The World-Wide Source of Industry Information:

The Industry Concentration of Short Sellers

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ABSTRACT

In a recent study, Boehmer et al. (2017) find that internationally short sellers' information advantage at the firm level is weaker than in the U.S. due to endogenous and exogenous short-sale constraints. Thus, we conjecture that internationally short sellers' private information is more prevalent at the industry and market level where the firm level short-sale constraints are less relevant. Using short sellers' industry concentration and capital exposure, we find that the top three most shorted industries are associated with 0.42 percent (1.17 percent) lower returns over the subsequent one month (three months) in our sample of 37 countries from 2006 to 2014. In addition, we also show that short sellers' industry concentration predicts stock market returns when the targeted industries are economically important in the country.

Keywords: short interest, industry information, pricing efficiency

JEL classification: G10, G12

1. Introduction

While the source of short sellers' information advantage is still debated, there is a strong academic consensus that short sellers' are informed traders because they are successful in identifying overvalued stocks (Desai et al., 2002, Asquith, Pathak, and Ritter, 2005; Boehmer, Jones, and Zhang, 2008).[1] In a recent study, Huszar, Tan, and Zhang (2017) provide complementary evidence by showing that short sellers combine firm specific information with industry information and that the most shorted industries experience downturns. Rapach, Ringgenberg, and Zhou (2016) also show that short sellers' information is not only relevant at the firm level but also at a more aggregate level. They find that the de-trended aggregate market short interest ratio outperforms well-known market return predictors in the U.S. In sum, the extant U.S. empirical short-sale literature reveals that short selling at the firm, at the industry, and at the market have forecasting ability in the U.S.

Internationally, understanding the role of short selling is more challenging because of the limited feasibility and intensity of short selling in a number of less developed markets (Bris, Goetzmann, and Zhu, 2007; Saffi and Sigurdsson, 2011). Recently, Boehmer et al. (2017) examine the information content of short selling at the firm level in a cross-country study. They find significant variations in short-sale penetration across countries and document that, in a number of countries, short-sales trades account for only a small fraction of the total trading volume. Their results imply that the degree and quality of firm-level information possessed by short sellers are largely dependent on market development, market quality and relevant short-sale regulations.

[11] While the majority of the short-sale studies focus on the pricing implication of short sales, a handful of studies are concerned with the source of the private information of short sellers. Boehmer and Wu (2013) and Engelberg, Reed, and Ringgenberg (2012) find that short sellers primarily focus on important scheduled news releases and are able to front run the market because they are more highly skilled information processors. On the other hand, Anderson, Reeb, and Zhao (2010) among others suggest that short sellers trade on private information which they obtain as an insider or through their connection to insiders.

In this study, we conjecture that in the presence of endogenous and exogenous short-sale constraints, short sellers' ability to convey material firm specific information to the market may be distorted. For example, in China and Hong Kong, only about half of the market is outright shortable, while in Europe and in the U.S. financial stocks have been protected by short sale bans during the 2008 Global Financial Crisis (GFC).[2] In addition to the outright short sale bans, endogenous short-sale constraints also affect short sellers. While these traders are known to promote pricing efficiency (Boehmer and Wu, 2013), they are also subject to high trading costs and short squeeze risks; and therefore, prefer large, liquid stocks, with low idiosyncratic volatility, and low shorting risk (Diether, Lee, and Werner, 2009; Au, Doukas, and Onayev, 2009; Engelberg, Reed, and Ringgenberg, 2016). Internationally, on smaller stock exchanges where only a few index stocks are liquid, short sellers may abstain from trading on their firm specific information in the smaller less liquid stocks because of high trading costs.

Taken together, internationally short sellers' information may not be fully reflected at the firm level in countries with less developed stock lending market and lower pricing efficiency as suggested by Beneish, Lee, and Nichols (2015) who show that when short sale constraints are binding, short-sale demand is not informative at the firm level. The absence of evidence at the firm level does not necessarily imply short sellers' un-informativeness, rather it may suggest that short sellers' information is more prevalent at the aggregate industry or country level reflecting the aggregate belief of this group of relatively informed traders. Thus, we hypothesize that internationally short sellers' information advantage can be captured at the more aggregated level, for example, at the industry level. Such conjecture is supported by anecdotal evidence of short sellers having strong industry preferences which are often connected with specific

[2] In addition to outright short sale restrictions a number of countries introduced short sale disclosure regime, including Japan (Duong, Huszar and Yamada, 2015; Boehmer, Duong, and Huszar, 2017), the European Union (see Jones, Reed, and Waller, 2016) and most recently South Korea (Korea Herald, 2016). While the disclosure regimes are not outright restrictions, they tend to discourage institutional traders from shorting as shown by Duong et al (2015) for Japanese stocks, and by Jones et al (2016) for European stocks.

countries where the target industries are more prevalent. For example, commodity traders and oil refinery service companies in Singapore were hard hit by international short sellers during and after the significant drop in oil prices in 2014 when short sellers shifted into mining- and oil-related industries (Haigh and Stringer 2014; Holm 2014).

The preliminary support for our conjecture comes from the lack of short-sale coverage for majority of stock in our 37 country sample from July 2006 to December 2014.[3] We find that in large developed financial markets such as the U.K., most of the individual stocks have some nontrivial short-sale activities suggesting that short sellers are able to trade on firm specific information. However, in half of our sample, short selling is highly concentrated in a few industries within the country (e.g., see Appendix Table 1). Hence, unlike prior studies we do not use the short interest ratio because a large fraction of the stocks have zero shorting. Rather we measure short sellers' industry exposure (*IndSVconc*) as the industry fraction of the total shorted value in the country and also identify the top one and top three most shorted industries based on shorted value.

In a pooled regression based on the 37 countries, we find that on average the most shorted industry is associated with 45 basis points (bps) lower returns over the next 20 trading days after controlling for industry characteristics. The results hold when we use the top three most shorted industries instead of the top one most shorted. To ensure that our results are not driven by some of the larger countries in the sample with more industry representation, we also provide by country analysis of the short sellers' industry information. With the exception of two countries (Sweden and Turkey), we find that the industry concentration of short sellers has significant return predictability. In most countries, our dummy variable which captures the top three highly shorted industries is associated with significant negative returns. However, in a

[3] In this analysis, we exclude the U.S. for several reasons. The U.S. stock markets are very complex and have hundreds of international listings which may not be representative of their local economy. More importantly, the key focus of the paper is documenting the industry information of short sellers worldwide, which was already documented by Huszar et al. (2017) for the U.S. market.

handful of countries where the latter dummy measure is uninformative, the continuous measure, short sellers' relative capital exposure to the specific industry (*IndSVconc*), predicts subsequent industry decline. We find that that the most negative effect associated with the most shorted industries are in Finland, Greece, Portugal, and Spain. For the Finnish economy, the problems are associated with the declining competitiveness of the IT sector with the collapse Nokia's mobile phone segment. For Greece, Portugal, and Spain, the short sellers' negative information is concentrated in the financial sector, most likely due to sovereign debt issues.

Last, we consider the economic implications of short sellers' industry information at the macro level. We conjecture that short sellers' industry concentration also conveys aggregate information at the country level when short sellers concentrate on the most economically important industries in the specific country. For example, if short sellers target stocks in the mining industry in Australia which is an economy that is heavily dependent on the mining industry, then short sellers' industry outlook can proxy for the market-level economic information. We find supporting empirical evidence for this conjecture in our country-level return regression, by showing that high concentration of short selling in the most economically important industries predicts lower market return using the country's MSCI index.

Taken together, this study makes three distinctive contributions. First, it extends the U.S. findings that short sellers as a group of active investors provide useful aggregate industry and market information internationally. Second, the information value provided by short sellers in an international setting can alleviate the information disadvantage of retail investors. Since the 2008 Global Financial Crisis (GFC), most stock exchanges around the world make an effort to disclose information about short-sale trades regularly to the public, either based on all short sale trades, or at least information about the large trades.[4] Last, our findings reveal that there are

[4] In the U.S., the NYSE, the NASDAQ, and the BATS exchanges regularly disseminate information of aggregate short-sale volume. While the frequency of this information from NYSE and NASDAQ is only bi-weekly, the BATS exchanges actually provide daily and even transaction level data at no cost to all interested parties. Similarly

global financial capital movements in some strategic industries, such as financial services, oil and gas, and IT industries. These trends, mainly driven by international short sellers, should be examined more closely to better understand the vulnerability in the underlying economies and global financial systems due to the highly concentrated industry sectors within some countries and the increasing global connectedness among these industries.

The rest of the paper is structured as follows: Section 2 reviews the relevant literature and develops our empirical hypotheses. Section 3 presents the sample description and key variables. Section 4 presents the empirical findings and section 5 concludes.

2. Literature Review and Hypothesis Development

At the stock level, numerous U.S. studies (e.g., Boehmer et al. 2008; Desai et al. 2002) find that large shorting activity or large short positions predict lower future returns, implying that short sellers are relatively informed traders. Short sellers are not only successful in identifying overvalued stocks to short (Dechow et al. 2001) but also effectively avoid shorting undervalued stocks (Boehmer, Huszár, and Jordan, 2010). They are even thought to minimize shorting costs and the short squeeze risk by avoiding illiquid stocks and stocks with high idiosyncratic volatility and short covering risk (Au et al. 2009; Diether et al. 2009; Engelberg et al. 2016). Short-sale trades attract much attention not only because short sellers seemingly realize large profits but also because their trades promote pricing efficiency (Boehmer and Wu, 2013) and prevent the formation of price bubbles (Hong and Stein, 2013).

However, capturing the return predictability of short selling internationally is a challenge because of the different regulatory restrictions and the stage of market development. Bris,

in the international markets, the Japan exchange group and the Hong Kong Stock Exchange (HKex) also report weekly and daily short-sale information publicly. European Exchanges are less advanced or less likely to overwhelm investors with data and they generally provide insights only about the large short positions. See Gruenwald, Wagner, and Weber (2010) for a detailed review of disclosure requirements relevant to short selling.

Goetzman, and Zhu (2007) and Saffi and Sigurdsson (2011) suggest that exogenous short-sale constraints, related to short-sale bans, outrights short-sale restrictions and underdevelopment of the securities lending markets obstruct pricing efficiency internationally. In addition to these external limitations, short sellers are also keenly aware of shorting costs and shorting risk (Engelberg et al. 2016). These latter aspects of short-sale constraints are endogenous because short sellers not only promote pricing efficiency (Boehmer and Wu, 2013) but also demand higher pricing efficiency. Thus the absence of short sellers in specific stocks or market segment is likely attributable to trading frictions.

Hence, when one move from studying short sellers in the U.S. to a international setting, there is a need to consider the diversity in regulatory frameworks and market frictions across different financial markets as suggested by Boehmer et al. (2017). Nevertheless, studying the information provisional role of short sellers in an international context is important for several reasons. First, short sellers are expected to be relatively informed traders because of the higher risk and costs associated with short-sale trades (Diamond and Verrecchia, 1987). Second, short sellers are deemed to serve as social gatekeepers as their presence is associated with less severe earnings management (Massa, Zhang, and Zhang, 2015). In addition, Massa et al. (2016) find that short sellers induce corporate insiders to disseminate information in a faster way. These studies, by suggesting that the presence of short sellers can aid internal governance and information dissemination, highlight the importance of understanding why and how short sellers trade internationally. With the greater availability of short-sale information globally, retail investors may also benefit (reduce their information advantage) from a deeper understanding of the implication of these trades.

Anecdotal evidence (Barrons, 2013, CNBC, 2015, Reuters, 2015) suggest that short sellers have industry as well as country preferences. Recent studies (Huszar et al. 2017; Rapach et al. 2016) find that aggregating the firm specific short sale information at the industry and market

level has important return predictability at the industry and the market level in the U.S. Internationally, short sellers' information advantage is expected to be more prevalent at the industry or country level because at the firm level their trades may not be feasible in the presence of outright short sale bans and binding short-sale constraints, such as limited loan supply or high trading costs. However, no prior studies that have examined industry or market return predictability of short selling internationally.

This void in the literature is somewhat surprising as there are two economic reasons why international short sellers may possess aggregate information. First, due to endogenous or exogenous short-sale constraints in different countries, short sellers may not be able to effectively trade on their private firm information. If short sellers have significant negative information about Company X in industry *i* but are unable to trade on company X, then they may decide to trade on a related company in industry *i* or along the supply chain. Second, as suggested by Boehmer et al. (2008), Jones et al. (2016) and Duong et al. (2016) the relatively informed short sellers internationally are expected to be active non program traders, such as hedge funds. These active institutional traders are multinational traders with limited resources, who have to make strategic capital allocation across various industries and markets. As these funds have claimed to focus on market neutral trades, they will prefer to hedge country and industry risk, and short and long stocks within a country. They are also likely to focus on key industries in order to be cost efficient in their information discovery process. Hence, our first empirical hypothesis is as follows:

H1: The top most shorted industry (proxied by the concentration of shorting activity or the relative capital exposure of short sellers in that industry) subsequently underperforms.

H1A: The top three most shorted industries (proxied by the concentration of shorting activity or the relative capital exposure of short sellers in these industries) subsequently underperform.

In the international setting, the data coverage of short selling is less than perfect with high variation in short sale penetration because of the regulatory restrictions. For example partial short-sale bans in China, Indonesia, Thailand and Hong Kong restrict shorting to a subset of the market while trade intensity short-sale bans in Taiwan restrict short selling based on turnover. Hence, we do not rely on the traditional short interest or days-to-cover measures as per prior studies. Instead, we measure the short-sale industry concentration within the country as the percentage of total market shorted value which is executed within a country, and identify the top most shorted industry and the top three most shorted industries in each country on each trading day. We construct value-weighted industry returns as the main dependent variable and perform regression analysis after controlling for industry characteristics.

In many smaller countries, industry sectors are usually more concentrated, like the IT and semi-conductor sectors for South Korea and Taiwan, the mining sector for Australia and Canada, and the energy sector for Singapore. In our data from Markit Securities Data, a South Korean firm was the top most shorted firm in 2016. The renewable energy equipment firm Celltrion was listed as being the top "special" (i.e., with lending fees significantly exceeding the general collateral rate, resulting in a negative rebate rate for the short seller) in Asia and the fourth globally, contributing to about 3% of the global lending income, with lending fee ranging from 15% to 20% in 2016.

Figure 1 reveals significant concentration in short sales in a few industries in less developed markets. Appendix A.1 reports the frequency of a specific industry being the most shorted, that is, has the highest short-sale industry concentration in the country. For example in Australia, the mining industry is the most shorted industry about 43% of the time. In Hungary and Taiwan, the banking and the IT sector are the most shorted 88% and 100% of the time respectively, reflecting the financial problems in Hungary and dominance of the IT sector in Taiwan. We conjecture that in these markets, the industry short selling information may even have a

spillover effect to the aggregate economy. We would like to verify whether the aggregate information possessed by short sellers at the industry level can predict the market-level return in those countries with highly concentrated industries which are also targeted by short sellers. Hence, our second empirical hypothesis is as follows:

H2: High concentration of short selling in the top most economically important industry signals the subsequent decline of the market.

H2A: High concentration of short selling in the top three most economically important industries signals the subsequent decline of the market.

Specifically, we test whether short sellers targeting the economically most important industry (or industries) predict returns, using our measure of the top most shorted and the top three most shorted industry dummies. We use 30% as the cutoff point for economically most important industry, and 60% for the largest three industries.

3. DATA

3.1. Primary Dataset and Sample Coverage

The primary data set covers active and delisted common stocks from 41 countries, excluding non-common equities (e.g. duplicates, other equities, suspended equities, unclassified equities, unquoted equities), non-equity investment instruments and cross-listed stocks. The dataset comprises daily stock returns, trading volumes, closing share prices, total number of shares outstanding, market capitalizations and market-to book-ratios from Thomson Reuters Datastream between July 3, 2006 and December 31, 2014 for 37 countries.[5] Following the standard in the literature (Griffin, Kelly and Nardari, 2009), we exclude non-common shares, potentially erroneous observations where a single-day return is in excess of 200%, and delete two daily observations for a specific stock where either of the single-day return is in excess of

[5] Our sample is largely consistent with that of Boehmer et al. (2017). The major difference is the exclusion of U.S. data because prior studies (Rapach et al. 2016; Huszar et al. 2017) have already documented evidence of industry and macro information U.S. short sellers.

100% and the two-day cumulative return is less than 20%. In addition, we also exclude illiquid stocks, that is stocks with no trading volume and no change in their return index for the previous calendar month.

Our sample period is from July 2006 to December 2014 because we merge our Datastream data with Markit Securities Finance (formerly Data Explorers) data which is available to us only for this period. For Markit, we merge in the stock out on loan, which is measured in USD millions. We complement our firm level data with country level information, such as daily exchange rate (local currencies relative to the USD), and country MSCI indices return data from Bloomberg. Our final sample comprises daily stocks returns with Markit Securities Finance data and country index returns for 37 countries, for which we are able to obtain information on more than 10 actively traded stocks and obtain short sale or securities lending information from Markit for at least part of our sample period.

As our research focus is on industry information, we keep only valid daily observations for stocks that have a designated active industry sector. Table 1 Panel A reports the 40 active industry sectors from DataStream (excluding 4 inactive industry sectors, namely Sector 29 Non-equity investment instruments; Sector 40 Suspended equities, Sector 44 Unclassified stocks, and Sector 45 Unquoted equities) with the relevant number of firm observations in the pooled sample and the time-series average of the cross-sectional average number of stocks across industries.

[Insert Table 1 here]

Table 1 Panel B provides the cross-country coverage, namely the number of trading days per country, the time-series average of daily number of firms by country, and the number of unique industry sector by country. On average, we have about 30 unique industries per country. The notable exception is Hungary, one of the smallest market capitalization and least active stock market, where on average about 38 firms, representing 21 industry sectors. Hungary is

also one of the least covered country in the sample with only about 2 firms per industry sector. Still for completeness sake, we keep the country and the relevant observations in our data following Boehmer et al. (2017). Ireland is the second smallest country by industry representation, with 50 firms on average over time representing 24 industry sectors.[6]

Overall, our sample consists of 37 countries, with the average market coverage ranging from 38 firms in Hungary to about 3,500 firms in Japan.[7] In our sample period, the Japanese stock exchange was the largest exchange with about 4 trillion market capitalization while China was a close second. Again the number are based on the in sample time series average. Our sample covers about 2,300 trading days in each country, spanning over about ten years from July 2016 to December 2014, including the Global Financial crisis and the European Debt Crisis period as well. These periods are important for our empirical work because short-sale bans and regulatory interventions are expected to weaken short sellers' ability to incorporate new information into the market effectively, and thus our results.

3.2. Variables Constructions and Definitions

Table 2 provides detailed description of our variables. Specifically, our dependent variables, *IndRet*, are the cumulative 5-day, 20-day, 60-day holding period returns on value-weighted industry portfolio. We also calculate buy and hold stock market or country level returns, *CntryRet*, at the same frequency based on the tradable country MSCI Indices. Besides our key "informational" shorting measures, we also include standard controls such as total market capitalization, value-weighted average market-to-book and turnover measures at the industry

[6] While the Irish stock exchange has significantly more listings than the Hungarian exchange, the Irish market primarily comprise ETF listings. As we exclude ETFs from our sample, the remaining Irish market is relatively small as large industrial firms are listed elsewhere on other more liquid exchanges where their peer firms are listed.

[7] We have over 3000 firms for Japan because we capture the whole Japanese market, encompassing TSE, OSAKA and JASDAQ listed stocks. During the sample period, there was active cross-trading across the various platforms. More importantly, in the latter part of our sample period, the Tokyo Stock Exchange merged with Osaka, establishing a merged Japanese stock exchange, which increase the coverage to over 3000 firms. Thus, for consistency, we include all Japanese stocks that are listed on major stock exchanges throughout the entire sample period.

and the country level in the regression analysis. As momentum is shown to be more persistent at the industry level, we also control for lagged monthly returns at the industry level.

[Insert Table 2 here]

With regards to our research focus of the information content of short sellers, we create a unique measure at the industry level which captures the capital exposure of short sellers. Given the different degrees regulatory constraints and stages of market development, we cannot expect short sellers to have similar market penetration across countries. Thus, we calculate the total aggregate market shorted values and concentration of the industry shorted value (*IndSVconc*), which is the fraction of total market aggregate shorted value associated with the specific industry. Last, to facilitate the comparability across countries, we establish two short-sale industry dummy variables which capture the short sellers' peak industry interest.

The $Top1IndSV_{t,c,i}$ takes on a value of one for the specific industry for the specific day when the industry is the top most shorted industry based on the capital exposure of short sellers, that is the percentage of total shorted value in the country, and zero otherwise. The same methodology applies for $Top3IndSV_{t,c,i}$ which takes on a value of one when the industry is among the top three most shorted industries in the country and zero otherwise. To visually understand the short-sale concentration across countries during our sample period, Figure 1 depicts the monthly average short-sale concentration for the most shorted industry, the top three most shorted industries, and Herfindahl-Hirschman index short-sale concentration index by country. In addition to the dummy variables, we also use two continuous measures ($IndSVconc_i$) and a within country industry rank measures, *SVRank*, based on the *IndSVconc* measure to capture the relative intensity of short sellers' industry information.

[Insert Figure 1 here]

We also consider the relative economic importance of the industries in their home country to test whether short sellers' industry concentration signals market wide aggregate information.

Following the same logic as with our short-sale concentration measures, we calculate the relative economic importance of each industry, where *IndMVconc* is the fraction of total market capitalization represented by the specific industry. In addition we also use two dummy variables to capture the significance of short sellers' industry concentration. $Top1c_{c,t}$ ($Top3c_{c,t}$) takes on a value of one when the most shorted industry represents 30% or more (if the top three most shorted industries represent at least 60% or more) of the total shorted value in the country on a specific day.[8]

3.2. Descriptive Statistics and Overview of Short-sellers Industry Concentration, Globally

Table 3 presents the relevant summary statistics of the key variables by country. *LogInMcap* is the time-series average of the natural logarithm average industry market capitalization in millions of USD across industries by country. The industry size reflects the size of the economy or the stock market but it is affected by the concentration of the economy. For example, the average industry size is relatively big for Hungary but only a few industries are represented on this market. Table 3 also displays the time-series average for the key variables, for the cumulative holding returns on value-weighted industry portfolios for 5-, 20- and 60-days, the average industry liquidity, and the market-to-book ratio. The industry relative market capitalization (*IndMVconc*) and industry relative shorted value (*IndSVconc*), are of key interest to us, capture the economic importance of the industry in the country and the within country concentration of short sellers. Again Hungary and Ireland are the most concentrated countries as expected while Canada and the United Kingdom exhibit the lowest industry concentration.

[Insert Table 3 here]

[8] The exact cutoffs are 0.294 and 0.598 which are the in sample medians for the total shorted value represented by the top 1 and the top 3 most shorted industries.

Next, we describe the cross country difference in short sellers' market penetration and industry concentration to facilitate the interpretation of our empirical results. In Figure 1 as mentioned earlier, we depict the industry concentration by country for our sample of 37 from July 2006 to December 2014. We have a couple of countries with zero short selling for a couple of days or even with extended period of times. For example, at the beginning of the ample, we have very low coverage for Brazil, which is captured by close to 100% HHI short-sale concentration index. As the market coverage increased and the securities lending activity picked up with the centralized clearing our concentration measures decline dramatically. For more information on Brazil securities lending and short selling Chague et al. (2016) provide a good overview.

Indonesia, Philippines, and Malaysia have sometimes also spotty coverage. Malaysia had short-sale ban after the onset of the global financial crisis (the missing coverage is captured by zero concentration in our graph from 2008 to 2012 effectively). Since Markit securities Finance does not effectively measure sort selling but securities borrowing, we still have a couple of observations for Malaysia in 2011 despite the short-sale bans. In case of the Philippines and Indonesia, our graphs depicts high concentration, implying that effectively the top there industries shorting constitute to 80-100% of the total shorting activity throughout the sample period. Similar concentration can be observed for Thailand as well where the top three industries market share is also close to 80% until 2013. In these market initially shorting was restricted to index constituents explicitly and then implicitly due to short sellers need for liquidity.

While the concentrations seem to be relatively stable the short sellers industry preference do tend to move across industries within the country with the exception of the very small countries, such as the Hungarian and the Irish exchanges. Appendix A.1 Table shows the

frequency of the most sorted industries, which seems remarkable concertation on financials in Indonesia but varies significantly in Thailand and the Philippines.

4. Empirical Results

Our empirical analysis is structured in three parts. In the first section, we examine the information from short sellers' industry concentration using across-country pooled panel for the period between July 7, 2006 and December 31, 2014. While the pooled regression results can provide general support for our hypothesis, the profitability of a global cross industry trading strategy is expected to be relatively low because of high trading costs across the 37 markets. Thus, in the section 4.2, we provide more detailed insights at the country level, and report the return predictability of industry concentration within country which results can be more readily exploited for a trading strategy. Last in Section 4.3., we examine the potential spillover effect of industry information at the market level, taking into account the economic importance of the targeted industries.

4.1. Industry Information from Short Sellers Globally

First, we examine short sellers' information advantage in a pooled sample including all industries from 37 sample countries from July 2006 to December 2014. Table 4 shows the return predictability of short sellers' industry concentration. Table 4 Panel A focuses on the top one most shorted industry, (*Top1SVInd* dummy variable) and the top three most shorted industries (*Top3SVInd* dummy variable). Table 4 Panel B shows the industry return predictability with continuous measures, with short sellers' relative concentration and the industry shorted rank. In both Panels, Models 1A-B, Models 2A-B, Models 3A-B examine the return predictability at the 5-day, 20-day and 60-day horizon, respectively.

Table 4 Panel A Models 1A and 2A results suggest that on average the most shorted industry is associated with 11 bps lower returns over the next 5 days and about 44 bps lower returns over

the next 20 days, after controlling for industry characteristics. The results for the top three industries in Models 1B and 2B are economically and statistically similar.

[Insert Table 4 here]

In addition to documenting the informativeness of short sellers at the extremes with the dummy variables in Table 4 Panel B, we examine the information content in more general setting. First, we use the short sales relative concentration (*IndSVconc*) measure, which capture the relative industry exposure of short sellers, as the ratio of shorted value in the specific industry relative to the total shorted value in the country. We find that on average an industry with 10% more shorting is associated with 10 bps lower returns at the 20-day horizon and 26 bps lower returns at the 60-day horizon. In Models 1B, 2B, and 3B, we use the inverse of the industry shorted rank. We use the inverse of the industry rank because we want to be consistent with the sign in interpreting the coefficient because our highest rank is 1 for the most shorted industry, thus the 1/SVrank takes on the value of 1 for the most shorted industry in a country and 1/n for the least shorted industry depending on the size of the economy, the number of industries represented. The results with Models 1B, 2B and 3B are comparable with those in Models 1A, 2A, and 3A.

Taken together the results from Table 4 suggest that short sellers' concentrated trade in a specific industry or in a few industries signal negative lower industry returns up to three months ahead. While these results are interesting, the pooled panel results may mask the general applicability of an investment strategy. Specifically the sample is unevenly balanced across countries because for some countries we have 40 industry observations a day while for others only about 20. This means that our results that short sellers' industry concentration predict industry returns may not be economically and statistically significant in each country in our sample. Furthermore the practicality of an investment strategy that involves trading specific stocks or industry portfolios across 37 countries is questionable. Thus, in the next step we

examine the return predictability of industry short-sale concentration within each of the 37 countries in our sample to provide guidelines for an implementable trading strategy.

4.2.By Country: Industry Information from Short Sellers

In Table 5 Panel A, we focus on the return predictability of dummy variables which capture the top one and top three most shorted industries in the country and test whether these industries are associated with significant lower returns over the next 20-day investment horizon. We show only the coefficient estimates on these key short-sale concentration variables, but the full specification results are available upon request. With the exception of Germany, Sweden, the United Kingdom, and Turkey, the short-sale concentration captured by the dummy variables, depicting either at the most shorted industry or at the top three most shorted industries, are associated significant negative industry returns in 33 countries out of our sample of 37 countries.

[Insert Table 5 here]

Next in Table 5 Panel B, we examine the industry return predictability with two continuous measures, namely the relative industry concentration of short sellers trade *IndSVconc* and the invers of the industry shorted rank variable. We find that the relative dollar explore of short sellers to a specific industry predicts returns in the United Kingdom and in Germany significantly. Thus, we have only two countries remaining where we did not find evidence of short sellers return predictability at the industry level, namely Sweden and Turkey.

Sweden is one of the few countries in Europe where no additional short-sale restrictions bans, or naked bans have been put in place following the Financial crisis (ESMA, 2012), thus it is possible that the informed short selling are executed as naked short sales or that Markit does not have complete coverage for the country. An alternative hypothesis is that the Wallenberg group's direct and indirect control over 40% of the Swedish stock market (Economist, 2016) restrict the loan supply and prevent effective short selling as suggested by

Anderson et al. (2010) and Benish et al. (2016). In the case of Turkey, the market is relatively undeveloped and during the first four years of the sample until end of 2009, not only there was there political uncertainty but new Turkish lira was also undergoing a reform which have likely discouraged active institutional traders from entering the market.

4.3. Country Level Results, Market Information from Short Sellers' Industry Trades

In the last section, we consider the market level implications of short sellers' presence. As shown in Figure 1 and Appendix Table 1, in most countries short selling is very concentrated in a specific industry. In smaller economies or even in developed economies like in Canada and Australia, there may only be one or a few economically important industries. Specifically in Australia, the mining sector is often in the headline news and thus international investors in Australia are likely to be motivated to trade in this key industry sector. Thus we posit that if short sellers as group of relatively informed investors concentrate on the country's economically most important industry, then they are likely to signal downturn at the aggregate market level.

[Insert Table 6 here]

In Table 6, our dependent variables are the country MSCI index returns for 5-days, 20-days and 60-days. We use MSCI index returns instead of value-weighted average market returns because we want to be able to suggest realizable trading strategy, or investment advice. Specifically we want to investigate whether short sellers geographic and industry preferences which is often discussed in the media can provide guidance to the ordinary investors. In Table 6, our key variable for capturing short sellers' concentration are two dummy variables. *Top1c* takes on the value of one when 30% or more of the total market shorted value is concentrated in the economically most important industry, while *Top3c* takes on the value of one if about 60% or more of the total market shorted value is concentrated in the three economically most important industries. We also account for the market size of the top one and top three industries

because we expect the short sellers' industry information to coincide with the market information when the targeted industries represent a significant fraction of the market.

Table 6 presents results from pooled country regression, using about 2300 daily observations for each country in the sample with the Fama-French 5 Global Factors (ex US) as controls (Fama and French, 2015). The large negative coefficient on our interaction variables of *Top1c* and *Top3c* and market size of the targeted industries, *Top1c*IndMVconc* and *Top1c*IndMVconc*, support our hypothesis that short sellers industry information have market spillover effect in concentrated economies.

5. Conclusion

Desai et al. (2002) and Boehmer et al. (2008), among others, show that highly shorted stocks subsequently underperform, implying that short sellers are informed traders as their trades have significant return predictability. Huszar et al. (2017) complement these findings and show that short sellers combine firm specific information with industry information, by documenting that highly shorted stocks in the highly shorted industries underperform the highly shorted firms from less shorted industries. In addition, Rapach et al. (2016) show that the de-trended market short interest ratio in the U.S. is one of the most robust market return predictor. Taken together U.S. empirical asset pricing studies find that short sellers are significant information providers at the firm, industry and market levels.

However, the empirical evidence on the information content from short selling internationally is scarce and conflicting. A notable exception is Boehmer et al (2017)'s work which shows that shorts sellers convey significant firm specific information to the market through their trades but the quality and economic importance of such information differ across countries. The authors suggest that capturing the private information from relatively informed active institutional traders internationally is challenging because market quality and

institutional trader penetration vary significantly across countries as well as the quality of accounting information which could support institutional traders' price discovery process.

In this study, we show that while short sellers' information provisional trades at the firm level may be obstructed by market fictions, such high trading risk (e.g., low liquidity and high short sale risk) and exogenous short-sale constraints (e.g., short sale ban, restricted loan supply), their trades may still carry information at the industry and market level where stock specific constraints are less bindings. Specifically we find in a pooled global industry, with 37 countries from 2006 to 2014, that short sellers' trades contain material industry and market information. First, we show that on average the most shorted industry is associated with 45 basis points (bps) lower returns over the next 20 trading days after controlling for industry characteristics. We also show in within country regression results that the return predictability of short sellers is robust across countries, which is strikingly different result from Boehmer et al (2017). In addition to the industry information, we also show that short sellers' industry concentration in the most economically important industries in the country signals a market wide downturn.

Taken together, we provide three contributions. The first two relates to the empirical evidence that short sellers provide industry and market information internationally. Last, we aim to provide additional guidance to retail investors in the ever changing and complex international investment sphere. We suggest that retail investors should pay close attention to short sellers industry and market congregation which is often featured in the media and stocks exchanges more readily disclosure short-sale trades for public inspection at no costs following the Global Financial Crisis (GFC). In addition we suggest that regulators and policy makers should also pay attention to institutional short sellers' global trends to better understand the vulnerability in the underlying economies and global financial systems due to the highly concentrated industry sectors within some countries and the increasing global connectedness among these industries.

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Table 1. Sample Coverage Summary Statistics

Panel A. List of Industry Sectors

Columns 1 and 2 refer to the Sector code and description from DataStream. Columns 3 and 4 report total number of firm day observations and the time-series average of daily firm representation of the specific industry. [9]

Sector	Sector / industry classification	TotalFirmDayObs	Ave Firms
1	Aerospace and Defense	201,751	90
2	Alternative Energy	287,830	129
3	Automobiles and Parts	1,216,614	544
4	Banks	1,186,260	531
5	Beverages	488,895	219
6	Chemicals	1,983,421	887
7	Construction and Materials	2,874,959	1,286
8	Electricity	752,044	336
9	Electronic and Electrical Equipment	3,139,988	1,404
10	Equity Investment Instruments	209,242	94
11	Financial Services	2,772,490	1,240
12	Fixed Line Telecommunications	235,453	105
13	Food and Drug Retailers	509,534	228
14	Food Producers	2,005,111	897
15	Forestry and Paper	416,203	186
16	Gas, Water and Multi-utilities	369,887	165
17	General Industrials	705,951	316
18	General Retailers	1,879,872	841
19	Health Care Equipment and Services	1,037,123	464
20	Household Goods and Home	1,144,929	512
21	Industrial Engineering	2,758,353	1,234
22	Industrial Metals and Mining	1,776,274	794
23	Industrial Transportation	1,184,121	530
24	Leisure Goods	743,721	333
25	Life Insurance	146,895	66
26	Media	1,480,384	662
27	Mining	4,007,163	1,792
28	Mobile Telecommunications	275,077	123
30	Nonlife Insurance	362,139	162
31	Oil and Gas Producers	1,554,924	695
32	Oil Equipment and Services	502,993	225
34	Personal Goods	1,748,979	782
35	Pharmaceuticals and Biotechnology	1,664,609	744
36	Real Estate Investment and Services	2,524,705	1,129
37	Real Estate Investment Trusts	767,001	343
38	Software and Computer Services	2,853,110	1,276
39	Support Services	1,988,084	889
41	Technology Hardware and Equipment	2,811,098	1,257
42	Tobacco	31,007	14
43	Travel and Leisure	1,775,980	794

[9] Stocks with sector codes 29 (Non-Equity Investment Instruments), 33 (Other Equities), 40 (Suspended Equities), 44 (Unclassified) and 45 (Unquoted equities) are excluded as they are presenting non-common shares or suspended share.

Table 1 continued

Table 1. Panel B. List of Sample countries and Relevant Market Indices

Under the heading of *Country* are the 37 unique countries listed in alphabetic order. *Days* are the number of trading days with valid observations during the sample period of July 3, 2006 to December 31, 2014. *#Firms* and *Industries* columns list the time-series average of the total number of firms in a country and the total number of unique industries. *AveIndfirms* provides the time-series average of the average number of firms across industries. *Mcap country (Bn USD)* is the total market capitalization based on all firms in billion USD. Market index/ Bloomberg ticker list the country index used to calculate country returns with the corresponding Bloomberg ticker.

Country	Days	#Firms	Industries	AveInd #firms	Mcap country (Bn USD)	Market Index / Bloomberg ticker
Australia	2386	1587.52	39	40.71	1,209	MSCI Australia Index / MXAU
Austria	2394	84.69	32	3.07	128	MSCI Austria Index / MXAT
Belgium	2337	135.03	34	4.22	274	MSCI Belgium Index / MXBE
Brazil	2139	266.19	38	7.20	841	MSCI Brazil Index / MXBR
Canada	2388	2348.70	40	59.48	1,752	MSCI Canada Index / MXCA
China	2328	2124.83	38	56.21	3,983	MSCI China Index / MXCN
Denmark	2410	177.35	32	5.87	231	MSCI Denmark Index / MXDK
Finland	2426	133.90	33	4.17	209	MSCI Finland Index / MXFI
France	2458	731.97	40	18.65	1,989	MSCI France Index / MXFR
Germany	2440	901.79	38	23.85	1,558	MSCI Germany Index / MXDE
Greece	2282	228.66	33	7.21	101	MSCI Greece Index /MXGR
Hong Kong	2361	1129.74	40	28.83	1,793	MSCI Hong Kong Index / MXHK
Hungary	2294	37.96	21	2.11	25	MSCI Hungary Index /MXHU
Indonesia	2222	333.22	37	9.28	294	MSCI Indonesia Index / MXID
Ireland	2363	49.91	24	2.55	93	MSCI Ireland Index / MXIE
Israel	2372	422.25	35	12.43	156	MSCI Israel Index / MXIL
Italy	2451	287.81	39	7.54	668	MSCI Italy Index / MXIT
Japan	2372	3696.52	40	92.41	4,123	MSCI Japan Index / MXJP
Malaysia	2351	917.94	38	24.35	346	MSCI Malaysia Index / MXMY
Mexico	2382	106.21	31	3.98	354	MSCI Mexico Index / MXMX
Netherlands	2442	125.16	31	4.19	620	MSCI Netherlands Index / MXNL
New Zealand	2380	115.61	33	3.61	48	MSCI New Zealand Index / MXNZ
Norway	2406	210.21	32	6.86	271	MSCI Norway Index / MXNO
Philippines	2278	198.52	33	6.66	144	MSCI Philippines Index / MXPH
Poland	2010	377.30	36	10.78	161	MSCI Poland Index / MXPL
Portugal	2334	45.38	27	2.11	79	MSCI Portugal Index / MXPT
Russia	2167	201.70	33	7.33	742	MSCI Russia Index / MXRU
Singapore	2382	677.38	39	17.86	495	MSCI Singapore Index / MXSG
South Africa	2405	307.67	34	9.11	427	MSCI South Africa Index / MXZA
South Korea	2398	1660.43	40	42.95	953	MSCI Korea Index / MXKR
Spain	2451	131.14	38	3.93	737	MSCI Spain Index / MXES
Sweden	2425	453.40	39	12.62	531	MSCI Sweden Index / MXSE
Switzerland	2423	255.51	32	8.35	1,350	MSCI Switzerland Index / MXCH
Taiwan	2381	1512.07	37	40.87	752	MSCI Taiwan Index / M3TW
Thailand	2358	536.66	37	14.61	379	MSCI Thailand Index / MXTH
Turkey	2358	302.37	36	8.79	228	MSCI Turkey Index / MXTR
United Kingdom	2434	1504.90	40	37.62	3,249	MSCI U.K. Index / MXGB

Table 2. Descriptions of Key Variables

Table 2 provides a summary of the key variables of interests, our dependent variables (i.e., industry and market returns), the shorting variables, and the control variables.

Variable Name	Definition and the Description of Variable Construction
A. Dependent Variables: Return Measures (where x = 5, 20, 60)	
$IndRet_{1,\,1+x}$ *(excIndRet)*	$IndRet_{1,\,1+x}$ *(excIndRet)* is the future x-day industry raw (excess) value-weighted cumulative holding period returns, measured with day skipping
$CntryRet_{1,\,x+1}$	Cumulative future x days return of country, skipping the first day (denoted in %)
B. Shorting and Industry Information Variables	
Industry Level Shorting Measures	
$IndSVconc_{t-1,c,i}$ *(1/SVrank)*	*IndSVconc* captures the industry interest of short sellers, as the ratio of the total shorted value on a specific day (t), in specific country (c), for a specific industry (i). In each country on each day, industries are ranked based on the *IndSVconc* measure in descending order where one is assigned to the most shorted industry. We use the inverse of this industry short-sale rank in the regression analysis to facilitate cross-country comparison and support the intuition that more short selling is associated with more negative returns.
$Top1MVInd_{t-1,c,i}$ $(Top3MVInd_{t-1,c,i})$	$Top1MVInd_{t,c,I}$ $(Top3MVInd_{t,c,i})$ dummy variable takes on the value of one for the largest industry (the top three largest industries) based on the aggregate industry market capitalization in country *c* a specific day (*t-1*), zero otherwise.
$Top1SVInd_{t-1,c,i}$ $(Top3SVInd_{t-1,c,i})$	$Top1SVInd_{t,c,I}$ $(Top1SVInd_{t,c,i})$ *d*ummy variable takes on the value of one for the industry (for the top three industries) which has the largest aggregate shorted value (for industries which are within the top three most shorted industry based on total shorted value) in country *c*, on a specific day (*t-1*), zero otherwise.
$IndMVconc_{t-1,c,i}$	*IndMVconc* captures the relative market importance of a specific industry. It is the ratio of industry importance on a specific day (t-1) in a specific country (c), represented by a specific industry (i), which is the sum of market capitalization of all firms in industry *i* relative to the total country market capitalization.
$IndMVconc_{\text{Top1}}$ $(IndMVconc_{\text{Top3}})$	$IndMVconc_{Top1}$ ($IndMVconc_{Top3}$) is the relative market importance of the largest industry in the country (the top three largest industries) calculated as the total market capitalization of the largest industry (top three) relative to the total market
$Top1c\ (Top3c)_{t-1,c}$	Top1c (Top3c) dummy variable takes on the value of one for the top most shorted industry accounts when it accounts for 30% of the total shorted value in the country (when the top three most shorted industries account for 60% of the total shorted value in the country).
$MarketSV_{t-1,c}$	$MarketSV_{t,c}$ is the total shorted value in the specific country on day t, measured in USD, as reported by Markit. In the regression analysis, we use the natural logarithm of this measure, *logMarketSV*.
C. Control Variables: Industry and Country Level Measures	
vwMtBV	The value-weighted averages of the previous month firm market-to-book values for a specific industry in country i
vwTurn	The value-weighted averages of the previous month firm market-to-book values for a specific industry in country i
LogIndMCap	The natural logarithm of the sum of market capitalization (in US$ millions) for an industry in country i
$LagIndRet_{20}$	The value-weighted average cumulative industry return for the previous 20-days.

Table 3.

The summary statistics report the time-series averages of the key variables (which are defined in Table 2) for each country. $LogIndMCap_t$ is the natural logarithm of the industry total market capitalization in a specific country, where the market capitalization is measured in the millions of USD. $IndRet_{1,5}$, $IndRet_{1,20}$, $IndRet_{1,60}$ are the 5-day, 20-day, and 60-day cumulative holding period returns on the value-weighted industry portfolio. *vwTurn* is the value-weighted average turnover and *vwMtBV* the value weighted average market-to-book ratio, *IndMV%* is the time-series average percentage of the total market capitalization contributed by a specific industry on day *t* for a specific country *c*. Similarly, *IndSV%* is the time series average percentage of the total short value contributed by the industry.

Country	LogIndMcap	vwTurn	vwMtBV	$IndRet_{1,5}$	$IndRet_{1,20}$	$IndRet_{1,60}$	IndMVconc	IndSVconc
Australia	9.260	0.062	2.722	0.000	0.001	0.003	0.026	0.026
Austria	8.284	0.026	1.812	0.000	-0.002	-0.004	0.040	0.036
Belgium	8.400	0.044	2.006	0.001	0.003	0.010	0.036	0.031
Brazil	9.499	0.053	2.884	0.001	0.004	0.010	0.032	0.027
Canada	9.673	0.052	2.597	0.001	0.005	0.014	0.025	0.025
China	10.886	0.371	3.447	0.003	0.013	0.042	0.028	0.026
Denmark	8.335	0.077	2.387	0.000	0.000	0.004	0.037	0.033
Finland	8.253	0.055	2.036	0.001	0.006	0.018	0.031	0.031
France	10.097	0.058	1.985	0.001	0.004	0.012	0.026	0.026
Germany	9.542	0.052	2.283	-0.002	-0.004	-0.006	0.026	0.026
Greece	7.485	0.024	1.490	-0.001	-0.004	-0.014	0.039	0.032
Hong Kong	9.927	0.055	2.162	0.002	0.009	0.029	0.027	0.026
Hungary	6.990	0.051	1.679	-0.001	-0.004	-0.010	0.087	0.056
Indonesia	8.516	0.043	4.045	0.003	0.012	0.035	0.041	0.028
Ireland	8.093	0.038	2.434	0.000	-0.001	-0.003	0.055	0.051
Israel	7.743	0.029	2.153	0.001	0.004	0.014	0.035	0.029
Italy	9.181	0.071	1.850	0.000	-0.001	0.000	0.027	0.026
Japan	10.857	0.653	1.470	0.001	0.003	0.010	0.025	0.025
Malaysia	8.394	0.040	1.686	0.002	0.008	0.024	0.030	0.027
Mexico	9.198	0.028	2.329	0.002	0.007	0.019	0.043	0.038
Netherlands	9.534	0.083	2.191	0.001	0.003	0.010	0.034	0.034
New	7.102	0.020	2.085	0.000	0.000	0.001	0.041	0.031
Norway	8.282	0.067	2.197	0.000	0.002	0.005	0.035	0.033
Phillipines	8.216	0.019	2.619	0.002	0.007	0.022	0.059	0.034
Poland	7.774	0.044	2.351	0.000	0.002	0.007	0.037	0.029
Portugal	8.148	0.031	1.736	-0.001	-0.007	-0.021	0.058	0.047
Russia	9.701	0.014	2.006	-0.002	-0.011	-0.020	0.068	0.037
Singapore	8.837	0.045	2.066	0.001	0.004	0.011	0.026	0.026
South	9.052	0.041	2.714	0.003	0.010	0.030	0.032	0.030
South	9.248	0.184	1.663	0.001	0.005	0.017	0.027	0.026
Spain	9.642	0.078	2.774	0.000	0.000	0.000	0.031	0.030
Sweden	9.002	0.077	2.737	0.001	0.005	0.017	0.033	0.028
Switzerland	10.031	0.067	2.647	0.001	0.003	0.007	0.033	0.033
Taiwan	9.204	0.113	1.878	0.002	0.008	0.026	0.030	0.027
Thailand	8.566	0.095	2.130	0.003	0.010	0.033	0.034	0.027
Turkey	8.382	0.290	2.560	0.003	0.012	0.038	0.032	0.029
United	10.285	0.079	2.940	0.002	0.006	0.017	0.026	0.025

Table 4. Pooled Panel Regression: Predicting Industry Returns

The dependent variable is the future cumulative holding period returns on value-weighted industry portfolio for 5-days in Models 1A-B, for 20-days in Models 2A-B, and for 60-days in Models 3A-B. The returns are measures in percentages and calculated with day skipping from time *t*+1. In Panel A, the shorting measures are dummy variables T*op1SVInd*$_{t-1,c,I}$ and *Top1SVInd*$_{t-1,c,i}$ which take on the value of one for the top most shorted industry *i* and the top three most shorted industries, respectively, based on the ratio of total shorted value relative to the aggregate country specific market shorted value at time *t-1*. In Panel B, the shorting measures are continuous measures: *IndSVconc* as the ratio of total shorted value allocated to the specific industry in the country, and *1/SVrank* which is the inverse of the industry shorted value rank, where the most shorted industry is ranked 1 while the least shorted is ranked 40 in a country with 40 industries, calculated at time t-1. The standard control variables are: the natural logarithm of the industry total market capitalization in USD, the value-weighted average market-to-book ratio in the industry, the value-weighted average daily turnover. These measures are based on the average values in the previous calendar month. And *LagIndRet*$_{t-20}$ is the previous 20-day cumulative returns on the value-weighted industry portfolio.

Panel A. The Return predictability of Short-Sale Concentration for the Top 1 and Top Three Most Shorted Industries

	(1A)	**(1B)**	**(2A)**	**(2B)**	**(3A)**	**(3B)**
	IndRet$_{t+1,t+5}$		**IndRet$_{t+1,t+20}$**		**IndRet$_{t+1,t+60}$**	
Top1SVInd	-0.113***		-0.446***		-1.280***	
	(-6.36)		(-5.95)		(-5.48)	
Top3SVInd		-0.109***		-0.421***		-1.170***
		(-6.08)		(-6.70)		(-7.04)
LogIndMCap	0.056***	0.060***	0.208***	0.221***	0.538***	0.574***
	(4.97)	(5.13)	(5.83)	(6.00)	(5.83)	(5.99)
vwMtBV	0.047	0.048	0.158	0.160	0.458	0.463
	(1.25)	(1.27)	(1.19)	(1.21)	(0.96)	(0.98)
vwTurn	-0.031***	-0.031***	-0.134***	-0.136***	-0.447***	-0.451***
	(-4.60)	(-4.64)	(-5.41)	(-5.47)	(-5.65)	(-5.72)
LagIndRet$_{20}$	-0.008**	-0.008**	0.002	0.002	0.063***	0.063***
	(-2.55)	(-2.56)	(0.23)	(0.23)	(4.69)	(4.69)
Constant	-0.359***	-0.382***	-1.316***	-1.404***	-3.110***	-3.348***
	(-4.01)	(-4.16)	(-4.37)	(-4.53)	(-3.82)	(-3.99)
Observations	2,730,921	2,730,921	2,730,921	2,730,921	2,730,921	2,730,921
R-squared	0.072	0.072	0.227	0.227	0.334	0.335

Table 4. continued

Panel B. The Return Predictability of Short-Sale Concentration with Continuous Short-sale Concentration Measures, IndSVconc and 1/SVrank

	(1A)	(1B)	(2A)	(2B)	(3A)	(3B)
	$\mathbf{IndRet_{t+1,t+5}}$		$\mathbf{IndRet_{t+1,t+20}}$		$\mathbf{IndRet_{t+1,t+60}}$	
$IndSVconc_{t,c,i}$	-0.312***		-1.030***		-2.657***	
	(-3.06)		(-3.19)		(-3.10)	
1/SVrank		-0.182***		-0.699***		-1.951***
		(-6.96)		(-7.27)		(-6.76)
LogIndMCap	0.055***	0.062***	0.173***	0.229***	0.393***	0.597***
	(3.26)	(5.22)	(4.13)	(6.13)	(3.94)	(6.14)
vwMtBV	0.040	0.048	0.115	0.161	0.316	0.467
	(1.42)	(1.27)	(1.19)	(1.22)	(0.88)	(0.98)
vwTurn	-0.027***	-0.031***	-0.117***	-0.136***	-0.406***	-0.454***
	(-3.66)	(-4.67)	(-4.56)	(-5.51)	(-5.02)	(-5.76)
$LagIndRet_{20}$	-0.009**	-0.008**	-0.001	0.002	0.060***	0.063***
	(-2.69)	(-2.56)	(-0.09)	(0.22)	(3.93)	(4.69)
Constant	-0.362***	-0.388***	-1.077***	-1.425***	-2.025**	-3.408***
	(-2.72)	(-4.20)	(-3.14)	(-4.59)	(-2.35)	(-4.05)
Observations	2,400,305	2,730,921	2,400,305	2,730,921	2,400,305	2,730,921
R-squared	0.081	0.072	0.253	0.227	0.365	0.335

Table 5. Predicting Industry Returns: By Country Results

Panel A. Coefficient Estimates on Short-Sale concentration Measures, for the Top 1 (Top1SV) and Top 3Most Shorted Industries (Top3CV), using the Specification from Table 4 Panel A.

		Top1SV		Top3SV	
		Coeff	**t-stats**	**Coeff**	**t-stats**
Australia	AU	-0.451***	(-3.45)	-0.723***	(-9.04)
Austria	AT	-0.833***	(-5.30)	-0.956***	(-9.43)
Belgium	BE	0.028	(0.20)	-0.769***	(-8.79)
Brazil	BR	-0.961***	(-6.40)	-0.605***	(-6.59)
Canada	CA	-0.194	(-1.56)	-0.558***	(-7.31)
China	CN	0.072	(0.48)	-0.271***	(-2.95)
Denmark	DE	-0.893***	(-5.99)	-0.781***	(-8.14)
Finland	FI	-1.521***	(-11.35)	-0.659***	(-7.45)
France	FR	-0.575***	(-4.96)	-0.549***	(-7.85)
Germany	DE	0.027	(0.21)	-0.107	(-1.33)
Greece	GE	-1.256***	(-6.82)	-1.126***	(-9.60)
Hong Kong	HK	-0.008	(-0.05)	-0.230***	(-2.60)
Hungary	HU	-0.811***	(-4.48)	-2.161***	(-15.84)
Indonesia	ID	0.122	(0.65)	-0.208*	(-1.73)
Ireland	IR	-1.645***	(-7.28)	-0.036	(-0.24)
Israel	IS	-0.377***	(-3.00)	-0.251***	(-3.21)
Italy	IT	-0.386***	(-3.02)	-0.789***	(-9.80)
Japan	JP	-0.622***	(-5.95)	-0.293***	(-4.64)
Malaysia	MY	0.012	(0.09)	-0.306***	(-3.27)
Mexico	MX	-0.045	(-0.33)	-0.190**	(-2.24)
Netherlands	NE	-0.478***	(-3.48)	-0.279***	(-3.32)
New Zealand	NZ	-0.591***	(-4.07)	0.081	(0.88)
Norway	NO	-0.565***	(-3.07)	-1.021***	(-8.84)
Philippines	PH	-0.565***	(-3.07)	-1.021***	(-8.84)
Poland	PO	-0.416***	(-2.59)	-0.159	(-1.56)
Portugal	PT	-1.121***	(-5.69)	-1.087***	(-8.16)
Russia	RO	0.239	(1.12)	-1.079***	(-7.40)
Singapore	SG	-0.675***	(-5.15)	-0.273***	(-3.34)
South Africa	ZA	-0.990***	(-7.25)	-0.438***	(-5.26)
South Korea	KR	-0.760***	(-5.73)	-0.852***	(-10.52)
Spain	ES	-1.100***	(-7.65)	-0.736***	(-8.06)
Sweden	SE	-0.144	(-0.96)	0.097	(1.06)
Switzerland	CH	-0.130	(-1.09)	-0.256***	(-3.50)
Taiwan	TW	-0.052	(-0.44)	-0.222***	(-3.00)
Thailand	TH	-0.501***	(-3.90)	-0.351***	(-4.37)
Turkey	TR	-0.149	(-0.95)	0.149	(1.58)
United Kingdom	UK	0.265**	(2.29)	-0.113	(-1.60)

Panel 5 continued

Panel B. Coefficient Estimates on Short-Sale concentration Measures, Industry Relative Shorted Value and Inverse of the Industry Shorted Value Rank using the Specification from Table 4 Panel B.

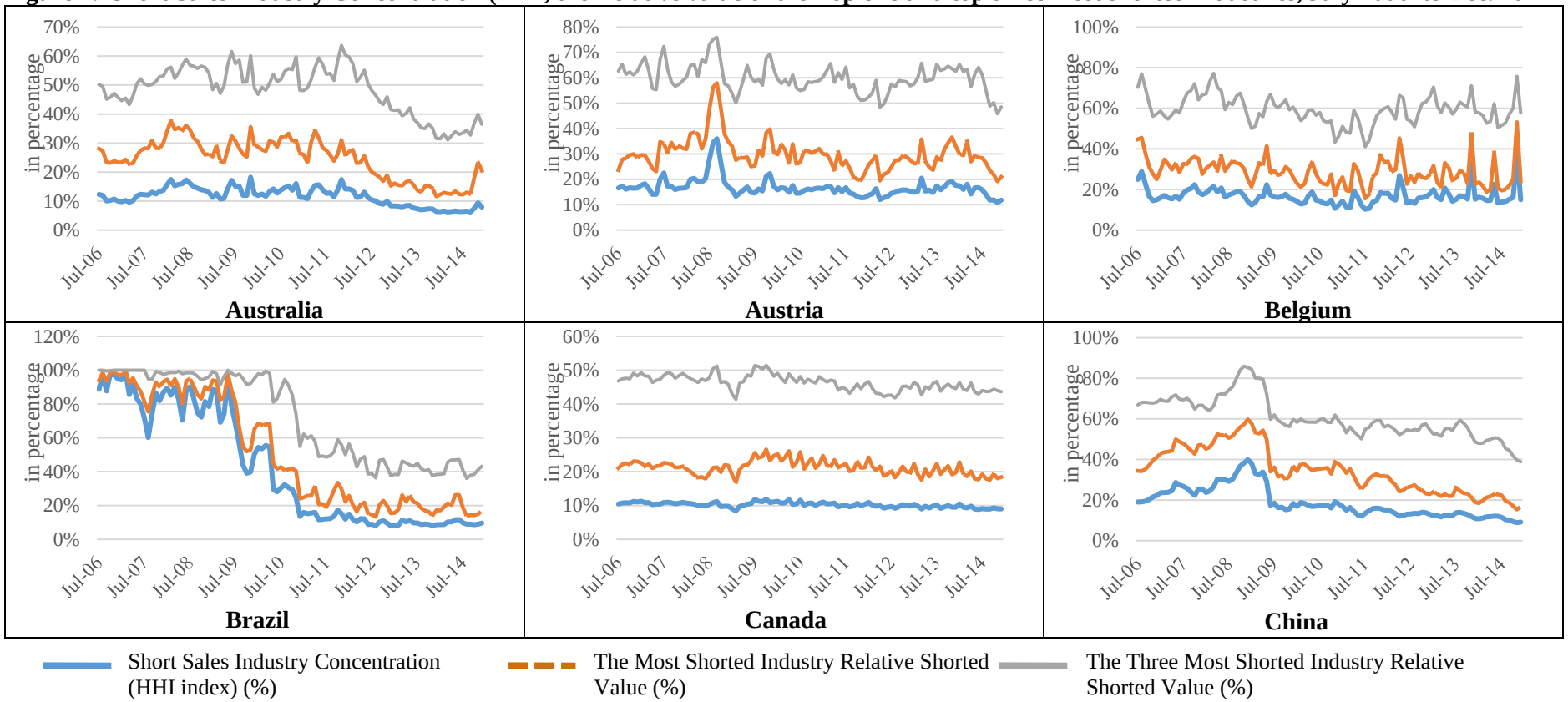
		IndSVconc		1/SVrank	
		Coeff	**t-stats**	**Coeff**	**t-stats**
Australia	AU	-2.957***	(-6.17)	-0.923***	(-7.00)
Austria	AT	-5.062***	(-10.06)	-1.649***	(-9.50)
Belgium	BE	-1.409***	(-3.42)	-1.035***	(-7.12)
Brazil	BR	-1.747***	(-7.92)	-1.149***	(-7.98)
Canada	CA	-3.102***	(-6.45)	-0.744***	(-6.09)
China	CN	-1.581***	(-3.97)	-0.190	(-1.26)
Denmark	DE	-3.217***	(-7.61)	-1.335***	(-8.23)
Finland	FI	-3.455***	(-9.17)	-1.678***	(-11.21)
France	FR	-5.858***	(-9.71)	-0.861***	(-7.78)
Germany	DE	-2.422***	(-4.84)	-0.272**	(-2.08)
Greece	GE	-3.107***	(-9.67)	-1.777***	(-9.36)
Hong Kong	HK	0.573	(0.89)	-0.133	(-0.89)
Hungary	HU	1.055***	(4.92)	-2.869***	(-12.78)
Indonesia	ID	-0.077	(-0.33)	-0.147	(-0.80)
Ireland	IR	-3.394***	(-6.91)	-1.132***	(-4.42)
Israel	IS	-0.831***	(-3.71)	-0.495***	(-3.90)
Italy	IT	-4.101***	(-9.95)	-1.193***	(-9.07)
Japan	JP	-4.681***	(-6.30)	-0.490***	(-4.85)
Malaysia	MY	0.167	(0.91)	-0.368***	(-2.74)
Mexico	MX	-1.230**	(-2.34)	-0.276*	(-1.93)
Netherlands	NE	-0.503	(-1.18)	-0.428***	(-3.12)
New Zealand	NZ	-0.671***	(-2.68)	-0.481***	(-3.02)
Norway	NO	-3.301***	(-7.33)	-1.271***	(-6.49)
Philippines	PH	-3.301***	(-7.33)	-1.271***	(-6.49)
Poland	PO	-0.714***	(-2.83)	-0.953***	(-5.84)
Portugal	PT	-5.684***	(-11.36)	-1.835***	(-7.69)
Russia	RO	0.754***	(2.76)	-0.982***	(-4.27)
Singapore	SG	-4.352***	(-9.50)	-0.773***	(-5.65)
South Africa	ZA	-3.576***	(-8.72)	-1.013***	(-7.41)
South Korea	KR	-4.451***	(-6.80)	-1.053***	(-8.09)
Spain	ES	-3.012***	(-9.06)	-1.499***	(-9.77)
Sweden	SE	-0.046	(-0.09)	-0.230	(-1.52)
Switzerland	CH	-1.227***	(-3.14)	-0.231*	(-1.83)
Taiwan	TW	-0.018	(-0.08)	-0.387***	(-3.15)
Thailand	TH	-1.956***	(-6.95)	-0.689***	(-5.32)
Turkey	TR	-0.203	(-0.67)	0.116	(0.71)
United Kingdom	UK	-2.775***	(-4.92)	-0.222*	(-1.95)

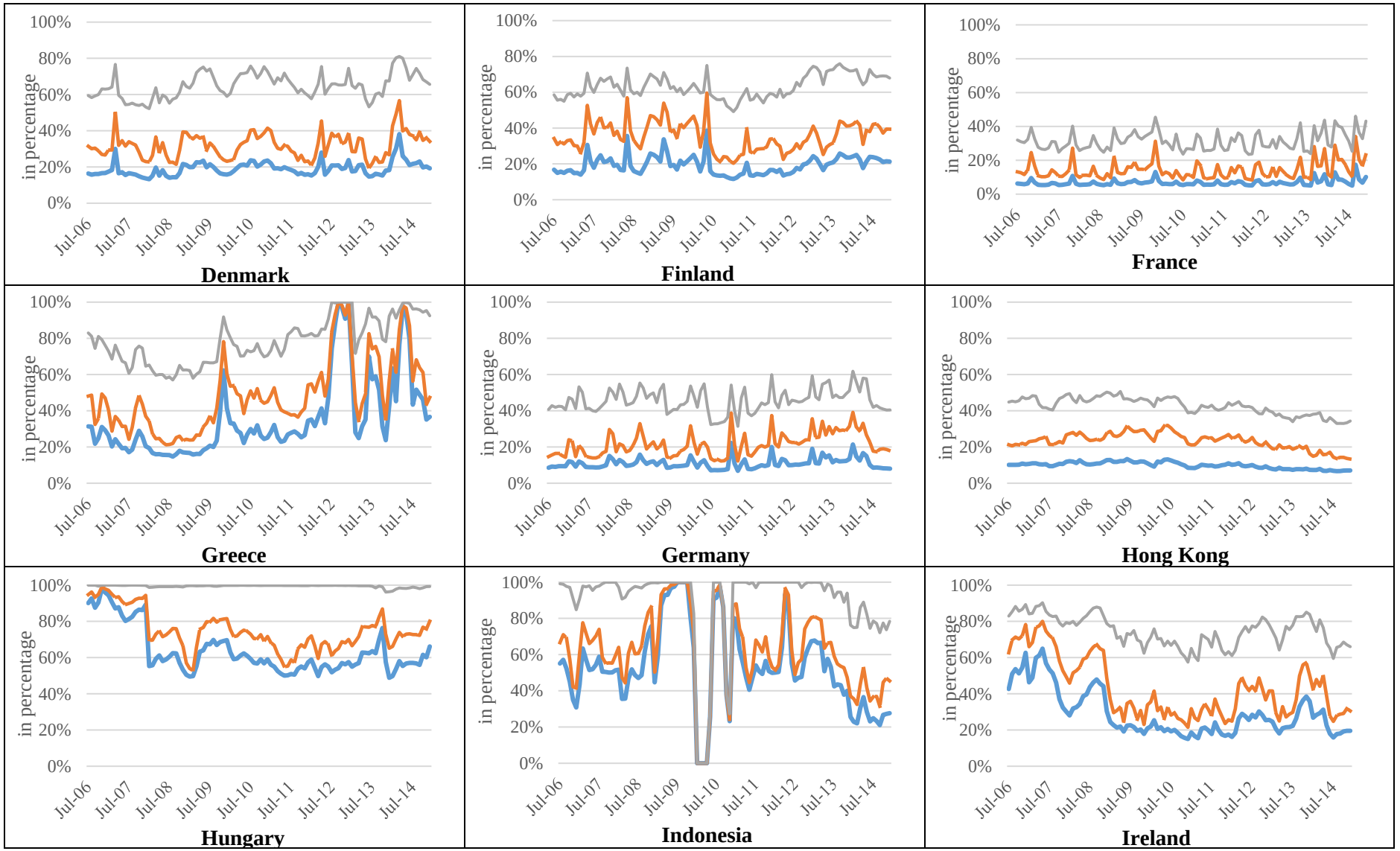
Table 6. Country Information from Short Sellers' Industry Concentration

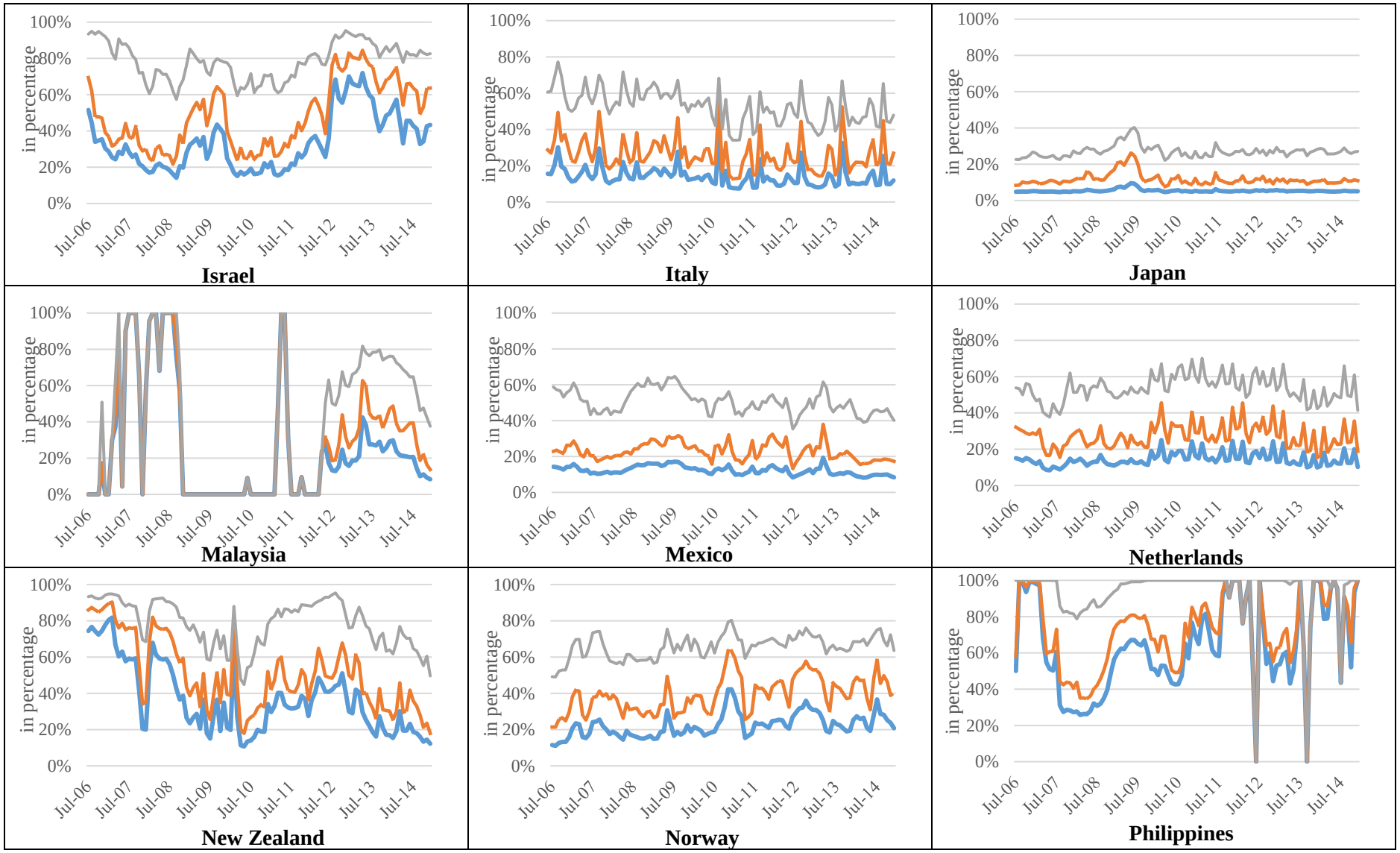
Top1c (*Top3c*) dummy variable takes on the value of one when the top 1 most shorted industry aggregate shorted value is 30% or more (if the top three most shorted industry aggregate shorted value is 60% or more) in the country on a specific day. *IndMVconc* $_{Top1}$ (*IndMVconc* $_{Top3}$) is the relative economic importance of the top 1 (top 3) most shorted industry in country measured by the fraction of the total market capitalization in the country that is represented by the top industry (top three industries). Top1c*IndMVconc$_{Top1}$ and Top3c*IndMVconc$_{Top3}$ are interaction variables of the aforementioned variables.

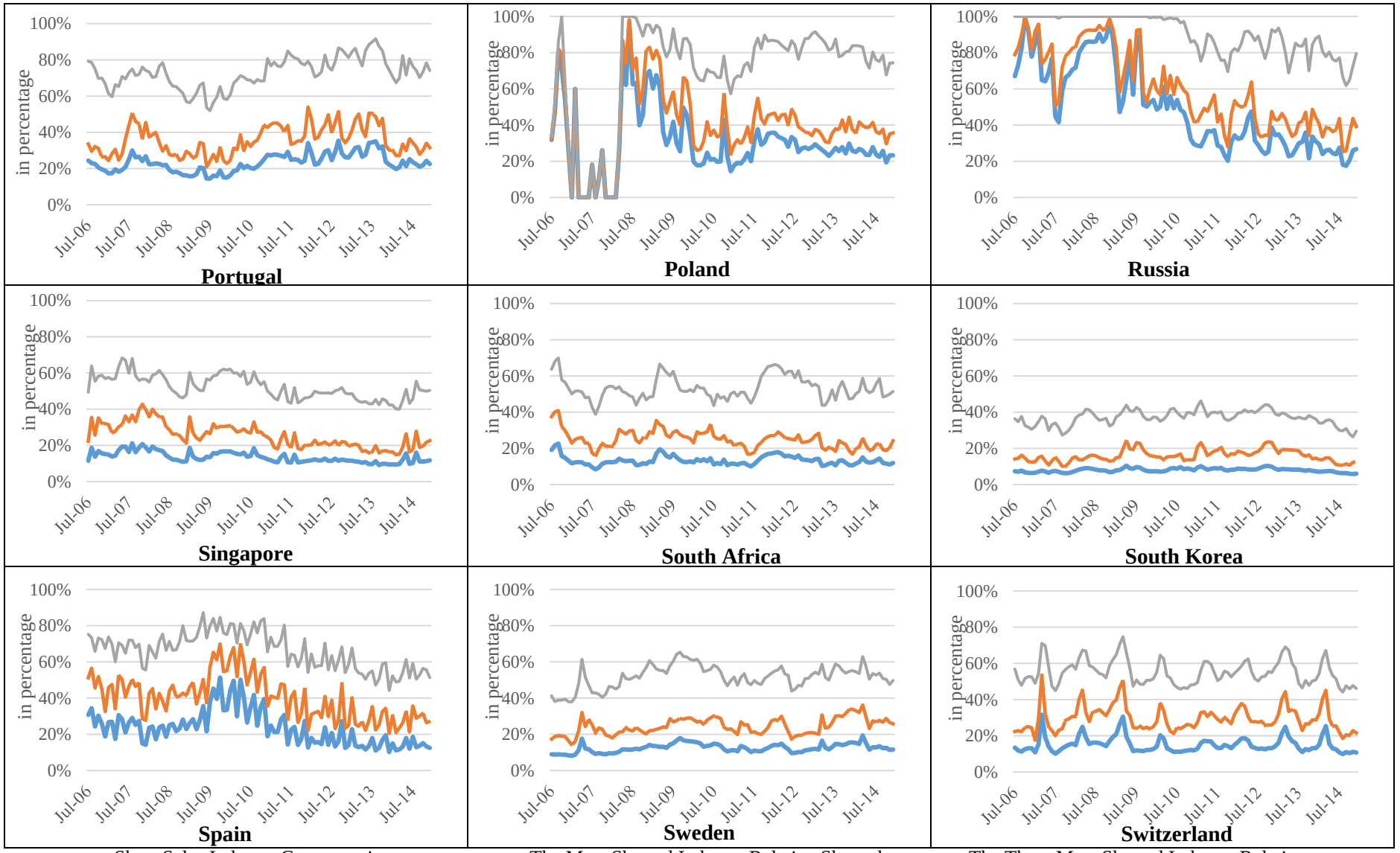
	(1A) **excCntryRet$_{1+5}$**	**(2A)** **excCntryRet$_{1+20}$**	**(3A)** **excCntryRet$_{1+60}$**	**(1B)** **excCntryRet$_{1+5}$**	**(2B)** **excCntryRet$_{1+20}$**	**(3B)** **excCntryRet$_{1+60}$**
Top1c	0.260**	0.719*	1.528			
	(2.05)	(1.69)	(1.39)			
IndMVconc$_{Top1}$	0.282	1.160	-2.470			
	(0.49)	(0.52)	(-0.42)			
Top1c*IndMVconc $_{Top1}$	-1.381**	-4.011*	-6.370			
	(-2.71)	(-1.95)	(-1.21)			
Top3c				0.462**	1.575*	5.053**
				(2.19)	(1.85)	(2.10)
IndMVconc$_{Top3}$				0.544	2.418	5.334
				(1.33)	(1.28)	(0.92)
Top3c*IndMVconc $_{Top3}$				-1.170**	-3.999*	-12.507**
				(-2.37)	(-2.00)	(-2.19)
LogMarketSV	-0.074***	-0.323***	-1.030***	-0.080***	-0.339***	-1.077***
	(-3.07)	(-2.96)	(-3.85)	(-3.24)	(-3.11)	(-4.08)
MarketFactor	0.513***	0.556***	0.602***	0.513***	0.556***	0.601***
	(27.03)	(30.10)	(24.06)	(26.96)	(29.84)	(24.04)
SMB factor	-0.044	0.128***	0.223***	-0.043	0.129***	0.225***
	(-1.43)	(3.98)	(4.98)	(-1.43)	(4.04)	(5.05)
HML factor	0.109**	0.191***	0.102	0.109**	0.191***	0.106
	(2.56)	(3.38)	(1.40)	(2.56)	(3.38)	(1.49)
RMW factor	-0.220***	-0.051	0.045	-0.219***	-0.051	0.052
	(-4.28)	(-0.79)	(0.58)	(-4.27)	(-0.78)	(0.68)
CMA Factor	-0.390***	-0.370***	-0.136**	-0.390***	-0.370***	-0.140**
	(-6.44)	(-7.32)	(-2.42)	(-6.45)	(-7.39)	(-2.50)
Constant	0.587***	2.593***	9.188***	0.489*	2.058*	7.353***
	(3.33)	(3.43)	(4.89)	(2.00)	(1.92)	(2.79)
Observations	75,858	75,858	75,858	75,858	75,858	75,858
R-squared	0.350	0.416	0.499	0.350	0.416	0.500

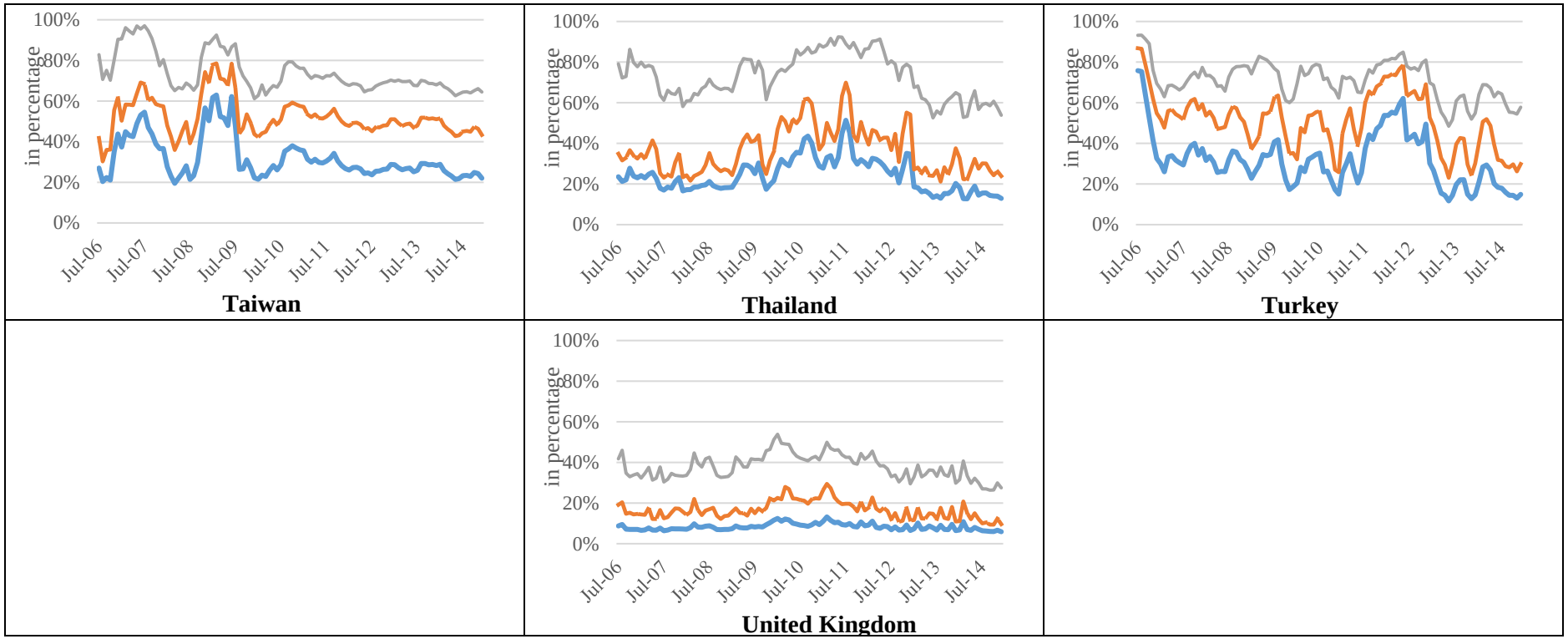
Figure 1. Short Sales Industry Concentration (HHI, the Relative value of the Top one and top three most shorted industries, July 2006 to Dec. 2014



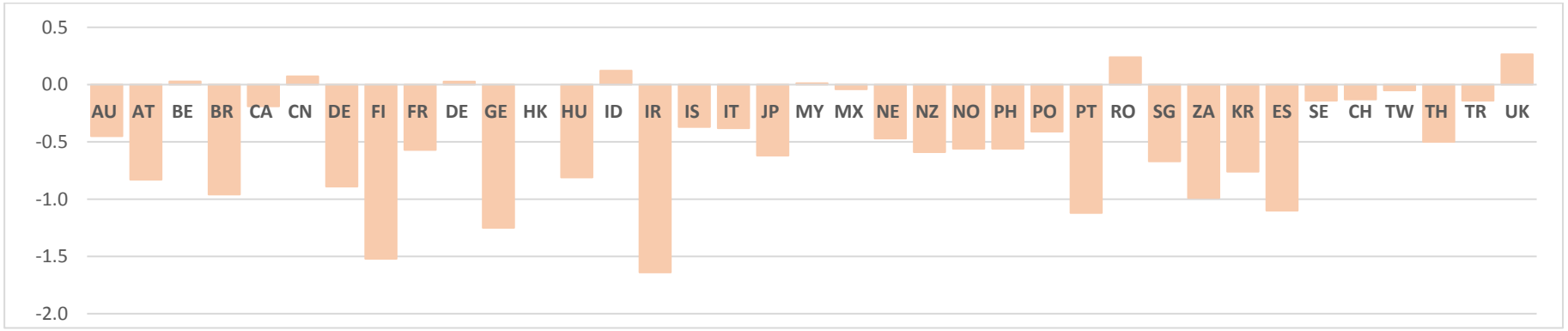

Denmark
Finland
France
Greece
Germany
Hong Kong
Hungary
Indonesia
Ireland
in percentage
100%
80%
60%
40%
20%
0%
Jul-06
Jul-07
Jul-08
Jul-09
Jul-10
Jul-11
Jul-12
Jul-13
Jul-14
Short Sales Industry Concentration (HHI index) (%)
The Most Shorted Industry Relative Shorted Value (%)
The Three Most Shorted Industry Relative Shorted Value (%)


Israel
Italy
Japan
Malaysia
Mexico
Netherlands
New Zealand
Norway
Philippines
in percentage
100%
80%
60%
40%
20%
0%
Jul-06
Jul-07
Jul-08
Jul-09
Jul-10
Jul-11
Jul-12
Jul-13
Jul-14
Short Sales Industry Concentration (HHI index) (%)
The Most Shorted Industry Relative Shorted Value (%)
The Three Most Shorted Industry Relative Shorted Value (%)


Portugal
Poland
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
in percentage
100%
80%
60%
40%
20%
0%
Jul-06
Jul-07
Jul-08
Jul-09
Jul-10
Jul-11
Jul-12
Jul-13
Jul-14
Short Sales Industry Concentration (HHI index) (%)
The Most Shorted Industry Relative Shorted Value (%)
The Three Most Shorted Industry Relative Shorted Value (%)


Taiwan
Thailand
Turkey
United Kingdom
in percentage
100%
80%
60%
40%
20%
0%
Jul-06
Jul-07
Jul-08
Jul-09
Jul-10
Jul-11
Jul-12
Jul-13
Jul-14
Short Sales Industry Concentration (HHI index) (%)
The Most Shorted Industry Relative Shorted Value (%)
The Three Most Shorted Industry Relative Shorted Value (%)

Panel A. *Short-sale Industry Concentration Coefficient Estimates, with The Top Most Shorted Industry Dummy*



Panel B. *Short-sale Industry Concentration Coefficient Estimates, with The Top 3 Most shorted Industries Dummy*

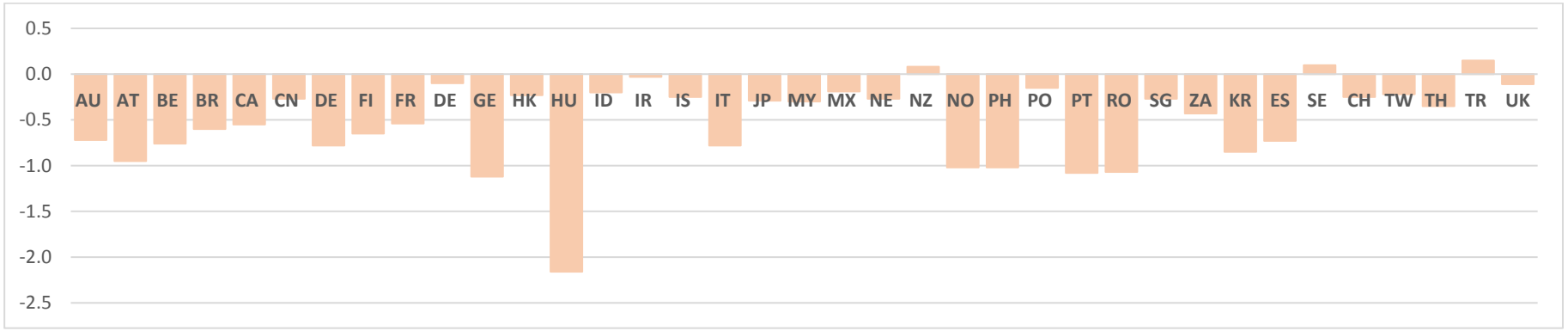
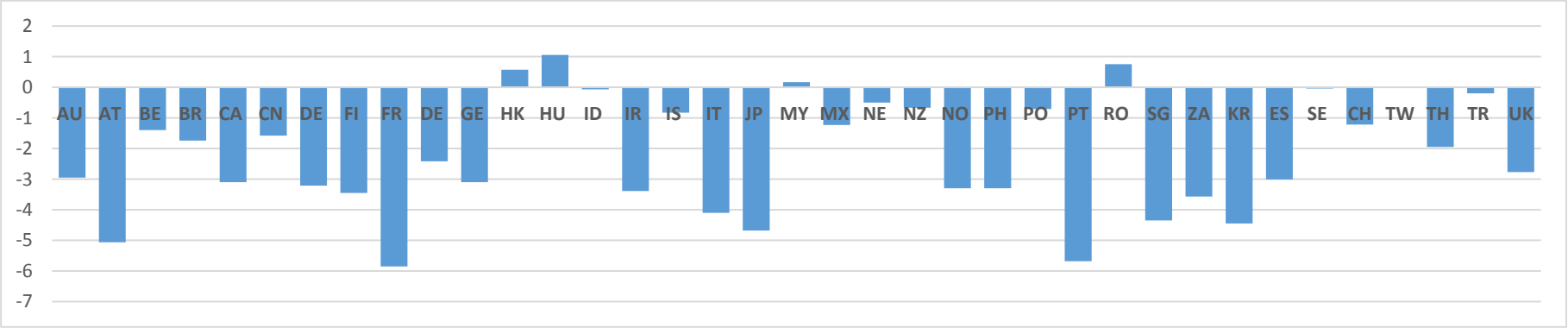


Figure 2. Return Predictability of Short-sale Concentration by Country, with Dumy Industry Measures
The figure depicts the country specific coefficient estimates on the short-sale industry concentration measure, based on Table 4 Panel A specifications where the short-sellers industry concentration is captured with dummy variables which take on the value of one for a specific industry if the industry is the top most shorted industry (in top Panel of the Figure) and if the industry is among the top three most shorted industries in a country at time t-1 (in the lower Panel of the Figure).

Panel A. *Short-sale Industry Concentration Coefficient Estimates, with the Industry Relative Shorted Value Measure (IndSVconc)*



Panel B. *Short-sale Industry Concentration Coefficient Estimates, with the Inverse of the Industry Short-sale Concentration Rank*

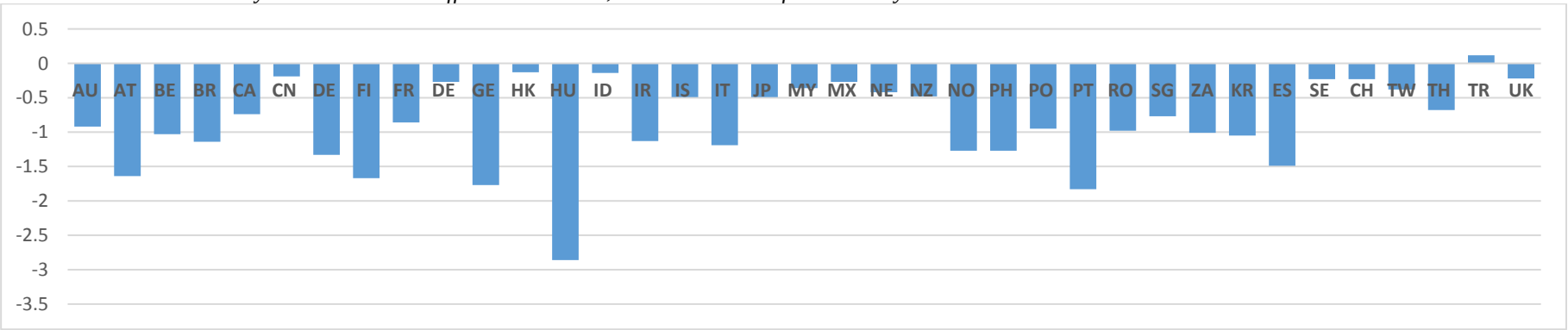


Figure 3. Return Predictability of Short-sale Concentration by Country, with Continues Industry Measures
The figure depicts the country specific coefficient estimates on the short-sale industry concentration measure, from Table 4 Panel B specification with continues industry measures, with the industry relative short sale value (IndSVconc) and with the invrese of the industry short-sale value rank (1/SVrank).

Appendix Table 1. Industry Concentration of Short Selling by Country

Country	Top 1 Most Shorted with frequency	Top 2 Most Shorted with frequency	Top 3 Most Shorted with frequency
Australia	Mining 79.61%	Banks 15.12%	General Retailers 4.59%
Austria	Banks 65.98%	Industrial Engineering 23.63%	Industrial Metals and 5.36%
Belgium	Banks 30.42%	Beverages 30.02%	Beverages 14.40%
Brazil	Equity Investment 48.79%	Financial Services (Sector) 19.98%	Oil and Gas Producers 7.52%
Canada	Banks 94.87%	Oil and Gas Producers 3.20%	Life Insurance 1.31%
China	Banks 82.40%	Construction and Materials 13.28%	Life Insurance 4.19%
Denmark	Industrial 38.57%	Alternative Energy 19.26%	Pharmaceuticals and 18.05%
Finland	Technology Hardware 74.71%	Industrial Engineering 23.90%	Forestry and Paper 0.68%
France	Oil and Gas Producers 39.83%	Banks 16.29%	Construction and 9.50%
Germany	Chemicals 61.21%	General Industrials 15.57%	Automobiles and Parts 8.33%
Greece	Banks 54.50%	Fixed Line 26.78%	Industrial Transportation 5.63%
Hong Kong	Real Estate Investment 98.61%	Personal Goods 0.90%	Banks 0.36%
Hungary	Banks 99.19%	Oil and Gas Producers 0.81%	
Indonesia	Banks 70.76%	Mobile Telecommunications 14.40%	Mining 9.07%
Ireland	Banks 41.85%	Travel and Leisure 20.12%	Food Producers 16.92%
Israel	Technology Hardware 55.76%	Chemicals 26.73%	Health Care Equipment 9.18%

Table 1. Continued

	Top 1 Most Shorted with frequency	Top 2 Most Shorted with frequency	Top 3 Most Shorted with frequency
Italy	Oil and Gas Producers 44.01%	Banks 20.30%	Oil and Gas Producers 14.99%
Japan	Banks 42.39%	General Retailers 31.41%	Automobiles and Parts 7.70%
Malaysia	Banks 34.54%	Mobile 29.33%	Gas, Water and Multi- 18.64%
Mexico	General Retailers 33.66%	Banks 16.97%	Mobile 15.44%
Netherlands	Personal Goods 37.53%	Oil and Gas Producers 36.59%	Fixed Line 5.81%
New Zealand	Fixed Line 57.74%	Construction and 31.68%	Software and Computer 5.54%
Norway	Oil Equipment and 70.21%	Oil and Gas Producers 25.65%	Banks 3.74%
Philippines	General Industrials 42.39%	Real Estate Investment 31.39%	General Retailers 18.70%
Poland	Banks 52.54%	Industrial Metals and 30.22%	Oil and Gas Producers 5.23%
Portugal	Fixed Line 43.38%	Banks 36.72%	Electricity 6.62%
Russia	Industrial Metals and 68.77%	Banks 25.11%	Oil and Gas Producers 2.12%
Singapore	Real Estate Investment and 49.28%	Food Producers 21.78%	Banks 10.94%
South Africa	Mining 59.09%	Industrial Metals and 13.50%	Banks 10.71%
South Korea	Leisure Goods 51.98%	Construction and 13.95%	Chemicals 12.02%
Spain	Banks 87.71%	Fixed Line 8.78%	Construction and Materials 1.26%
Sweden	Industrial Engineering 73.81%	Banks 11.97%	General Retailers 7.43%
Switzerland	Pharmaceuticals and 91.81%	Food Producers 6.66%	Technology Hardware and 99.69%
Taiwan	Technology Hardware and 99.69%	Life Insurance 0.32%	
Thailand	Banks 29.16%	Oil and Gas Producers 25.97%	Construction and Materials 20.25%
Turkey	Banks 99.01%	Mobile 0.50%	Food and Drug Retailers 0.36%
United Kingdom	Mining 52.07%	General Retailers 12.51%	Banks 8.55%