of economically linked stocks/industries, institutional investors were considered to make informed decisions. I find a similar result: that institutional investors in international settings react to useful information. Moreover, I add to the existing finding that there are some industries that do not act as intelligently in trading as others, which could possibly explain the cross-predictability we see in certain type of industries.

An informed trader would acknowledge cross-linkages between international industries and trade based on positive signals observed in linked industries. Moreover, investors will trade the relevant industries simultaneously in order to fully utilize the information. We test these two implications and further explore the cases where institutional investors do not behave as informed traders.

In order to test the simultaneous trading of related industries by institutional investors, I estimate panel regression of the following form:

$$\Delta IO_{i,t} = \alpha_i + \gamma_t + \beta^{customer} \Delta IO_{i,t}^{customer} + \delta \, \Delta IO_{i,t-1} + e_{i,t}$$

where $\Delta IO_{i,t}$ is change of institutional ownership of industry i and $\Delta IO_{i,t}^{customer}$ is changes in institutional ownership in customer industries. The change of institutional ownership of customer industry is calculated in a way that is analogous to customer and supplier industry returns. To test whether institutional investors trade the same way across industries with different liquidity levels, I interact the liquidity dummy variables with the changes of institutional ownership in the customer industry. I include industry-level fixed effects α_i and quarter fixed effects γ_t to control for unobserved heterogeneity across different industries and systematic fund inflows over time. A lag of change of institutional ownership is included to control for persistence in change of ownership by institutional investors.

Results are reported in Table 3.7. In line with results found in previous literature, I also find evidence of simultaneous trading of related industries, as seen in the first and second columns of Table 3.7. Interestingly, however, institutional investors do not behave the same way with illiquid industries. The third and fourth columns of the table report estimation results of the above regression using interactions of change of customer industries institutional ownership with

Table 3.7: Institutional investors and informed trading

This table reports estimates from panel regressions. The dependent variables are quarterly changes of institutional ownership in the country-industry portfolio. The explanatory variables are previous quarter's change of institutional ownership in the country-industry portfolio, quarterly change of institutional ownership in the customer industry, and its interaction terms with dummies representing liquidity levels. Country-industry fixed effects and time fixed effects are controlled for in all regressions.

		(1)	(2)	(3)	(4)
d_IO_customer(t)		**0.079**	**0.080**		
		(3.37)	(3.39)		
d_IO_customer(t)	× Q1 least liquid			**-0.246**	**-0.227**
				(-6.18)	(-5.50)
	Q2			0.001	0.004
				(0.01)	(0.08)
	Q3			**0.206**	**0.186**
				(5.56)	(4.77)
	Q4			**0.157**	**0.131**
				(4.08)	(3.28)
	Q5 most liquid			**0.178**	**0.196**
				(5.19)	(5.53)
d_IO_customer(t-1)	× Q1 least liquid				0.006
					(0.14)
	Q2				0.061
					(1.26)
	Q3				**0.130**
					(3.12)
	Q4				**0.158**
					(3.89)
	Q5 most liquid				0.009
					(0.23)
d_IO(t-1)			**0.048**	**0.047**	**0.046**
			(8.28)	(8.19)	(8.02)
R squared		0.0688	0.0709	0.0746	0.0753
Number of observations		30949	30947	30947	30947

Table 3.8: Action of Institutional Investors

This table reports estimates from panel regressions. The dependent variables are quarterly changes of institutional ownership in the country-industry portfolio. The explanatory variables are previous quarter's change of institutional ownership in the country-industry portfolio, customer industry portfolio returns, their interaction terms with dummies representing liquidity levels, and positive and negative customer industry returns. Country-industry fixed effects and time fixed effects are controlled for in all regressions.

		(1)	(2)	(3)	(4)
CR(t)		**0.016**			
		(5.37)			
CR_pos(t)			**0.013**		
			(3.16)		
CR_neg(t)				**0.029**	
				(5.28)	
CR(t)	× Q1 least liquid				0.004
					(0.92)
	Q2				**0.012**
					(3.04)
	Q3				**0.023**
					(5.86)
	Q4				**0.017**
					(4.30)
	Q5 most liquid				**0.025**
					(6.52)
CR(t-1)		**0.006**			
		(2.14)			
CR_pos(t-1)			**0.009**		
			(2.38)		
CR_neg(t-1)				0.001	
				(0.26)	
CR(t-2)		0.001			
		(0.36)			
CR_pos(t-2)			0.001		
			(0.24)		
CR_neg(t-2)				0.001	
				(0.14)	
d_IO(t-1)		**0.047**	**0.048**	**0.048**	**0.048**
		(8.19)	(8.23)	(8.25)	(8.31)
R squared		0.0716	0.0711	0.0714	0.0727
Number of observations		30947	30947	30947	30947

Table 3.9: Action of Institutional Investors

This table reports estimates from panel regressions. The dependent variables are quarterly change of institutional ownership in the country-industry portfolio. The explanatory variables are the previous quarter's changes of institutional ownership in the country-industry portfolio, positive and negative customer industry portfolio returns, and their interaction terms with dummies representing liquidity levels. Country-industry fixed effects and time fixed effects are controlled for in all regressions.

		(1)	(2)	(3)	(4)
CR_pos(t)	× Q1 least liquid	-0.001 (-0.10)	-0.001 (-0.25)		
	Q2	0.010 (1.84)	0.009 (1.50)		
	Q3	**0.021** (3.91)	**0.019** (3.51)		
	Q4	**0.017** (3.17)	**0.017** (3.08)		
	Q5 most liquid	**0.020** (3.66)	**0.020** (3.67)		
CR_neg(t)	× Q1 least liquid			0.010 (1.50)	**0.016** (2.31)
	Q2			**0.021** (3.14)	**0.020** (2.84)
	Q3			**0.035** (5.31)	**0.032** (4.56)
	Q4			**0.027** (4.16)	**0.023** (3.38)
	Q5 most liquid			**0.043** (6.68)	**0.045** (6.65)
CR_pos(t-1)	× Q1 least liquid		**0.011** (2.01)		
	Q2		**0.012** (2.37)		
	Q3		**0.010** (2.14)		
	Q4		0.006 (1.16)		
	Q5 most liquid		0.004 (0.82)		
CR_neg(t-1)	× Q1 least liquid				**-0.015** (-2.16)
	Q2				0.003 (0.37)
	Q3				0.008 (1.16)
	Q4				0.010 (1.44)
	Q5 most liquid				-0.003 (-0.47)
d_IO(t-1)		**0.048** (8.25)	**0.048** (8.22)	**0.043** (6.68)	**0.048** (8.25)
R squared		0.0714	0.0717	0.0724	0.0730
Number of observations		30947	30947	30947	30947

liquidity level dummies. The results indicate that moderately to highly liquid industries are traded simultaneously with customer industries, but do not behave the same way as illiquid industry groups.

I do an additional analysis replacing changes of ownership of customer industries with returns. This analysis is designed to measure the responsiveness of institutional investors to useful information. If institutional investors are behaving as informed traders, they will react positively to the current period customer returns because these returns are known to predict future returns of an industry portfolio. I also include the previous quarter's customer returns to assess responsiveness to past information, as well as to current information. Responding to past information would indicate that investors are not reacting to a signal to the full extent. In the following analysis, I separate customer returns into positive and negative customer returns to see if institutional investors react differently to positive and negative signals from economically linked industries.

Estimation results analyzing institutional investor reaction to customer industry returns are reported in Tables 3.8 and 3.9. Results in the first column of Table 3.8 indicate that institutional investors indeed react to current signals from customer industries. Moreover, we see evidence of lagged response to past signals. Results from separating positive and negative signals are reported in the second and third columns of the table, and we see that there is no evidence of lagged response to negative signals from customer industries, yet there are some lagged responses to positive signals. So, we could deduce that lagged responses are likely to come from positive signals. Lagged responses to positive signals are in line with what I find in the section on portfolio formation. We saw that most predictability or profit came from the long leg of the long-short portfolio, and that the selection of industries in the long leg portfolio was in the top quintile, sorted by customer industries.

The fourth column of Table 3.8 also reports results similar to the change of institutional ownership according to liquidity levels. In line with what I found in Table 3.7, we see institutional investors do not react to customer industry signals when trading the least liquid industries.

One may argue the non-existence of reaction in the most illiquid stocks may be in the nature of how institutional investors trade illiquid industries, and not related to lack of informed trading or slow reaction. To address this issue, I provide two additional results that shed light on institutional investor behavior and illiquid industries. In Table 3.8 we see that institutional investors react to negative customer returns in the way that an informed trader would, and lagged reaction to positive customer returns. If it is simply that institutional investors do not adjust their holdings of the most illiquid stocks for whatever reason, then these investors should not react to negative customer industry returns, either, and moreover should not show lagged reaction to positive customer industry returns. On the other hand, if institutional investors show immediate reaction to some signals and lagged reaction to other signals in trading illiquid industries, we would have more support to our explanation.

To test this prediction, I estimate institutional investors' change of holdings of industry portfolios in reaction to positive and negative customer industry returns for different levels of illiquidity. Estimated results are reported in Table 3.9. In this regression analysis we see evidence of immediate responses to negative signals from customer industries, even for the most illiquid industries (see column 3 and 4) and lagged responses to the positive signals concentrated in illiquid industries. These results are in line with our initial conjecture that cross-predictability is caused by lagged response in illiquid industry portfolios.

4. Conclusion

This paper demonstrates that industry stock returns can be predicted from internationally linked industries, and finds that slow reaction to known information is more likely to be an explanation for cross-predictability, rather than slow information diffusion or investor inattention.

Trading strategies utilizing this cross-predictability result in monthly returns as high as 1.57%, with a significant part of these returns coming from the long leg of the long-short portfolio. We see greater returns from trading strategies in the latter sample where snapshots of the economic linkage are more accurate and trade volume is greater.

The international testing ground in my paper is suitable for testing existing theories of cross-predictability because the conditions upon which these theories rely, such as informational segmentation, illiquidity, and other market friction, are more natural in international settings. I explore possible explanations for cross-predictability, including slow information diffusion and slow price reaction due to liquidity. Among these possible explanations, I see liquidity explanation as most in line with my findings. According to my findings, the existing theory of investor inattention doesn't fully explain the predictability because the most relevant information for the prediction was likely to be known by investors, either by analyst co-coverage or institutional co-ownership. Moreover, I find evidence that institutional investors do not promptly react to signals obtained from linked industries when trading illiquid industries, while they quickly react to news, hence behaving more like informed traders, when trading liquid industries. Lagged reactions were most prominent in most illiquid industries in response to positive signal from their linked industries, but not so much for negative signals. Such lagged reactions to positive signals by investors are in line with the fact that most of the cross-predictability is coming from the long leg of the long-short portfolio.

REFERENCES

Bae, Keehong, Arzu Ozoguz, and Hongping Tan, forthcoming, Do foreigners facilitate information transmission?, *Journal of Financial Economics*.

Bartram, Söhnke M., John Griffin, and David Ng, 2010, How Important are Foreign Ownership Linkages for International Stock Returns, *Working Paper*.

Bekaert, Geert, Campbell Harvey, and Christian Lundblad, 2007, Liquidity and Expected Returns: Lessons from Emerging Markets, *Review of Financial Studies* 20, 1783-1831.

Bekaert, Geert, Campbell Harvey, Christian Lundblad, and Stephan Siegel, 2007, Global growth opportunities and market integration, *The Journal of Finance* 62 (3), 1081-1137

Bekaert, Geert, Campbell Harvey, Christian Lundblad, and Stephan Siegal, 2011, What Segments Equity Markets?, *Review of Financial Studies* 24, 3841-3890.

Cohen, Lauren and Andrea Frazzini, 2008, Economic links and predictable returns, *Journal of Finance* 63 (4), 1977-2011.

Fama, Eugene and Kenneth French, 2012, Size, value, and momentum in international stock returns, *Journal of Financial Economics* 105, 457-472.

Fan, Joseph, and Larry Lang, 2000, The measurement of relatedness: An application to corporate diversification, *Journal of Business* 73, 629-660.

Griffin, John, Patrick Kelly, and Federico Nardari, 2009, Do Market Efficiency Measures Yield Correct Inferences? A Comparison of Developed and Emerging Markets, *The Review of Financial Studies* 23(8), 3225-3277.

Hong, Harrison, Walter Torous, and Rossen Valkanov, 2007, Do industries lead stock markets?, *Journal of Financial Economics* 83, 367-396.

Hou, Kewei, 2007, Industry information diffusion and the lead-lag effect in stock returns, *Review of Financial Studies* 20, 1113-1138.

Hou, Kewei, and Tobias Moskowitz, 2005, Market frictions, price delay, and the cross-section of expected returns, *Review of Financial Studies* 18, 981–1020.

Lesmond, David A., 2005, Liquidity of Emerging Markets, Journal of Financial Economics 77, 411–52.

Lesmond, David, Joseph Ogden, Charles Trzcinka, 1999, A new estimate of transaction costs, *Review of Financial Studies* 12, 1113–1141.

Lo, Andrew, and A. Craig MacKinlay, 1990, When are contrarian profits due to stock market overreaction?, *Review of Financial Studies* 3, 175–205.

Menzly, Lior and Oguzhan Ozbas, 2010, Market segmentation and cross-predictability of returns, *Journal of Finance* 65(4), 1555-1580.

Rizova, Savina, 2011, Predictable trade flows and returns of trade-linked countries, Working paper.

Shleifer, Andrei, and Robert Vishny, 1997, The limits of arbitrage, *Journal of Finance* 52, 35-55.

Table A3.1: Industry classification

Industries	Description	French SIC30	GTAP industries
1	Food Products	1	pdr,wht,gro,v_f,osd,c_b,pfb,ocr,ctl,oap, rmk,wol,fsh,cmt,omt,vol,mil,pcr,sgr,ofd
2	Beer & Liquor, Tobacco Products	2,3	b_t
3	Recreation	4	ros
4	Printing and Publishing	5	ppp
5	Apparel	7	wap, lea
6	Chemicals	9	crp
7	Textiles	10	tex
8	Construction and Construction Materials	11	for,lum,nmm,cns
9	Steel Works Etc	12	i_s,nfm
10	Fabricated Products and Machinery	13	fmp,ome,omf
11	Electrical Equipment, Business equipment	14, 23	ele
12	Automobiles and Trucks	15	mvh
13	Aircraft, ships, and railroad equipment	16	otn
14	Precious Metals, Non-Metallic, and Industrial Metal Mining	17	omn
15	Coal	18	col
16	Petroleum and Natural Gas	19	oil,gas,p_c
17	Utilities	20	ely,gdt,wtr
18	Communication	21	cmn
19	Personal and Business Services	22	obs,dwe
20	Transportation	25	otp,wtp,atp
21	Wholesale, Retail	26, 27	trd
22	Banking, Insurance, Real Estate, Trading	29	ofi,isr
23	Everything Else	6, 8, 24, 28, 30	osg

Table A3.2: Time-series averages of market capitalization

Time-series averages of market capitalization for all firms in the country-industry portfolio in billions USD. Sample period is from January 1980 to March 2009

(continued)

Country	Food	Beer & Tobacco	Recreation	Printing and publishing	Apparel	Chemicals	Textile	Construction	Steel works	Machinery	Electrical & Business equip	Auto
Argentina	1.32	0.41		0.02	0.16	0.39		0.54	3.61	0.10		0.29
Australia	7.21	6.48	4.61	3.99	0.36	4.02	0.07	6.27	7.54	0.58	0.94	0.88
Austria	0.63	0.37	0.80			0.50	0.07	2.56	2.25	0.83	0.41	0.50
Belgium	0.68	7.18	0.23	0.35	0.38	5.30	0.23	2.48	1.61	0.19	1.68	
Brazil	1.96	9.26	0.07	0.16	0.83	42.54	2.98	18.30	14.60	1.03	1.82	25.93
Canada	7.55	9.75	0.40	16.09	0.14	4.33	0.62	5.00	3.91	2.43	35.66	4.53
Chile	2.57	2.93	0.32	0.06		1.11	0.12	2.77	2.72		0.02	
China	11.77	14.26	8.75	1.03	3.13	27.93	6.21	15.43	41.98	15.92	32.88	17.14
Colombia	1.20	2.09	0.05				0.09	3.04	0.10	0.02		
Czech Republic	0.03	0.68	0.01			0.06	1.17	0.07				
Denmark	0.64	1.90	0.77	0.20	0.31	3.57	0.08	1.96	0.60	3.77	1.25	0.05
Finland	0.71	0.48	0.81	1.70	0.10	1.56	0.30	1.49	3.96	6.79	57.93	1.82
France	19.16	7.64	8.32	2.29	24.03	12.61	0.40	28.67	12.01	13.19	44.24	17.51
Germany	4.41	2.42	1.45	2.55	6.16	27.27	0.43	16.47	9.99	11.49	50.09	70.42
Greece	5.26	0.45	3.00	1.00	0.20	0.34	0.51	4.99	2.91	0.34	0.67	
Hong Kong	4.67	1.44	2.18	1.91	3.62	2.72	1.49	6.61	5.62	2.64	9.70	1.91
Hungary	0.04	0.08			0.00	0.52	0.01	0.05		0.06		0.09
India	4.44	9.65	0.67	0.57	0.42	8.90	3.07	21.61	25.17	15.10	7.98	11.44
Indonesia	3.81	5.47	0.15	0.04	0.23	1.20	0.64	3.85	0.25	0.08	0.01	1.67
Ireland	2.92	2.44	0.73	0.86		0.04		6.10			0.13	
Italy	2.58	1.00	1.90	6.04	2.70	0.99	0.77	4.66	2.20	4.05	2.46	10.78
Japan	62.56	32.78	159.67	15.58	12.95	107.38	20.64	132.96	108.96	135.93	254.56	247.06
Korea	4.70	3.08	33.99	0.32	0.92	6.62	1.70	14.93	15.32	4.71	18.59	11.40
Malaysia	13.07	2.89	5.46	0.93	0.18	1.45	0.35	9.05	2.23	1.33	1.74	3.54
Mexico	8.70	4.37	0.13	0.01	0.04	0.64	0.07	5.03	0.96	0.01		0.09
Morocco	3.08	0.40				0.11		2.65	0.58		0.06	0.02
Netherlands	4.10	9.21	20.49	10.85	0.05	10.76		3.63	8.68	5.17	3.73	0.34
New Zealand	0.48	0.08	0.03	0.06	0.05	0.18	0.11	2.82	0.16	0.11	0.15	
Peru	0.57	0.98		0.03		0.05	0.08	0.74	0.23	0.00	0.00	0.00
Philippines	0.64	2.10	0.16	0.08		0.06	0.01	0.77	0.12		0.13	
Poland	0.57	1.25	0.16	0.86	0.29	1.09	0.09	1.99	0.77	0.79	1.01	0.42
Portugal	0.15	0.18	0.14	0.17		0.14	0.03	5.78		0.01	0.09	0.17
Singapore	4.43	1.41	0.40	4.27	0.40	0.34	0.28	3.54	1.04	1.33	4.52	1.31
Spain	3.33	0.42	0.11	1.88	0.30	1.53	0.12	39.25	3.17	4.62	0.42	0.67
Sweden	0.68	1.77	0.49	1.11	11.26	1.84	0.02	7.56	2.87	12.19	30.85	8.99
Switzerland	2.61	0.08	0.17	0.50	0.06	2.04		1.53	0.40	6.49	3.38	0.40
Taiwan	5.10	0.03	4.53	0.08	2.84	29.21	8.88	11.22	15.59	2.54	159.41	5.83
Thailand	2.22		0.40	0.41	0.50	5.49	0.34	3.33	0.90	0.19	1.84	0.37
Turkey	1.19	1.32	0.71	1.43	0.07	1.89	0.50	5.40	2.10	0.16	1.06	3.14
United Kingdom	58.61	97.36	18.75	42.79	3.04	24.32	2.87	43.89	9.28	18.16	37.04	11.29
United States	253.03	109.24	122.93	77.29	28.17	140.51	7.95	100.06	64.26	308.46	832.25	107.96
Number of countries with the industry	41	40	37	36	32	40	36	41	37	36	36	33

(continued)

Country	Air craft, ships, railroad	Precious Metals	Coal	Petroleum & Natural gas	Utililities	Communication	Personal & Bus Srv	Transportation	Wholesale, retail	Finance	Everything else	Num industries in a country
Argentina				15.29	1.28	8.90	0.06	0.01	0.27	4.11	0.09	17
Australia	0.26	58.31	3.92	13.51	6.15	26.65	13.36	8.26	23.82	76.51	15.41	23
Austria				5.39	4.60	6.75	1.07	1.35	0.65	15.11	1.77	18
Belgium	0.08	0.06	0.01	6.13	14.41	4.14	0.65	0.98	7.49	40.26	5.11	22
Brazil	2.10	24.68		31.64	29.08	17.65	0.93	2.75	10.69	34.41	3.94	22
Canada	1.71	62.31	0.34	91.83	15.71	28.20	11.42	9.95	17.20	116.69	13.61	23
Chile		0.65	0.07	8.88	21.03	5.81	0.37	2.53	8.33	11.33	4.19	19
China	3.84	8.52	8.44	35.37	34.01	7.86	6.22	36.51	24.55	75.94	36.42	23
Colombia		0.08			1.44	0.37	0.04	0.02	0.69	6.60	0.28	15
Czech Republic				0.85	10.74	5.77	0.01		0.24	2.96	0.69	13
Denmark	0.09	0.06			0.48	6.64	1.44	11.56	1.48	18.49	14.82	21
Finland		1.86		2.66	10.35	8.58	2.31	1.52	1.81	7.65	14.00	21
France	16.56	4.03		86.33	39.43	42.31	16.36	10.31	67.61	106.84	127.62	22
Germany	0.87	2.22	0.82	2.38	65.39	86.63	27.49	17.43	26.11	148.02	55.55	23
Greece	0.30	0.98		4.26	5.91	10.35	1.56	1.41	3.43	25.20	3.26	21
Hong Kong	0.78	0.73	0.78	12.41	24.01	87.68	3.17	38.00	12.12	113.13	10.67	23
Hungary				5.26	0.92	4.85	0.05		0.01	3.91	2.67	15
India	0.23	3.80	0.27	64.18	17.27	27.71	39.18	3.64	1.68	41.52	36.11	23
Indonesia		1.80	1.64	0.94	2.82	10.17	0.27	0.73	4.23	11.72	5.41	22
Ireland		0.24		0.66		0.44	0.83	2.07	1.60	16.24	5.88	15
Italy	3.21	1.50		77.32	31.19	32.93	5.52	7.56	3.71	119.33	8.74	22
Japan	4.79	4.45	0.25	32.16	131.78	191.53	77.61	141.97	222.93	488.57	279.52	23
Korea	7.36	0.65		3.46	17.91	18.23	5.56	4.48	9.70	28.89	9.00	22
Malaysia	0.34	0.36		1.77	13.89	12.13	3.12	8.45	3.77	23.03	5.62	22
Mexico		2.20		2.30		13.71		0.63	18.57	13.37	3.44	18
Morocco		0.43		0.84	0.34	14.44	0.01		0.27	6.36	0.12	15
Netherlands	0.02			70.05		23.30	7.04	6.22	22.02	49.07	3.97	19
New Zealand		0.07		0.45	2.89	6.99	0.35	2.08	2.37	0.05	1.55	20
Peru		3.76		0.35	1.66	2.07		0.03	0.27	3.41	0.01	18
Philippines	0.05	0.40	0.01	0.89	1.79	5.31	0.26	0.64	1.15	7.78	0.68	20
Poland		2.79		8.10	0.55	9.85	0.83	0.17	1.20	17.17	2.02	21
Portugal	0.12			11.50	11.68	10.01	0.64	0.07	4.70	8.31	2.06	19
Singapore	8.48		1.43	1.65	0.24	28.51	3.00	17.75	2.42	26.44	6.13	22
Spain	0.30	0.28	0.04	19.25	55.37	61.28	4.45	7.96	19.70	96.42	5.27	23
Sweden	1.43	1.35		1.34	1.54	15.04	5.73	1.91	4.16	33.65	21.08	22
Switzerland				0.07	6.05	0.11	2.52	1.39	2.70	22.67	26.96	19
Taiwan		0.10		18.83	0.56	22.86	3.42	9.33	7.26	19.34	8.18	21
Thailand	0.01	0.19	0.85	11.66	1.44	9.55	0.87	2.52	2.17	17.14	3.39	22
Turkey		0.07		2.73	1.71	8.20	0.04	1.35	3.74	15.00	3.79	21
United Kingdom	19.15	102.99	0.56	240.96	73.47	184.15	70.87	36.65	133.66	319.44	243.10	23
United States	87.68	30.15	8.65	486.08	300.82	471.15	533.08	118.97	523.45	1323.91	1170.78	23
Number of countries with the industry	24	33	16	39	38	41	39	38	41	41	41	

Table A3.3: Number of firms

Number of firms that ever existed in each country-industry portfolio. Sample period is from January 1980 to March 2009.

(continued)

Country	Food	Beer & Tobacco	Recreation	Printing and publishing	Apparel	Chemicals	Textile	Construction	Steel works	Machinery	Electrical & Business equip	Auto
Argentina	12	3		1	2	8		10	4	4		4
Australia	48	18	36	12	6	16	2	51	19	26	56	17
Austria	7	4	3			3	4	16	5	10	6	5
Belgium	7	4	3	4	1	7	5	9	7	4	12	
Brazil	21	3	5	3	4	18	10	23	22	12	9	11
Canada	24	10	25	19	2	27	3	54	19	37	115	19
Chile	19	7	7	1		6	2	13	9		1	
China	57	26	20	4	12	115	47	82	92	71	139	60
Colombia	4	2	1				3	10	2	1		
Czech Republic	1	1	1			2	2	1				
Denmark	8	5	13	5	3	8	3	21	2	12	16	3
Finland	6	2	5	10	1	3	3	8	4	16	22	3
France	50	20	46	20	22	19	12	59	24	57	115	21
Germany	19	23	47	15	12	26	14	56	14	77	133	25
Greece	31	6	6	10	5	6	18	42	19	3	10	
Hong Kong	28	7	49	15	30	24	24	44	18	24	105	10
Hungary	4	1			1	1	1	1		2		1
India	50	13	22	9	8	93	53	83	68	67	56	44
Indonesia	39	5	1	3	11	13	13	16	13	5	2	12
Ireland	8	1	1	1		1		8			1	
Italy	12	2	10	10	11	11	11	31	8	22	20	9
Japan	174	9	126	49	39	186	50	421	103	321	487	137
Korea	64	9	63	9	37	78	44	145	90	108	304	80
Malaysia	92	3	19	13	15	26	12	151	41	41	60	27
Mexico	10	1	2	1	1	3	2	9	4	2		1
Morocco	7	2				4		4	2		1	1
Netherlands	5	2	4	8	3	7		22	5	6	26	3
New Zealand	17	3	3	2	1	3	4	7	2	4	3	
Peru	19	3		1		2	4	3	3	1	1	1
Philippines	13	2	6	1		4	1	13	3		6	
Poland	16	3	1	4	6	8	4	40	10	7	16	5
Portugal	8	2	6	5		2	4	14		1	3	1
Singapore	40	2	20	14	6	17	6	49	24	44	104	5
Spain	10	5	1	4	3	4	1	23	5	7	2	3
Sweden	5	2	17	9	5	8	2	24	7	37	82	11
Switzerland	10	1	4	2	1	5		15	2	32	24	1
Taiwan	32	1	30	4	15	56	57	58	53	59	548	22
Thailand	54		14	13	12	19	14	44	25	10	25	9
Turkey	26	3	5	7	7	14	25	34	12	4	12	14
United Kingdom	83	33	165	88	30	52	31	166	24	100	218	26
United States	355	74	523	211	198	252	139	571	208	546	2176	193
Total number of firms	1495	323	1310	587	510	1157	630	2451	972	1780	4916	784

(continued)

Country	Air craft, ships, railroad	Precious Metals	Coal	Petroleum & Natural gas	Utilities	Communication	Personal & Bus Srv	Transportation	Wholesale, retail	Finance	Everything else	Total number of firms
Argentina				7	9	3	1	1	4	9	5	87
Australia	2	526	44	132	21	49	212	29	102	94	146	1664
Austria				2	7	3	10	4	7	18	15	129
Belgium	2	2	1	1	7	7	21	6	18	25	19	172
Brazil	1	3		5	39	29	8	7	23	43	25	324
Canada	9	967	20	478	31	52	237	26	85	99	172	2530
Chile		2	2	2	23	7	3	9	16	22	15	166
China	10	16	20	12	59	5	32	67	114	83	198	1341
Colombia		1			3	1	3	1	3	12	7	54
Czech Republic				2	9	2	1		1	3	5	31
Denmark	1	1			3	2	19	14	23	67	22	251
Finland		1		3	3	6	22	8	15	14	21	176
France	15	6		14	13	30	255	30	151	96	178	1253
Germany	8	7	1	4	33	24	191	26	87	130	117	1089
Greece	2	6		3	3	13	18	12	72	30	36	351
Hong Kong	3	10	7	8	19	30	97	34	115	80	125	906
Hungary				1	3	3	2		4	5	9	39
India	5	6	1	27	25	23	90	21	20	80	163	1027
Indonesia		8	5	7	2	9	13	17	29	55	40	318
Ireland		6		9		2	10	4	10	11	13	86
Italy	1	3		4	26	12	23	25	18	82	45	396
Japan	12	10	1	18	27	44	520	158	747	222	460	4321
Korea	9	4		7	12	21	128	30	98	56	216	1612
Malaysia	3	2		20	18	18	99	43	73	91	111	978
Mexico		2		1		8		4	12	16	12	91
Morocco		3		2	1	1	1		5	12	3	49
Netherlands	1			2		6	33	6	36	16	27	218
New Zealand		2		2	9	5	13	13	29	7	13	142
Peru		12		1	8	3		1	4	24	4	95
Philippines	1	14	1	10	8	9	9	6	10	41	10	168
Poland		1		4	5	13	22	2	31	24	25	247
Portugal	1			1	1	8	8	4	12	17	17	115
Singapore	11		1	19	4	7	51	34	75	43	91	667
Spain	1	2	1	3	17	7	7	7	16	28	19	176
Sweden	2	13		9	5	15	108	26	42	27	71	527
Switzerland				2	10	1	19	12	28	50	46	265
Taiwan		1		2	8	7	57	25	68	58	94	1255
Thailand	1	2	4	11	6	15	24	13	48	48	82	493
Turkey		2		1	9	1	2	3	23	28	40	272
United Kingdom	16	152	14	125	60	90	676	88	341	170	397	3145
United States	98	190	29	871	302	660	2649	408	1755	3935	3263	19606
Total number of firms	215	1983	152	1832	848	1251	5694	1224	4370	5971	6377	

Figure 3.1: Cross-sectional regression coefficients (customer)

Time series of the monthly long-short portfolio sorted based on lagged customer industry returns. For each month, the long-short portfolio is formed from a long top quintile portfolio of equal-weighted industry portfolios and a short bottom quintile portfolio. The portfolio is rebalanced each month.

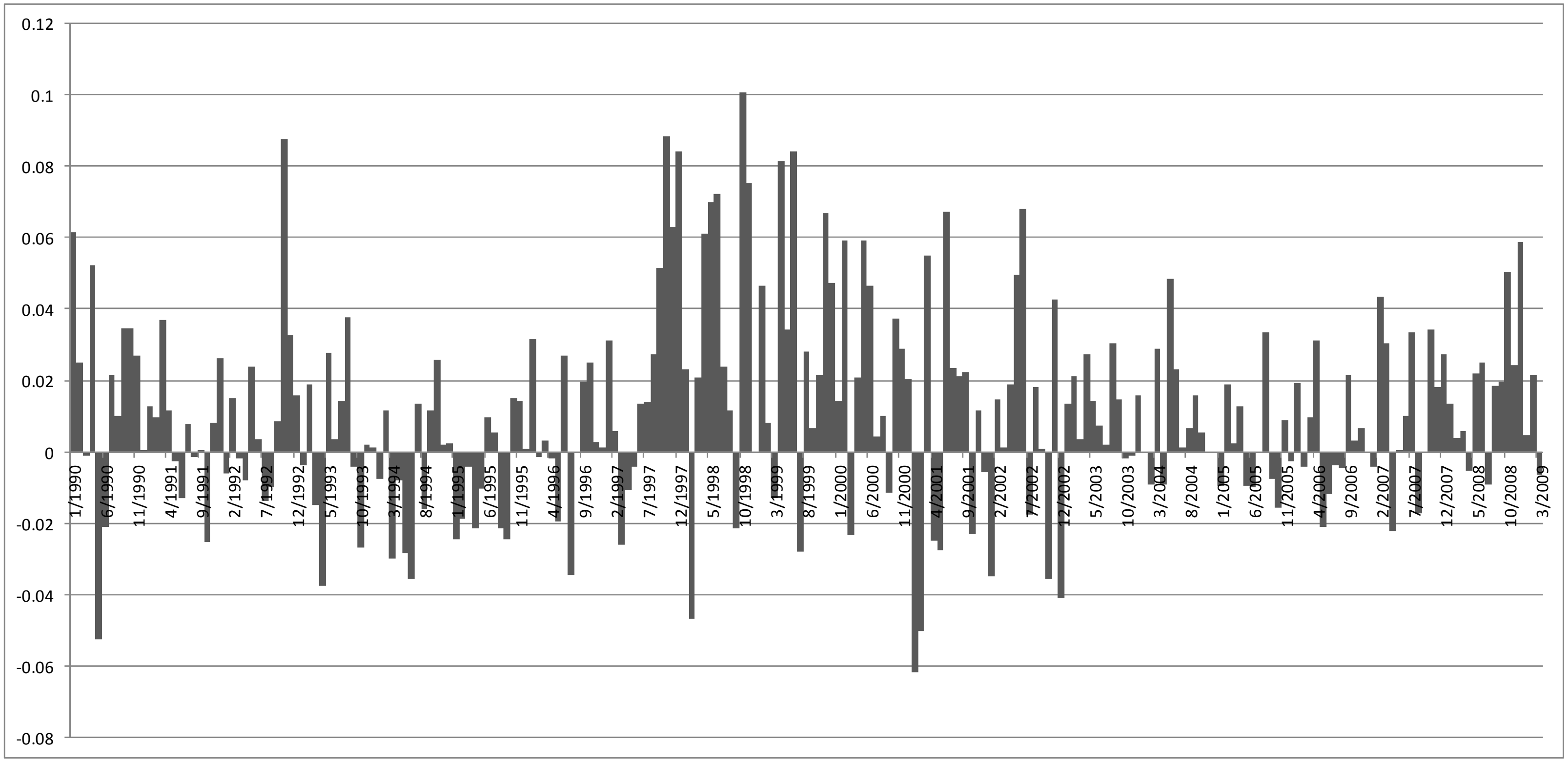
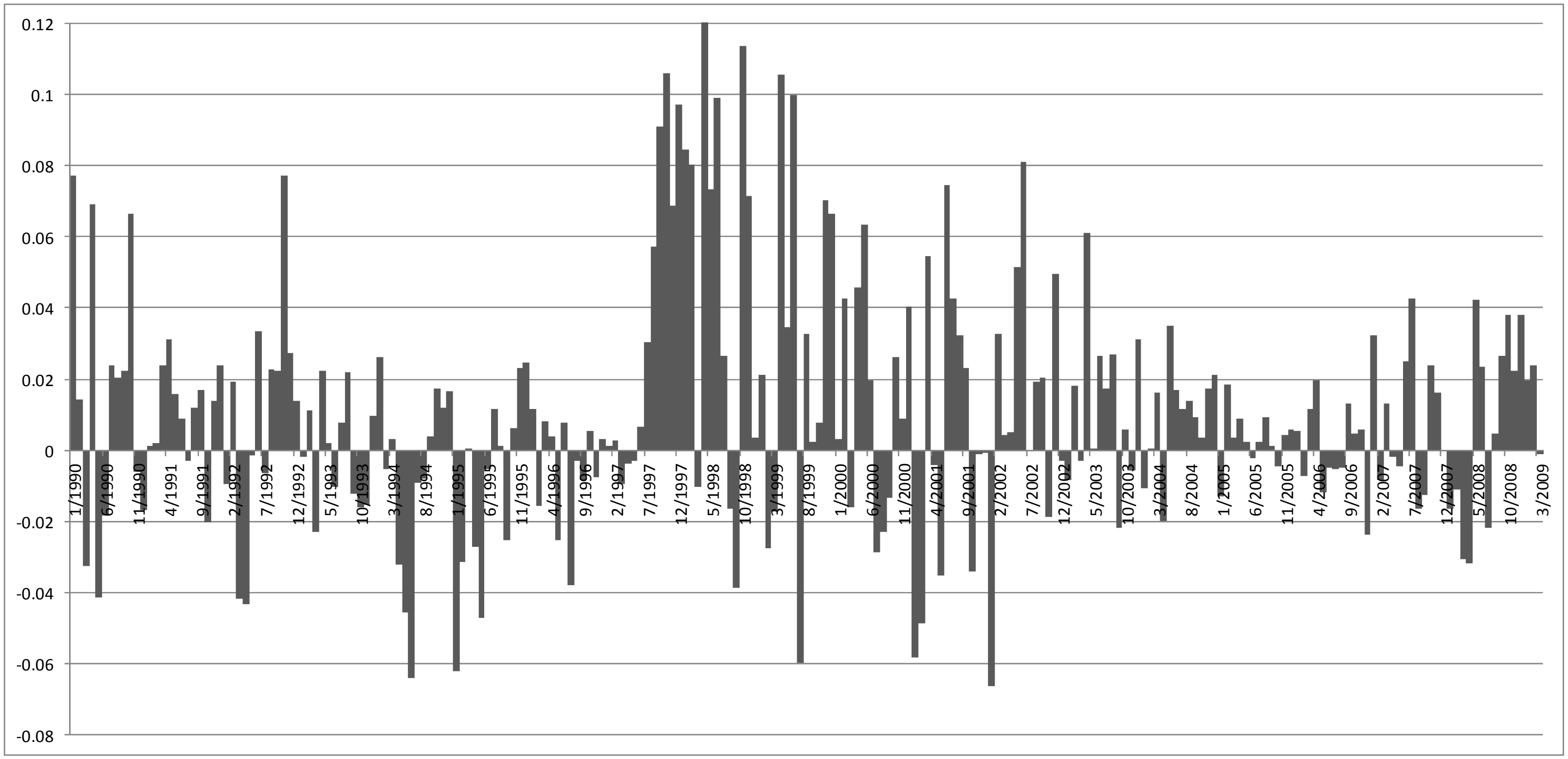


Figure 3.2: Cross-sectional regression coefficients (supplier)

Time series of the monthly long-short portfolio sorted based on lagged supplier industry returns. For each month, the long-short portfolio is formed from a long top quintile portfolio of equal-weighted industry portfolios and a short bottom quintile portfolio. The portfolio is rebalanced each month.



CHAPTER 4

INFORMATION BASED TRADING IN INDEX OPTIONS AND FUTURES

1. Introduction

The importance of information in security trading has been widely recognized by academic researchers, industry practitioners, and regulators. If private information is impounded in security prices through trading, then the outcome of trading activities may predict the future movements of security prices. The main focus of academics has been on the information content of trading activities on equities. If there are alternative linked investment vehicles, such as options and futures, which may be used by informed traders in exploiting their private information, then the trade outcome of these linked securities may portend future movements in prices of the underlying securities. As Black (1975) hypothesizes, informed traders may have greater incentive to participate in stock option trading instead of stock trading due to greater leverage and lower transaction costs that option trading offers.

Theories and models of informed trading, in general, are concerned with how private information is incorporated into asset prices. However, as Vega (2006) argues, it is possible that the private signals that an agent receives are acquired from an agent's superior processing skills of public information, such as macroeconomic news. It is this interpretation of information based trading that motivates our study on informed trading in Korea Stock Index 200 (KOSPI 200 hereafter) options and futures market. Furthermore, considering the fact that individual stock option trading is still at nascent stage and that KOSPI 200 return is dominated by a handful of index heavyweights, it is also possible that investors who possess private information concerning future returns of index heavyweights use KOSPI 200 index options and futures as trading vehicles in exploiting their private information.

In this article, using intraday trades data of KOSPI 200 options and futures from January 3, 2005 to March 20, 2009, we examine whether there is evidence of information based trading in index options and futures market. We investigate two types of intraday information based trading, directional and volatility trading. More specifically, we test whether trade imbalances in options and futures market predict intraday returns and realized volatility of KOSPI 200 index. We base our empirical design in testing directional information trading on Easley, O'Hara, and Srinivas (1998) model. Furthermore, we analyze intraday directional and volatility information based trading by investor types, domestic brokerage proprietary, individual, and foreign investors.

First, in directional information trading, we find that the trade imbalance of index options with the largest leverage, the out-of-the-money options (OTMs hereafter), is a better predictor of intraday KOSPI 200 returns compared to that of options with smaller implicit leverage. Our result agrees with the intuition that options with higher leverage are preferred vehicle to options with smaller leverage in exploiting the directional information on the underlying securities.

Secondly, we find that the trade imbalances of domestic (Korean) brokerage proprietary traders for both call and put options possess better predictability on KOSPI 200 intraday returns among investor types. To the contrary to the findings of Ahn, Kang, and Ryu (2008), we do not find convincing evidence that foreign traders possess superior information or information processing skills on macroeconomic news in index options directional trading. However, we document that the futures trade imbalances of foreigners have some predictive power on KOSPI 200 intraday return movements. In particular, we show that the futures trade imbalances of foreigners contain larger information content in predicting KOSPI 200 intraday return movements during the sub-prime mortgage crisis in the developed world (between January 2008 and March 2009). Furthermore, unlike in Kang and Park (2007) in which they find evidence for directional information based trading but not for volatility information trading, we find evidence consistent with the presence of volatility information trading in index options market. Among investor groups, the options trade imbalances of domestic brokerage proprietary traders for both call and put options contain information on future intraday KOSPI 200 realized volatility.

Our contribution to the literature is two-fold. A long line of research has been devoted to uncovering the importance of information on interrelationship between stock and options market [Manaster and Rendleman (1982); Anthony (1988); Bollen and Whaley (2004); Stephan and Whaley (1990); Easley et al. (1998); Pan and Poteshman (2006); Ni, Pan, and Poteshman (2008)]. These papers mainly focus on lead-lag relationship or linkage between equity and equity options. Our focus is on the analyses in the information content of index options/futures trading on the underlying stock index.[42] We acknowledge that we are not the first to examine information based trading in KOSPI 200 index options and futures market. The recent studies of Ahn, Kang, and Ryu (2008) and Kang and Park (2007) investigate informed trading in KOSPI 200 index options market. However, our empirical results differ from those of Ahn et al. (2008) and Kang and Park (2007) as we mentioned previously.

We also contribute to the literature in international finance. There is no consensus on the issue of whether domestic investors have informational advantage over foreign investors in trading domestic securities [Brennan and Cao (1997); Choe, Kho, and Stulz (2005); Dvorak (2005); Froot and Ramadorai (2001); Greenblatt and Keloharju (2000); Froot, O'Connell, and

[42] There are only a few empirical papers that investigate the role of information in index option trading. Pan and Poteshman (2006) examines information based trading in index options market in the US, but they find no evidence of it.

Seasholes (2001); Griffin, Nardari, and Stulz (2004)]. We re-examine the issue of informational advantage of domestic versus foreign investors in an extreme setting in the sense that we examine whether there is intraday information based trading potentially on news related to a handful of index heavyweights or on local macroeconomic fundamentals by investor type (domestic versus foreign investors). In this setting, foreign investors may be at greater informational disadvantage as local "proximity" may be critical in trading on very short-lived informational advantage.

This paper is organized as follows. Section II describes our sample. Section III introduces Easley et al. (1998) model and discusses explanatory variable construction. Section IV reports the results on directional information based trading in the index options and futures market. Section V discusses and reports the results on volatility information based trading. Section VI concludes.

2. Sample description

Our KOSPI 200 options and futures data are obtained from Korea Stock Exchange (KSE). Our data ranges from January 3rd, 2005 to March 20th, 2009. The KOSPI 200 futures debuted in May 1996, and the KOSPI 200 options started trading in July 1997. Although it is a relatively young market, the KOSPI 200 options market has grown dramatically over the past few years. The KOSPI 200 options market has been the largest derivative market in the world in terms of trading volume since 2001. As of 2008, the KOSPI 200 options market was approximately four times as large as (in terms of trading volume) the second largest derivative market in the world, the Eurodollar futures market. Over the sample period, the average daily option trading volume is approximately 10 million contracts. The KOSPI 200 futures are also fairly liquid with daily average trading volume topping 210,000 contracts during our sample period. For both KOSPI 200 options and futures, most of the trading volumes are concentrated in the nearest maturity contracts.

The KOSPI 200 options are European options, and they mature on every second Thursday in each month. On the other hand, the KOSPI 200 futures mature on second Thursday of March, June, September, and December. Both options and futures markets use cash settlement system on the day after the maturity date. The leverage of the KOSPI 200 options is 100,000 Korean Won (KRW) times the KOSPI 200 cash index level. The minimum tick size of the KOSPI 200 options is 0.05 points (5,000 KRW) for any contract with quoted price equal or larger than 3 points. The minimum tick size for the contracts with quoted price smaller than 3 points is 0.01 points (1,000 KRW). Four consecutive nearest maturity KOSPI 200 option contracts have nine different strike prices spaced evenly by 2.5 points for each maturity contracts. Further, the leverage of the KOSPI 200 futures is 500,000 KRW times the KOSPI 200 cash index level. The minimum tick size of the KOSPI 200 futures is 0.05 points (25,000 KRW).

Our data set consist of all trades and quotes (TAQ) for both KOSPI 200 options and futures between January 3rd, 2005 and March 20th, 2009. Both TAQ data are time-stamped to one hundredth of a second. The KOSPI 200 options and futures markets are order-driven electronic call markets. There are neither market makers nor liquidity providers in these markets. The regular trading hours for both options and futures markets are from 9:00 to 15:15; the KOSPI 200 cash market is open between 9:00 and 15:00. Furthermore, our data set includes trading statistics by investor categories for both options and futures. There are ten investor categories, which include individual traders, brokerage proprietary traders, and foreign traders. Trading statistics by investor categories consists of 30-second aggregation of call/put trading

Table 4.1: Summary statistics, daily options transaction amount and volume by investor type

This table reports mean, standard deviation, minimum, and maximum of daily transaction amount and volume of call and put options initiated by each investor type. Trade amount and volume of buy and sell trades are identified by the Korean stock exchange and are not estimated. Sample period is from 3 January 2005 to 20 March 2009 consisting of 1044 trading days.

			Mean	Std	Min	Max
Panel A: Transaction amount in 1 billion KRW						
Brokers	Call	Sell	100.852	41.812	22.426	353.815
		Buy	100.467	42.143	21.828	355.145
	Put	Sell	93.051	44.428	26.218	439.786
		Buy	92.562	44.046	26.038	425.128
Individuals	Call	Sell	143.700	62.458	35.385	506.595
		Buy	145.021	62.885	38.082	518.953
	Put	Sell	137.650	64.505	39.635	457.761
		Buy	139.238	66.630	39.542	505.420
Foreigners	Call	Sell	122.619	88.918	19.518	593.434
		Buy	121.913	88.272	18.888	568.883
	Put	Sell	143.905	119.011	21.631	938.660
		Buy	142.923	116.479	21.286	952.858
All investor	Call		380.093	175.427	92.595	1293.826
	Put		388.116	220.338	105.168	1722.169
Brokers / All Investors			0.271	0.068	0.086	0.409
Individuals / All Investors			0.380	0.049	0.214	0.527
Foreigners / All Investors			0.317	0.104	0.124	0.627
Panel B: Traded volume in million						
Brokers	Call	Sell	2.115	1.191	0.197	8.181
		Buy	2.056	1.142	0.191	7.520
	Put	Sell	1.755	1.129	0.243	7.654
		Buy	1.698	1.084	0.244	7.032
Individuals	Call	Sell	2.007	1.081	0.354	6.839
		Buy	2.078	1.120	0.376	6.944
	Put	Sell	1.712	0.945	0.323	7.018
		Buy	1.771	0.980	0.303	7.108
Foreigners	Call	Sell	0.983	0.544	0.191	3.189
		Buy	0.983	0.545	0.183	3.170
	Put	Sell	1.044	0.512	0.291	3.271
		Buy	1.053	0.510	0.279	3.244
All investor	Call		5.315	2.675	1.010	17.544
	Put		4.684	2.383	1.308	15.289
Brokers / All Investors			0.374	0.069	0.139	0.524
Individuals / All Investors			0.375	0.043	0.249	0.530
Foreigners / All Investors			0.217	0.085	0.062	0.546

volume, call/put traction amount for each investor category. The summary statistics on trades of major three investor types (brokerage proprietary trader, individuals, and foreigners) are reported in Table 4.1. However, this data set does not have the breakdowns for each option contract.

More importantly, the KOSPI 200 options and futures markets are different from well-studied US index options and futures markets, such as S&P 500 and S&P 100 options and futures markets. First, in the KOSPI 200 options market, call option trading volumes exceed those of put options unlike in the US index options markets; in the US index options, typically, put option volumes tend to be larger than those of call. During our sample period, call and put option trading volumes are approximately 5.6 million and 4.9 million contracts, respectively.

Secondly, there is active participation among individual traders in the KOSPI 200 options and futures markets unlike in the US index options and futures markets; institutional investors dominate trading activities both in the US index options and futures markets. The individual investors' trading volumes account for 36% to 38% of the daily total options trading volume in the KOSPI 200 options market. About 35% to 40% of the daily total trading volumes come from the brokerage proprietary traders, and foreign traders' activities constitute approximately 20% to 25% of the daily total trading volumes. The rest of option trading volumes mainly come from mutual funds and insurance firms. In the KOSPI 200 futures market, approximately 40%, 31%, 24%, and 2.5% of daily total trading volumes come from brokerage proprietary, individual, foreign, and mutual fund trades, respectively. Brokerage proprietary traders tend to be option sellers/writers, and individual traders are often option buyers. This phenomenon may be attributed to the fact that it is easier for brokerage proprietary traders to meet margin requirements compared to individual traders; the margin requirement for option writers is much more restrictive as they assume large risk. It is also important to note that these individual and brokerage proprietary traders in the KOSPI 200 options market are not generally considered as hedgers; they are typically known as speculators.

As earlier studies suggest, different types of traders may possess different levels of information, information processing skills, and trading skills that lead to superior trading profits. Together with the fact that majority of trading volume comes speculatively-motivated trades, active participation from various investor types, such as individual, brokerage proprietary, foreign traders, in the KOSPI 200 options and futures markets provide an ideal setting for studying information-based trading.

3. Directional trading model & variable construction

3.1 Directional informed trading hypothesis: across option leverage

In this section, we introduce our directional informed trading hypothesis. Our directional trading hypothesis is based on the prediction of information trading model of Easley, O'Hara, and Srinivas (1998). One of the key features of Easley et al. (1998) model is that it allows the informed traders to elect their trading venues, either in stock or in options market, or in both. Easley et al. (1998) develop an asymmetric information model in which the participation of an informed trader in stock and in options market is endogenously determined. According to their model, an informed trader chooses to trade either in or both in stock and options market depending on the depths of the markets and leverage available to the market. In particular, an informed trader prefers to trade both in stock and options market, i.e., in a "pooling equilibrium," when the proportion of informed traders is large, when the liquidity in the stock market is low, or when the leverage implicit in options is large enough so that an informed trader would favor trading in options market.

Easley et al. (1998) demonstrate that "specific" options volumes have information content for future stock price movements. They first categorize informational news events into positive and negative news on the underlying security. When there is positive news, an informed trader would have a choice among trading strategies of buying the stock itself, buying call options, or selling put options. On the other hand, an informed trader would choose among trading strategies of selling the underlying stock, selling call options, or buying put options if there is negative news on the underlying security. Call option buy volumes and put option sell volumes are denoted as "positive news" option volumes. Conversely, put option buy volumes and call option sell volumes are labeled as "negative news" option volumes. They show empirically that in a pooling equilibrium, these "positive news" option volumes and "negative news" option volumes impound information about future stock price movements. In our empirical implementation, we test whether these "positive news" option volume and "negative news" option volume impound information about future KOSPI 200 index returns.

Easley et al. (1998) model further includes the following feature. Easley et al. (1998) model may be extended so that informed traders not only elect to trade between equity and options, but also between equity and options with different leverage levels. To test whether option leverage is an important factor in predicting future KOSPI 200 index intraday returns, we subdivide call buy/sell and put buy/sell option volumes into moneyness categories. Options with larger leverage may be a preferred vehicle in exploiting informational advantage for informed traders. We hypothesize that the trading outcome of index options with larger leverage have higher information content in predicting return movements of the underlying stock index. Moreover, liquidity is also an important factor for informed traders in choosing in which markets (equities or options or both) to trade and also which options to trade within options market in

Easley et al. (1998) model. By subdividing call and put option volume into moneyness categories, we are essentially incorporating liquidity factor into our analysis because trading volumes monotonically increase with option leverage for both call and put options.

3.2 Directional informed trading hypothesis: across investor group

There has been a long debate in the international finance literature on who has advantage in trading domestic securities, domestic versus foreign traders. To date, there is no clear consensus on this issue. Advantage in domestic stock trading depends on which group of investors possesses superior information. Some articles find evidence indicating that foreign investors are better informed and sophisticated in processing information [Grinblatt and Keloharju (2000); Seasholes (2000); Froot, O'Connell, and Seasholes (2001); Froot and Ramadorai (2001)]. Leading explanations for foreign investors' informational advantage have been that foreign institutional investors may be more experienced and have access to better proprietary research.

On the other hand, some papers demonstrate that foreign investors are at informational disadvantage in local stock trading compared to local traders [Dvorak (2005); Hau (2001); Choe, Kho, and Stulz (2005); Kang and Stulz (1997); Shukla and van Inwegen (1995)]. One of the common sources of foreign investors' informational disadvantage is that foreign investors may be "distant" from the local markets where information mostly originates. Foreign investors may be at disadvantage in accessing and processing local information because of geographical distance, language differences, and cultural differences.

In this paper, we investigate which group of investors has informational advantage in trading local securities by examining trading activities in the KOSPI index options and futures market.[43] More specifically, we examine whether the information content of KOSPI 200 index options and futures transactions are different across investor groups in predicting intraday returns of the KOSPI 200 index. Foreign investors trading in Korean markets are mainly institutional investors [Choe, Kho, and Stulz (2005)]. To compare the information content of foreign institutional investor transactions to that of domestic institutional investor transactions, we further subdivide domestic investors into two groups, domestic brokerage proprietary traders and retail traders in our analysis. As we are examining intraday options and futures transactions, foreign investors may be at disadvantage if local proximity is an important factor in exploiting very short-lived informational advantage.[44]

3.3 Explanatory variable construction

We discuss explanatory variable construction in this section. Our explanatory variable construction is based on Easley et al. (1998). Our goal is to investigate whether call and put buy/sell transactions contain information about future intraday KOSPI 200 index returns. More specifically, we test whether information content is different across option type (call or put options) and also across option moneyness categories in predicting future price movements of KOSPI 200 index. For this purpose, we use trade and quote (TAQ) data. Buy and sell trades are classified using Lee and Ready (1991) algorithm and transaction price for each trade is multiplied with the corresponding volume to obtain transaction amount. Although we have trades

[43] Using intraday TAQ data over one year, 2002, Ahn, Kang, and Ryu (2008) examines informed trading in the KOSPI 200 index options market. Ahn, Kang, and Ryu (2008) conclude that foreign traders have an edge in trading KOSPI 200 index options over domestic traders based on spread decomposition analysis.

[44] Foreign institutional investors in Korea are required to register with the Financial Supervisory Services (FSS) and obtain identification number before they can start trading. These ID numbers are used to distinguish whether a transaction is made by a domestic or foreign investor. However, our data does not provide further information on the identity of foreign investors. Consequently, we are unable to identify trades made by Korean investors who set up a foreign nominee company to trade on the KOSPI 200 index options and futures market if there are any such trades.

and quotes after the close of the KOSPI 200 index, we limit our sample to intraday trades between 9 am to 2:50 pm where intraday return of the stock index is available. We group options into three moneyness categories using the absolute values of delta from the prices at end of previous trading date. An option is defined as ATM (at-the-money) if the delta is between 0.4 and 0.6, OTM (out-of-the-money) if the delta is smaller than 0.4, and ITM (in-the-money) if the delta is greater than 0.6. We then aggregate transaction amount (in Korean Won) over one-minute interval for each moneyness category to construct transaction amount variables. We use the delta values from the day before in assigning moneyness category. In Panel B of Table 4.2, we report mean, standard deviation, and 95th percentile statistics of for each option type and for each moneyness category. The average transaction amount increases as both call and put options are further out-of-the-money.

To examine whether the information content of KOSPI 200 index options and futures transactions are different across investor groups in predicting intraday returns of the KOSPI 200 index. Among ten investor groups available in our data, we only consider proprietary brokerage traders, individuals, and foreigners as these three investor groups make up about 95% of the total transaction each day both in the KOSPI 200 options market and in the KOSPI 200 futures market. We use investor trading statistics which is provided by KRX every 30 seconds.[45] The 30-second trading statistics include call options/put options/futures buy and sell volumes and transaction amount for each investor group. We add up the 30-second statistics every minute to compute 1-minute transaction amount for each investor group. Furthermore, for call options, put options, and futures and for each investor group, we construct 1-minute net buy transaction amount by subtracting the 1-minuie sell transaction amount from the 1-minute buy transaction

[45] We do not use Lee and Ready (1991) buy/sell algorithm in classifying each trade by each investor group. The KRX intraday data set precise trade classification from each order filled.

Table 4.2: Summary statistics, daily futures transaction amount and volume by investor type

This table reports mean, standard deviation, minimum, and maximum of daily transaction amount and volume of futures initiated by each investor type. Trade amount and volume of buy and sell trades are identified by the Korean stock exchange and are not estimated. Sample period is from 3 January 2005 to 20 March 2009 consisting of 1044 trading days.

		Mean	Std	Min	Max
Panel A: Transaction amount in 1 billion KRW					
Brokers	Sell	5361.533	2386.086	1094.493	12411.470
	Buy	5370.445	2392.602	1090.650	12567.296
Individuals	Sell	6906.418	2260.745	2536.985	14023.832
	Buy	6887.574	2259.592	2518.366	14277.224
Foreigners	Sell	4433.881	2378.329	820.801	16501.653
	Buy	4418.094	2345.693	894.624	16698.928
All investors		17833.558	6784.645	5474.076	43496.986
Brokers / All Investors		0.296	0.056	0.143	0.463
Individuals / All Investors		0.398	0.056	0.251	0.568
Foreigners / All Investors		0.242	0.055	0.122	0.468
Panel B: Traded volume in million					
Brokers	Sell	0.059	0.024	0.017	0.139
	Buy	0.059	0.024	0.017	0.140
Individuals	Sell	0.078	0.028	0.032	0.203
	Buy	0.078	0.028	0.030	0.199
Foreigners	Sell	0.049	0.025	0.012	0.192
	Buy	0.049	0.025	0.013	0.188
All investors		0.199	0.075	0.079	0.517
Brokers / All Investors		0.296	0.056	0.143	0.463
Individuals / All Investors		0.398	0.056	0.252	0.568
Foreigners / All Investors		0.242	0.055	0.122	0.468

Table 4.3: Summary statistics of regression variables

This table reports summary statistics of variables used in our regressions. Panel A reports underlying index return and realized volatilities in 1, 10, 30 minute windows. Basis point and basis point squared were used as units for return and realized volatility respectively. In Panel B and C, we report transaction amount in 1 billion KRW for each option and futures classification in one minute window. In Panel B, the options are classified according to moneyness. We classify an option as ITM if absolute value of delta from previous trading date is between 0.6 and 1, ATM if between 0.4 and 0.6, and OTM if between 0 and 0.4. Buy and sell trades were identified using Lee and Ready algorithm. In Panel C, options and futures are classified according to investor types. Buy and sell trades are obtained from Korean Stock Exchange not estimated.

Panel A		1 minute				10 min				30 min			
		Mean	Std	5th pctl	95th pctl	Mean	Std	5th pctl	95th pctl	Mean	Std	5th pctl	95th pctl
Index return		0.01	5.97	-8.20	8.33	0.10	21.14	-31.54	30.54	0.11	35.11	-52.74	49.17
Realized volatility		0.37	1.40	0.04	1.10	3.67	3.32	1.38	7.57	10.85	8.04	4.89	20.71

Panel B		ITM				ATM				OTM			
		Mean	Std	5th pctl	95th pctl	Mean	Std	5th pctl	95th pctl	Mean	Std	5th pctl	95th pctl
Call	Sell	0.06	0.14	0.00	0.28	0.10	0.14	0.00	0.37	0.36	0.36	0.02	1.05
	Buy	0.06	0.13	0.00	0.26	0.09	0.14	0.00	0.36	0.34	0.35	0.02	1.01
	Net	0.00	0.11	-0.10	0.09	0.00	0.10	-0.14	0.12	-0.01	0.19	-0.31	0.27
Put	Sell	0.05	0.14	0.00	0.24	0.08	0.12	0.00	0.31	0.39	0.40	0.02	1.15
	Buy	0.05	0.13	0.00	0.22	0.08	0.12	0.00	0.30	0.36	0.38	0.02	1.09
	Net	0.00	0.13	-0.10	0.08	0.00	0.09	-0.12	0.11	-0.02	0.19	-0.31	0.24

Panel C		Broker				Individual				Foreigner			
		Mean	Std	5th pctl	95th pctl	Mean	Std	5th pctl	95th pctl	Mean	Std	5th pctl	95th pctl
Call	Sell	0.28	0.26	0.02	0.78	0.40	0.35	0.06	1.07	0.34	0.39	0.02	1.09
	Buy	0.28	0.26	0.02	0.78	0.40	0.35	0.06	1.05	0.34	0.39	0.02	1.10
	Net	0.00	0.10	-0.15	0.15	0.00	0.19	-0.28	0.28	0.00	0.17	-0.24	0.24
	Net ratio	0.00	0.25	-0.38	0.40	0.01	0.22	-0.35	0.36	0.00	0.30	-0.51	0.51
Put	Sell	0.26	0.24	0.02	0.73	0.38	0.35	0.05	1.05	0.40	0.50	0.02	1.33
	Buy	0.26	0.24	0.02	0.73	0.39	0.34	0.05	1.03	0.40	0.49	0.02	1.33
	Net	0.00	0.10	-0.15	0.15	0.00	0.20	-0.26	0.26	0.00	0.19	-0.24	0.24
	Net ratio	0.00	0.26	-0.41	0.41	0.01	0.21	-0.33	0.35	0.00	0.27	-0.46	0.45
Futures	Sell	14.85	15.68	0.18	45.48	18.94	17.94	1.10	53.95	11.88	14.40	0.13	37.06
	But	14.85	15.57	0.19	45.29	18.91	18.01	1.06	54.09	11.86	14.41	0.13	37.11
	Net	0.00	7.39	-11.90	11.81	-0.03	10.36	-16.34	16.39	-0.02	9.64	-15.18	15.20
	Net ratio	0.01	0.38	-0.67	0.69	0.00	0.31	-0.53	0.51	0.00	0.46	-0.80	0.81

Table 4.4: Directional trading, by moneyness

This table reports time-series regression results. Dependent variables are index returns during different time windows. Column header indicates the size of the time window from which we calculate index returns used in the regressions. Main explanatory variables used in the regressions are option trade amount categorized by option type, moneyness, and whether the trades were buy or sell trades estimated by Lee and Ready algorithm. The following specifies regression model:

$$R_{t+j} = \beta_0 + \sum_{k=1}^{K} \beta_k X_{k,t} + \sum_{l=0}^{L} \phi_l R_{t-l} + \varepsilon_{t+j}, \quad j \in \{1, 5, 10, 60\},$$

where R_{t+j} is return of the underlying index from time t to $t+j$, $X_{k,t}$ are traded amount of sell and buy orders on calls and puts in moneyness categories as described in Table 3. Only $\beta_1, \dots, \beta_K$ are reported in this table. First 10 minutes of each trade date were excluded from the regression.

			1m	5m	10m	30m	60m
Call	ITM	Sell	-1.1625	-1.4888	-1.2481	-1.8791	-2.8109
			(-12.41)	(-5.98)	(-3.61)	(-3.17)	(-3.20)
		Buy	1.4034	2.4311	2.1908	2.2821	3.4544
			(14.58)	(9.51)	(6.16)	(3.75)	(3.86)
	ATM	Sell	-2.5715	-4.0438	-3.5920	-1.4286	1.2203
			(-24.08)	(-14.26)	(-9.11)	(-2.10)	(1.21)
		Buy	3.1817	5.3533	5.1163	4.6611	2.2604
			(29.37)	(18.61)	(12.79)	(6.80)	(2.23)
	OTM	Sell	-3.7062	-6.1055	-5.5900	-6.6513	-7.3989
			(-63.79)	(-39.58)	(-26.05)	(-18.02)	(-13.46)
		Buy	4.0353	6.8161	6.3309	7.8645	7.9840
			(66.86)	(42.53)	(28.40)	(20.53)	(14.00)
Put	ITM	Sell	1.1016	1.3412	1.0058	0.7307	-1.0729
			(12.95)	(5.94)	(3.20)	(1.36)	(-1.35)
		Buy	-1.3144	-2.0425	-1.9228	-1.5320	-0.8583
			(-14.28)	(-8.36)	(-5.65)	(-2.62)	(-1.00)
	ATM	Sell	2.4883	3.0347	3.0198	3.0913	3.1904
			(21.91)	(10.06)	(7.20)	(4.30)	(2.99)
		Buy	-3.2361	-4.7044	-4.3441	-7.1021	-9.2621
			(-27.76)	(-15.20)	(-10.09)	(-9.62)	(-8.45)
	OTM	Sell	2.7118	4.6130	4.3128	4.6674	5.4433
			(47.54)	(30.46)	(20.47)	(12.88)	(10.06)
		Buy	-3.1560	-5.2866	-4.5599	-3.8988	-2.9252
			(-52.18)	(-32.92)	(-20.41)	(-10.17)	(-5.12)
	adjusted R2		0.0778	0.0254	0.0130	0.0059	0.0028

amount. Panel C of Table 4.3 shows the summary statistics of 1-minute transaction amount by investor groups for the index options and futures.

4. Results

4.1 Results on directional informed trading in index options market

We discuss our regression models and results on intraday directional informed trading based on Easley et al. (1998) model in this section. We test whether call buy/put sell transactions predict positive returns on the underlying stock index (KOSPI 200) and call sell/put buy transactions predict negative returns on the underlying stock index. Furthermore, we examine whether information content is different across moneyness categories for aforementioned specific index option transactions. We regress future returns of the underlying index on buyer and seller initiated transaction amount of call and put options of different moneyness categories. Our dependent variables are 1, 5, 10, 30, and 60-minute future (ahead) returns of KOSPI 200 index, respectively. The explanatory variables are defined in the previous section. All regression models include lag returns of KOSPI 200 index to account for possible time-series correlation.

The regression results are reported in Table 4.4. The estimated coefficients on the constant and lag returns of KOSPI 200 index are not reported. The signs of all statistically significant coefficients (at 1%, 5%, and 10%) are consistent with the prediction of Easley et al. (1998) directional informed trading model. Index option transactions contain information on future underlying index returns as positive future returns of the underlying stock index (KOSPI 200) are associated with the decrease in call option sell transactions and put option buy transactions and with the increase in call buy and put sell transactions. Furthermore, our results demonstrate that the options with larger leverage contain higher information content in the sense that the estimated coefficients monotonically increase (in absolute values) with option leverage; OTM option transactions have higher information content. Our results are robust to alternative explanatory variable specifications. Instead of using transaction amount, we re-construct our explanatory variables measured in trade counts and trading volume. Our main results are unchanged.

4.2 Results on directional informed trading across investor groups

We investigate which of the three major investor groups (domestic brokerage proprietary, individual, and foreign traders) are better informed about KOSPI 200 intraday returns using 1-minute transaction amount statistics by these three investor groups. We examine the information content of trades for each investor class by regressing the subsequent 1, 5, 10, 30, 60-minute returns of the underlying index on the net buy amount of each investor group. Our regressions are estimated separately for each investor group, and then with all three investor groups' net buy transactions. If a group of investors has superior information processing capabilities on news related to the future returns of the underlying stock index, then the investor group's net call/futures (put) buy amount should be positively (negatively) related to the future returns of the underlying index.

The regression results on the index options are tabulated in Table 4.5 and Table 4.6. Our dependent variables are 1, 5, 10, 30, and 60-minute future (ahead) returns of KOSPI 200 index, respectively. In Table 4.5, the regressions are estimated separately for each investor group. We find that the brokerage proprietary traders' net buy amount has predictive power on intraday returns of the underlying index. Table 4.6 shows the regression estimates when net call/put buy transaction of investor groups enter the estimation altogether. Entered jointly, the results indicate

Table 4.5: Directional trading, by investor type

This table reports time-series regression results. Dependent variables are index returns during different time windows. Column header indicates the size of the time window from which we calculate index returns used in the regressions. Main explanatory variables used in the regressions are option net trade amount categorized by trader type and option type. Net trade amount is calculated as buy minus sell trade amount. Buy and sell trades are identified in the data, but the trades are aggregated by investor type and option type. The following specifies the regression model:

$$R_{t+j} = \beta_0 + \sum_{k=1}^{K} \beta_k X_{k,t} + \sum_{l=0}^{L} \phi_l R_{t-l} + \varepsilon_{t+j}, \quad j \in \{1, 5, 10, 60\},$$

where R_{t+j} is return of the underlying index from time t to $t+j$, $X_{k,t}$ are net buy transaction amount calculated by subtracting sell from buy transaction amount for each investor's trade and option type. Only $\beta_1, ..., \beta_K$ are reported in this table. First 10 minutes of each trade date were excluded from the regression.

		1m	5m	10m	30m	60m
Brokers	Net Buy Call	0.7337	2.4260	1.3049	-0.4322	-2.7934
		(4.20)	(5.24)	(2.03)	(-0.39)	(-1.73)
	Net Buy Put	-3.0613	-4.5359	-5.1260	-5.3301	1.0214
		(-15.82)	(-8.86)	(-7.20)	(-4.38)	(0.56)
Individuals	Net Buy Call	-2.5387	-3.8137	-4.6405	-6.7066	-8.0968
		(-17.06)	(-9.68)	(-8.48)	(-7.20)	(-5.93)
	Net Buy Put	3.1430	4.4451	3.4111	3.9788	10.0688
		(19.05)	(10.18)	(5.62)	(3.84)	(6.51)
Foreigners	Net Buy Call	-0.0836	-0.4389	-1.8838	-4.0019	-6.3993
		(-0.58)	(-1.16)	(-3.58)	(-4.48)	(-4.89)
	Net Buy Put	2.2006	3.3303	2.8763	4.2302	11.0441
		(13.71)	(7.84)	(4.87)	(4.20)	(7.35)
	adj. R2	0.0643	0.0185	0.0099	0.0041	0.0015

Table 4.6: Option directional trading, by investor type

Regression variables used in this table is identical to that of Table 5. The only difference is that only subset of the main explanatory variables are used in the regressions to examine explanatory power of the net transaction amount of each investor type.

This table reports time-series regression results. Dependent variables are index returns during different time windows. Column header indicates the size of the time window from which we calculate index returns used in the regressions. Main explanatory variables used in the regressions are option net trade amount categorized by trader type and option type. Net trade amount is calculated as buy minus sell trade amount. Buy and sell trades are identified in the data, but the trades are aggregated by investor type and option type. The following specifies the regression model:

$$R_{t+j} = \beta_0 + \sum_{k=1}^{K} \beta_k X_{k,t} + \sum_{l=0}^{L} \phi_l R_{t-l} + \varepsilon_{t+j}, \quad j \in \{1,5,10,60\},$$

where R_{t+j} is return of the underlying index from time t to $t+j$, $X_{k,t}$ are net buy transaction amount calculated by subtracting sell from buy transaction amount for each investor's trade and option type. Only $\beta_1,...,\beta_K$ are reported in this table. First 10 minutes of each trade date were excluded from the regression.

	1m	5m	10m	30m	60m
Panel A: Brokers					
Net Buy Call	0.0288	0.0568	0.0541	0.0559	0.0467
	(27.66)	(20.64)	(14.14)	(8.50)	(4.79)
Net Buy Put	-0.0652	-0.0948	-0.0907	-0.1011	-0.1001
	(-63.91)	(-35.18)	(-24.24)	(-15.75)	(-10.52)
Panel B: Individuals					
Net Buy Call	-0.0314	-0.0479	-0.0430	-0.0454	-0.0369
	(-59.38)	(-34.29)	(-22.14)	(-13.65)	(-7.51)
Net Buy Put	0.0192	0.0262	0.0206	0.0157	0.0106
	(38.18)	(19.74)	(11.16)	(4.97)	(2.28)
Panel C: Foreigners					
Net Buy Call	0.0253	0.0343	0.0267	0.0242	0.0141
	(44.70)	(22.99)	(12.91)	(6.86)	(2.72)
Net Buy Put	-0.0023	-0.0009	0.0036	0.0121	0.0235
	(-4.42)	(-0.64)	(1.91)	(3.76)	(4.97)

Table 4.7: Futures directional trading, by investor type, before and after 2008

This table reports time-series regression results. We divide regression sample into two subsamples: before 2008 and after 2008. Dependent variables are index returns during different time windows. Column header indicates the size of the time window from which we calculate index returns used in the regressions. Main explanatory variables used in the regressions are futures net trade amount categorized by trader type. Net trade amount is calculated as buy minus sell trade amount. Buy and sell trades are identified in the data, but the trades are aggregated by investor type. The following specifies the regression model:

$$R_{t+j} = \beta_0 + \sum_{k=1}^{K} \beta_k X_{k,t} + \sum_{l=0}^{L} \phi_l R_{t-l} + \varepsilon_{t+j}, \quad j \in \{1,5,10,60\},$$

where R_{t+j} is return of the underlying index from time t to $t+j$, $X_{k,t}$ are net buy transaction amount calculated by subtracting sell from buy transaction amount for each investor's futures trade. Only $\beta_1,...,\beta_K$ are reported in this table. First 10 minutes of each trade date were excluded from the regression.

Panel A: all sample		1m	5m	10m	30m	60m
Brokers	Net Buy Futures	4.8792	7.0393	5.8821	5.7753	3.2454
		(21.10)	(11.58)	(6.97)	(3.95)	(1.49)
Individuals	Net Buy Futures	0.3481	-3.3817	-4.4734	-4.7206	-10.1863
		(1.61)	(-5.95)	(-5.67)	(-3.45)	(-5.01)
Foreigners	Net Buy Futures	6.2216	9.0171	8.0896	8.8218	8.7932
		(29.03)	(16.00)	(10.34)	(6.51)	(4.36)
	adj. R2	0.0509	0.0170	0.0097	0.0040	0.0020
Panel B: after 2008						
Brokers	Net Buy Futures	1.7521	1.4031	-1.4945	-2.3507	-7.4839
		(3.22)	(0.93)	(-0.72)	(-0.65)	(-1.39)
Individuals	Net Buy Futures	-2.6816	-7.1502	-10.9473	-12.4005	-22.4732
		(-5.31)	(-5.10)	(-5.67)	(-3.69)	(-4.50)
Foreigners	Net Buy Futures	6.3438	11.3861	8.8026	8.2086	3.9795
		(12.56)	(8.13)	(4.56)	(2.44)	(0.80)
	adj. R2	0.0945	0.0199	0.0101	0.0046	0.0020

that the domestic brokerage traders possess superior information on the intraday returns of the underlying stock index, which is consistent with our finding in Table 4.5. From Table 4.6, there is some evidence that foreigners are informed traders.

In Panel A of Table 4.7, we report the estimation results for the KOSPI 200 index futures market. Our dependent variables are 1, 5, 10, 30, and 60-minute future (ahead) returns of KOSPI 200 index, respectively. The results in Panel A of Table 4.8 indicate that the domestic brokerage traders and foreigners possess superior information processing skills on news related the intraday stock index returns. This result is consistent with our findings in the index options market.

4.3 Results on information based trading during the sub-prime mortgage crisis

In this section, we investigate which investor group possesses informational advantage during the recent sub-prime mortgage crisis in 2008. It is unlikely that foreign investors are systematically better informed than domestic investors about events that affect the country as a whole is unlikely.[46] However, informational advantage of one investor group over another may depend on from where the information originates. If a country's return relevant information originates from outside of the country, which may be the case during the recent sub-prime mortgage crisis, then foreign investors could be better informed than the domestic investors.

We use the intraday trading statistics by investor group for the KOSPI 200 index options and futures to test whether foreigners are indeed better informed traders during the sub-prime mortgage crisis. We use the 1-minute transaction amount statistics of domestic brokerage proprietary, individual, and foreign traders. We define the sub-prime mortgage crisis period to be from January 3rd, 2008 to March 20th, 2009.

[46] The information asymmetry in favor of domestic investors is one of the main explanations of the home bias phenomenon.

Table 4.8: Futures directional trading, by investor type, before and after 2008

	1m	5m	10m	30m	60m
Panel A: Brokers					
Net Buy Futures ratio	0.1972	0.5701	0.5540	0.6889	0.9054
	(7.65)	(8.44)	(5.92)	(4.33)	(3.88)
Panel B: Individuals					
Net Buy Futures ratio	-1.3056	-3.0054	-3.1180	-3.2331	-4.1481
	(-41.82)	(-36.69)	(-27.46)	(-16.71)	(-14.55)
Panel C: Foreigners					
Net Buy Futures ratio	0.5818	1.3477	1.4906	1.7218	2.5516
	(27.32)	(24.11)	(19.25)	(13.04)	(13.15)
Panel D: Brokers after 2008					
Net Buy Futures ratio	0.1853	0.1222	-0.1011	0.3820	1.7400
	(1.80)	(0.43)	(-0.26)	(0.57)	(1.78)
Panel E: Individuals after 2008					
Net Buy Futures ratio	-2.8851	-5.9474	-6.2307	-6.1107	-7.5143
	(-26.80)	(-19.96)	(-15.22)	(-8.70)	(-7.25)
Panel F: Foreigners after 2008					
Net Buy Futures ratio	1.7842	3.8138	4.0361	4.1031	5.2033
	(23.95)	(18.51)	(14.26)	(8.43)	(7.24)

Table 4.8 and Table 4.9 report the regression results on the index options and futures market, respectively. Our dependent variables are 1, 5, 10, 30, and 60-minute future (ahead) returns of KOSPI 200 index, respectively, for both Table 4.8 and Table 4.9. From Table 4.8, in the KOSPI 200 index options market, we observe that the net put buy transaction of foreigners possesses some predictive power on the intraday return of the underlying index during the recent sub-prime mortgage crisis. However, the results are much stronger in the index futures market. In Table 4.9, among the three investor groups (domestic brokerage proprietary, individual, and foreign traders), we find that the foreigners' transaction in the index futures market contains better information content on the intraday returns of the underlying stock index during the sub-prime mortgage crisis. This may indicate that foreigners are superior in processing country return information originating from outside of Korea.

5. Volatility information based trading

In this section, we investigate whether index options are used for volatility informed trading. Our analysis of volatility informed trading is motivated by the fact that options are uniquely suited securities for investors who have information on future volatility. Unlike investors with information on underlying index returns who can choose to trade among in cash market, in index futures markets, or in index options market, investors with volatility information can only exploit it by participating in index options market. In addition, although there are a multitude of articles that examines directional information based trading in options market [Stephan and Whaley (1990); Amin and Lee (1997); Easley, O'Hara, and Srinivas (1998); Chan, Chung, and Fong (2002); Chakravarty, Gulen, and Mayhew (2004); Cao, Chen, and Griffin (2005); Pan and Poteshman (2006); Ahn, Kang, and Ryu (2008); Kang and Park (2007); Ni, Pan, and Poteshman (2008)], volatility information based trading in options markets is not well-studied.[47]

Our empirical analysis examines whether index option trading outcome contains information about the future volatility of underlying stock index. More specifically, we test which investor group (domestic brokerage proprietary traders, individuals, and foreigners) possesses information on the future intraday realized volatility of KOSPI 200 index. If some traders indeed possess superior information processing skills or even private information on future volatility in the KOSPI 200 index options market, then one would expect the net demand for volatility to be positively associated with the future volatility of underlying stock index as traders with information on future volatility would buy (sell) options when volatility is expected rise (fall).

In our empirical implementation for volatility informed trading, we take the similar approach as in Ni, Pan, and Poteshman (2008). We construct the demand for volatility from buys and sells of call and put options. We measure the net demand for volatility by each investor group in terms of net call and put option buy amount. Both call and put options have positive exposure to volatility, and thus we treat buy transaction amount for both call and put options as positive demand for volatility and sell volume as negative demand for volatility. We use the 1-minute transaction amount (of call and put options) by investor groups for the index options as our measure of investor net demand for volatility.

[47] Ni, Pan, and Poteshman (2008) test whether there is informed volatility trading in equities options market. By taking advantage of their unique data set, they construct non-market maker net demand for volatility products, such as options, from the trading volume of individual stock options. They find that the non-market maker net demand to be informative about the future realized volatility of underlying equities. They further document that the price impact on option contracts increases as informational asymmetry on the underlying stock volatility intensifies in the days leading up to earnings announcement dates when there is greater volatility uncertainty.

Table 4.9 Volatility trading

	1m	5m	10m	30m	60m
Panel A: Brokers					
Net Buy Call	0.0004	0.0018	0.0028	0.0047	0.0071
	(4.38)	(7.77)	(7.84)	(5.47)	(4.40)
Net Buy Put	0.0005	0.0008	0.0007	-0.0024	0.0036
	(5.15)	(3.47)	(2.04)	(-2.79)	(2.29)
Panel B: Individuals					
Net Buy Call	-0.0002	-0.0005	-0.0009	-0.0020	-0.0020
	(-3.53)	(-4.12)	(-4.94)	(-4.37)	(-2.36)
Net Buy Put	0.0000	0.0001	0.0000	0.0007	0.0010
	(-0.85)	(1.16)	(0.05)	(1.71)	(1.22)
Panel C: Foreigners					
Net Buy Call	0.0001	0.0000	0.0002	0.0012	0.0017
	(1.53)	(0.02)	(0.90)	(2.47)	(1.97)
Net Buy Put	-0.0001	-0.0008	-0.0009	-0.0018	-0.0046
	(-3.14)	(-6.49)	(-4.89)	(-4.02)	(-5.65)

Dependent variable $RV_{t,t+j}$ is realized volatility of the underlying index from end of period t to $t+j$. Net buy transaction amount is calculated by subtracting sell from buy dollar volume. Lags of returns and realized volatilities were included in the regressions but not reported. First 10 minutes of each trade date were excluded from the regression. Regressions are run for each investor type

To investigate whether any group of investor net demand for volatility in the KOSPI index options market predicts future volatility of underlying stock index, we regress future realized volatility on each investor net transaction amounts (domestic brokerage proprietary, individual, and foreign traders). The realized volatility is calculated from summing the square of 10-second log returns in a given time interval; we consider 1, 5, 10, 30, 60 minute intervals. The realized volatility is a sample equivalence of quadratic variation, which theoretically converges to the spot volatility [Andersen, Bollerslev, Diebold, and Labys (2001)]. We used the 10-second stock index returns because it is the highest frequency, which we could obtain from the KRX.

The regression result on intraday volatility information based trading in the KOSPI 200 index options market is presented in Table 4.9. Our dependent variables are 1, 5, 10, 30, and 60-minute future (ahead) realized volatility of KOSPI 200 index, respectively. The lag terms of realized volatility and returns are included in the regression specifications to control for time-series correlations, but the coefficients of lag terms are not reported to conserve space. Our regression estimates suggest index options are used to exploit volatility information on the underlying stock index. We find that brokerage proprietary traders engage in volatility information based trading. The estimated coefficients of brokerage proprietary traders' call/put net buy are mostly positive and statistically significant indicating that brokerage proprietary traders buy (sell) call/put when the future volatility of underlying stock index is expected to rise (fall).

6. Conclusion

We investigate two types of information based trading, directional and volatility trading, in our study. We further analyze directional and volatility information trading by investor types:

brokerage proprietary, individual, and foreign investors. First, in directional information trading, we find that the transaction amount of options with the largest leverage, the out-of-the-money options, is the best predictor of intraday KOSPI 200 returns compared to options with smaller implicit leverage. This result confirms and agrees with Easley, O'Hara, and Srinivas (1998) model that options with higher leverage are preferred vehicle to options with smaller leverage in exploiting the directional information on the underlying securities.

Secondly, we find that the domestic brokerage proprietary traders' net buy transaction amount of call/put options and that of futures possesses the best predictability on the KOSPI 200 index intraday returns. To the contrary to Ahn, Kang, and Ryu's (2008) findings, we do not find convincing evidence that foreign traders possess superior information or information processing skills in directional trading. However, during the recent sub-prime mortgage crisis in 2008, we find that the foreigners' transaction in the index futures market contains better information content on the intraday returns of the underlying stock index. This may indicate that foreigners are superior in processing relevant country return information originating from outside of Korea.

Thirdly, unlike in Kang and Park's (2007) work, which they find evidence of directional information based trading but not of volatility information trading, we find empirical evidence consistent with the presence of volatility information based trading. The domestic brokerage proprietary traders' call and put net buy transaction amount has predictive power on the intraday KOSPI 200 realized volatility. Our results indicate that brokerage proprietary investors possess superior directional and volatility information among investor groups, and they exploit these information using KOSPI 200 index options and futures.

REFERENCES

Ahn, H., J. Kang, and D. Ryu, 2008, Informed trading in the index option market: The case of KOSPI 200 options, *The Journal of Futures Markets*, 12, 1118-1146

Andersen, T.G., T. Bollerslev, F.X. Diebold, and P. Labys, 2001, The distribution of realized exchange rate volatility. Journal of the American Statistical Association 96, 42–55.

Anthony, Joseph H., 1988, The interrelation of stock and option market trading-volume data, Journal of Finance, 43, 949-96

Black, Fisher, 1975, Fact and fantasy in use of options, Fianacial Analyst Journal, 31, 36-41, 61-72

Choe, H., B. Kho, and R. Stulz, 2005, Do domestic investors have an edge? The trading experience of foreign investors in Korea, Review of Financial Studies, 18, 795-829

Dvorak, T., 2005, Do domestic investors have informational advantage? Evidence from Indonesia, Journal of Finance, 60, 817-839

Easley, David, Maureen O'Hara, and P. Srinivas, 1998, Option volume and stock prices: Evidence on where informed traders trade, Journal of Finance, 53, 431-465

Froot, K., P. O'Connell, and M. Seasholes, 2001, The portfolio flows of international investors, Journal of Financial Economics, 59, 151-193

Froot, K. and T. Ramadorai, 2001, The information content of international portfolio flows, working paper 8472, NBER

Grinblatt, M. and M. Keloharju, 2000, The investment behavior and performance of various investor types: A study of Finland's unique data set, Journal of Financial Economics, 55, 43-67

Hau, H., 2001, Location matters: An examination of trading profits, Journal of Finance, 56, 1959-1983

Kang, J. and H. Park, 2007, The information content of net buying pressure: Evidence from the KOSPI 200 index option market, Journal of Financial Markets, 11, 36-56

Lee, Charles and Mark Ready, 1991, Inferring trade direction from intraday data, Journal of Finance, 2, 733-746

Madhavan, A., M. Richardson, and M. Roomans, 1997, Why do security prices change? A transaction level analysis of NYSE stocks, Review of Financial Studies, 10, 1035-1064

Manaster, Stephen and Richard J. Rendleman,1982, Option prices as predictors of equilibrium stock prices, Journal of Finance, 37, 1043-1057

Ni,Sophie , X. Pan, and Allen Poteshman, 2008, Volatility information trading in the option market, Journal of Finance, 53, 1059-1091

Pan J. and Allen Poteshman, 2006, The information in option volume for future stock prices, Review of Financial Studies, 19, 871-908

Seasholes, M., 2000, Smart foreign traders in emerging markets, working paper, Harvard Business School

Shukla, R. K. and G. B. van Inwegan, 1995, Do domestics perform better than foreigners? An analysis of UK and US mutual fund managers, Journal of Economics and Business, 47, 241-254

Vega, C., 2006, Stock price reaction to public and private information, Journal of Financial Economics, 82, 103-133