

How Informed Are International Short Sellers?

Global and Local Industry Concentration of Short Sellers

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ABSTRACT

Internationally, documenting the information content from short sellers at the stock level is rather challenging because of various direct and indirect short sale constraints as suggested by Boehmer et al. (2022). To account for stock level short sale constraints and the cross-country variation in short sale feasibility, we focus on short sellers' information at the aggregate industry and country level. In a sample of 37 developed and developing stock exchanges, we find that the value-weighted portfolio consisting of stocks from the topmost shorted and top three most shorted industries are associated with 45 bps and 42 bps lower returns over the next 20 days. The industry concentration of short sellers also contains material information about the future performance of the country's stock market index when short sellers target the country's largest industries. We furthermore document evidence of the role of short sellers in global information propagation by showing that short sellers tend to trade on the same industry information in multiple countries simultaneously.

Keywords: Emerging Markets, Industry Concentration, Industry Information, Market Efficiency, Short Selling

JEL classification: G10, G12

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“Master short seller Jim Chanos targets First Solar and renewables”

.... The industry as a whole is being threatened from all angles, with module prices falling and installations only spiking on policy moves, and with China, one of the strongest contenders in the renewable space “increasing capacity and cutting costs until it’s uneconomic for everyone.” Forbes, May 11, 2011

1. Introduction

While professionals and market participants often blame short sellers for short raids and depressed share prices, the academic consensus is that short sellers are informed traders because of their ability in identifying overvalued stocks (Desai et al., 2002; Asquith, Pathak, and Ritter, 2005; Boehmer, Jones, and Zhang, 2008) and avoiding shorting undervalued ones (Boehmer, Huszar, and Jordan, 2010). Short selling can also improve price efficiency (Blau, 2012), support liquidity (Blau and Whitby, 2018), reduce the post-announcement drift after negative earnings surprises (Boehmer and Wu, 2013), and decrease price bubble formation (Hong and Stein, 2003). However, most of the short sale studies focus on U.S. exchanges where short selling is widely practiced and dominated by institutional investors.

Internationally, the information content in short selling is difficult to measure because short selling is generally more limited due to direct and indirect short sale constraints. Boehmer et al. (2022) examine the information content of short selling across 38 countries and document significant variations in short-sale penetration across countries. On average, they find stocks with high days-to-cover ratios are associated with lower future stock returns, but the degree and quality of firm-level information conveyed by short sellers are dependent on market development, market quality, and short-sale regulations. Boehmer et al. (2022)’s findings are consistent with earlier international studies, which document large variations in the feasibility and intensity of short selling and link the prevalence of short selling to market efficiency and development (Bris, Goetzmann, and Zhu, 2007; Saffi and Sigurdsson, 2011). Jain et al. (2013) and Hu et al. (2021) study short selling and traders’ reaction to earnings surprise in ADR and

show that there is a far “reach” of short sale restrictions from the home market, resulting in lower shorting activity in general and also after negative earnings surprise.

While short sellers are considered in academic literature informed traders and promoting pricing efficiency (Boehmer and Wu, 2013), only about half of the market is outright shortable in China and Hong Kong. Even in developed countries, short sale restrictions are common as financial stocks are frequently protected by short-sale bans in Europe since the 2008 Global Financial Crisis (GFC).¹ During the Covid-19 pandemic, several European and Asian countries again reintroduced short sale bans. In the aftermath of the pandemic, to avoid the hard landing due to recessionary pressures, South Korean regulators reintroduced short sale bans from November 6, 2023, to June 2024 (Reuters, 2023).

In addition to the regulatory constraints, endogenous short-sale constraints also affect short sellers. Low liquidity, high idiosyncratic volatility because of the associated high short sale risk, and potential short sale squeeze may deter short sellers from trading (Diether, Lee, and Werner, 2009; Au, Doukas, and Onayev, 2009; Engelberg, Reed, and Ringgenberg, 2018; Richardson, Saffi, and Sigurdsson, 2017). On smaller, less developed stock exchanges where potentially only a few index-component stocks are liquid, short sellers may abstain from trading altogether or may have to settle on trading a substitute stock because of high trading costs. Hence, short sellers’ information may not be fully reflected at the firm level when short-sale constraints are binding, such as in illiquid and informationally opaque markets (Beneish, Lee, and Nichols, 2015; Boehmer et al., 2022). The absence of evidence of short sellers’ private information at the firm level does not necessarily imply short sellers’ un-informativeness, it may suggest that

¹ In addition to outright short-sale restrictions, a number of countries introduced short-sale disclosure regimes. These include Japan (Duong, Huszar, and Yamada, 2015; Boehmer, Duong, and Huszar, 2017), the European Union (see Jones, Reed and Waller, 2016), and South Korea (Korea Herald, 2016). These disclosure regimes tend to discourage informed institutional traders from shorting to protect their trade secrets, as shown by Duong et al. (2015) for Japanese stocks and Jones et al. (2016) for European stocks.

short sellers' information is obstructed and more prevalent at a more aggregate level, capturing the consensus of the entire group of short sellers.

We hypothesize that internationally, short sellers' information is better captured at the aggregated level, such as at the industry level, especially in countries with more binding short sale constraints at the firm level. Moreover, short sellers can have strong industry preferences, often connected with specific countries where the target industries are more prevalent. For example, international short sellers were loading up on oil companies in Singapore during and after the significant drop in oil prices in 2014 (Haigh and Stringer, 2014; Holm, 2014). More recently in the summer of 2022, short sellers were trying to profit from the overpriced lithium stocks in Australia, as these stocks had a large price runup due to high demand from the electronic vehicle (EV) enthusiasts.

In this paper, we propose a novel measure for short selling in international markets, short sellers' industry exposure (*IndSVconc*), which is the ratio of the industry shorted value relative to the total shorted value in the country. The industry shorted value is the aggregate shorted value across all stocks in the specific industry. We also identify the top one and top three most shorted industries within a country each day based on the *IndSVconc*. The preliminary support for our measure comes from the lack of short-sale coverage for the majority of the stocks in our 37-country sample from July 2006 to December 2014.² We find that in large developed financial markets such as the U.K., most individual stocks have nontrivial short-sale activities, suggesting that short sellers can trade on firm specific information. However, in half of our sample, short selling is highly concentrated in a few industries within the country (see Figure 1). Hence, unlike prior studies, we do not use the firm level short interest ratio (SIR) because of the large fraction of the stocks without shorting.

² In this analysis, we exclude the U.S. for several reasons. The U.S. stock markets are rather globalized, including hundreds of international listings which may not be representative of the local US economy. More importantly, Huszar et al. (2017) has already studied the industry information from short sellers in the U.S. market.

In a pooled regression on the sample of 37 countries, we find that on average the most shorted industry is associated with 45 basis points lower returns over the next 20 trading days after controlling for industry characteristics. The results hold when we use the three most shorted industries instead of the topmost shorted one. In addition to the dummy variables, we show that the relative capital exposure of short sellers also predicts industry returns in the pooled sample.

To ensure that the developed countries with a larger number of industries do not dominate our results, we also provide a by country analysis of the short sellers' industry information. We find that the dummy variables capturing the most shorted industries and the continuous measures of short sellers' capital exposure are informative in smaller economies where short sellers are highly concentrated (e.g., Hungary, Ireland, and Taiwan) as well as in larger countries where short selling is well represented in most industries (e.g., the U.K., France, Germany, and Japan).

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

Taking macro implications a step further, we cogitate industry information at the global scale. Our findings reveal that the global financial market integration propagates global and industry shocks through active traders as the financial industry is consistently the globally most shorted industry throughout the entire sample period. When we further examine the return

predictability of the most shorted industries by including an additional interaction dummy that captures whether the top shorted industry in the country is the financial industry, we find that both the country level indicator and the global indicators forecast negative industry returns.

Overall, this study makes three distinctive contributions. First, we propose a new measure to better capture international short selling and extend the U.S. findings that short sellers as a group of active investors provide useful aggregate industry and market information internationally. Second, we suggest that the information value from the industry focus of active professional short sellers in an international setting can alleviate retail traders' information disadvantage.³ Last, the strategic industry and global movement of international short sellers warrant regulatory attention to better understand the vulnerability of the underlying economies and global financial systems in an increasingly interconnected global financial market.

The rest of the paper is structured as follows: Section 2 reviews the relevant literature and the development of 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., Asquith et al., 2005; Boehmer et al., 2008; Desai et al., 2002; Diether et al., 2009) find that large shorting activity or large short positions predict lower future returns, implying that short sellers are informed traders. Numerous studies have examined the information sources of short sellers. Boehmer and Wu (2013) and Engelberg et al. (2012) find that short sellers primarily focus on important scheduled news releases and

³ In the U.S., the NYSE, the NASDAQ, and the BATS exchanges regularly disseminate information on aggregate short-sale volume. While the frequency of this information from NYSE and NASDAQ is bi-weekly, the BATS exchanges provide daily level data at no cost to all interested parties. Similarly, in the international markets, the Japan Exchange Group and the Hong Kong Stock Exchange (HKex) report weekly and daily short-sale information to the public. European Exchanges are less advanced or less transparent and currently provide information only about the large short positions. See Gruenwald, Wagner, and Weber (2010) for a detailed review of disclosure requirements relevant to short selling.

are able to front run the market because they are more highly skilled information processors. Boehmer et al. (2020) and Purnanandam and Seyhun (2018) document that short sale activities are more informative around the arrival of new information, such as earnings or insider trades. Anderson, Reeb, and Zhao (2010) suggest that short sellers tend to trade on private information, which they obtain as an insider or through their connection with insiders. Activist short sellers also turned to the media and strategically revealed their private information to avoid limits to arbitrage constraints (Ljungvist and Qian, 2016) or influenced managerial decisions and disclosure (Brendel and Ryans, 2021). Boehmer et al. (2020) find that professional short sellers effectively combine public and private information in anticipating earnings events, while Au et al. (2009), Diether et al. (2009), and Engelberg et al. (2018) show that short sellers consider trading costs and risks by avoiding illiquid stocks and stocks with high idiosyncratic volatility and short covering risk). Short-sale trades attract much attention not only because short sellers are known to realize large profits but also because their trades promote pricing efficiency (Boehmer and Wu, 2013) and prevent the formation of price bubbles (Hong, Scheinkman, and Xiong, 2006).

Despite the academic consensus that short sellers convey new material firm specific information, the international evidence is scarce and conflicting at best. Bris, Goetzman and Zhu (2007) and Saffi and Sigurdsson (2011) suggest that exogenous short-sale constraints, outright short-sale bans, and the underdevelopment of the securities lending market can obstruct pricing efficiency internationally. In addition to outright short sale ban, and market restrictions, short sellers' concern with trading costs and risk could imply that they may refrain from shorting (Boehmer and Wu, 2013) where they are most needed in market with high frictions.

In developing countries, short selling is shown to reduce pricing efficiency and increase volatility, at least temporarily, as speculation increases after the lifting of short sale bans (Cai et al. 2019). Ni and Yin (2020) provide further evidence of the negative consequence of short

sellers in emerging markets by showing that stocks targeted by short sellers will reduce risky investment and cut back on R&D. Hence, when one move from studying short sellers in the U.S. to an international setting, there is a need to consider the diversity in regulatory frameworks, market frictions, and even culture across markets as suggested by Boehmer et al. (2022).

Studying the information provisional role of short sellers in an international context is important for several reasons. First, short sellers are expected to be informed traders because of the higher risk and costs associated with their trades (Diamond and Verrecchia, 1987); thus, their trading patterns may be useful guidance not only for institutional traders but also for retail traders. Second, short sellers are deemed to serve as social-welfare 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 faster to prevent front running. By showing that short sales promote pricing efficiency and aid internal governance, Bris et al. (2007) and Massa et al. (2015; 2016) highlight the importance of short sellers in the market for regulators and market participants alike. More recently Dixon and Kelley (2022) show that even in the U.S. short sellers may likely trade on industry or factor information in recession and focus on the firm information in expansion.

Anecdotal evidence (Barrons, 2013; CNBC, 2015; Reuters, 2015) suggests that short sellers have strong 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 return predictability at the industry and the market levels 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, there are no prior studies on industry or market return predictability of short selling internationally.

The lack of international evidence on short selling is probably due to two economic reasons. First, endogenous or exogenous short-sale constraints in different countries preclude short sellers from effectively trading on their private firm information. If short sellers have significant negative information on but are unable to short a firm, they may decide to short a related stock in the same industry or along the supply chain. Second, as suggested by Boehmer et al. (2008), Duong et al. (2016), and Jones et al. (2016), many internationally short sellers are active non-program hedge funds. While those hedge funds are larger compared to retail traders, they still have capital constraints, which was evident during the IT bubble and the recent meme-trading frenzy (Lamont and Stein, 2004; Hilliard and Hilliard, 2023). The informed active short sellers are shown to be concentrated and their capital allocation can explain excess comovement in LSE stocks (Geraci et al. 2023). Hence, our first empirical hypothesis is as follows:

H1: In a country setting, the topmost shorted industry (the industry with the highest capital exposure of short sellers in the country) subsequently underperforms, capturing negative industry information from short sellers.

H1A: The top three most shorted industries (the three industries with the highest capital exposure of short sellers in the country) 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 and market liquidity. 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 from prior studies. Instead, we measure the short sellers' industry concentration by their capital exposure to the specific industry and identify the top three most shorted

industries in each country on each trading day. In the regression analysis, to measure the return predictability, we use value-weighted industry returns as dependent variables with industry characteristics controls and country-time fixed effects.

Smaller economies tend to have stock markets with high industry concentration, where a significant fraction of the market belongs to one or a handful of key industries. This key industry is the IT and semi-conductor sector for South Korea and Taiwan, the mining sector for Australia and Canada, and the energy (or oil and gas) sector for Singapore. In Asia, short selling is highly concentrated on a few large firms. According to IHS Markit Securities Finance Data, the South Korean bio-tech firm, Celltrion, was 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 as short sellers actively targeted the company in 2016 (Global Investor Group, 2017).

Figure 1 documents the high industry concentration in short sales 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 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. Hence, our second empirical hypothesis is as follows:

H2: A high concentration of short selling in the topmost economically important industry on a domestic exchange signals future declines in the aggregate market.

H2A: A high concentration of short selling in the top three economically most important industries on a domestic exchange signals future declines in the aggregate market.

Specifically, we test whether short sellers targeting the economically most important industry (or industries) predict returns, using our measure of the topmost shorted and the top three most shorted industry dummies. We identify the economically the economically most important industries based on stock market representation, which is likely to be a noisy measure, especially in countries where important companies may be private or government enterprises. Given that we are predicting stock market performance and not raw economic performance, measured by GDP, we are confident that our measure is suitable.

Last, we consider the effect of globalization and the increasing presence of global financial institutions (Moshirian, 2003). Empirical evidence from Jones et al. (2016) and Boehmer et al. (2022) suggests that a small group of large short sellers are active globally across Europe, the U.S., and Japan. Thus, these short sellers are likely to have a global trading strategy exploiting the information propagation from the U.S. to other countries and vice versa. In addition, the global information source is expected to emanate from the few globally systematically important financial institutions, such as Citigroup, Goldman Sachs, JP Morgan, and Barclays. We specifically focus on the global financial sector because this sector is consistently the most shorted sector throughout our sample period. Thus, we want to investigate whether short sellers who are targeting this industry in multiple countries convey additional information. This is our third empirical hypothesis:

H3: When the country's most shorted industry is also the most shorted industry globally, then short sellers convey additional (global) negative information to the market.

3. Sample Construction and Sample Statistics

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, and 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.⁴ 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 100% and the two-day cumulative return is less than 20%. In addition, we exclude illiquid 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 IHS 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 have data for 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

⁴ Our sample is largely consistent with that of Boehmer et al. (2022). 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.

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, with one of the smallest market capitalizations, illiquid market, with a monthly average of 38 firms representing 21 industries. Hungary is also one of the least covered countries in the sample with only about two firms per industry. Still for completeness, we keep the country and the relevant observations following Boehmer et al. (2022). Ireland is the second smallest country by industry representation, with on average 50 firms representing 24 industry sectors.⁵

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.⁶ In our sample, the Japanese stock exchange was the largest exchange with about 4 trillion market capitalization while China was a close second. The numbers presented are based on the in-sample time-series averages. Our sample covers about 2,300 trading days in each country, spanning over about 10 years from July 2006 to December 2014, including the Global Financial crisis and the European Debt Crisis periods.

⁵ 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 on other more liquid exchanges where their peer firms are listed.

⁶ 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 were 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 3,000 firms. Thus, for consistency, we include all Japanese stocks that are listed on major stock exchanges throughout the entire sample period.

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 effectively at the stock level. While we may be inclined to investigate whether at times of strong firm level short sale bans, the industry information is stronger, the 2008 short sale bans hit an entire industry.

3.2. Variables Constructions and Definitions

Table 2 provides a detailed description of our variables. Specifically, our dependent variables, *IndRet*, are the cumulative 5-day, 20-day and 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 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 of regulatory constraints and stages of market development, we cannot expect short sellers to have similar market penetration across countries. Thus, we calculate the 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 when the industry is the topmost shorted industry for the specific day 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. Figure 1 provides a visual of 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 across countries over our sample period. In addition to the dummy variables, we use two continuous measures, namely the relative industry concentration of short sellers ($IndSVconc$) and the inverse of the within country industry rank measure ($1/SVRank$) to capture the relative intensity of short sellers' industry information.

[Insert Figure 1 here]

We also consider a specific industry relative economic importance in their home country to test whether short sellers' signal market wide aggregate information. Following the same logic as 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 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.⁷

3.3. 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 is not only a function of the country's economy but also influenced by the country diversification, the industry diversity in

⁷ 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.

the country. For example, the average industry size is relatively big in Hungary but only a few industries are represented on the exchange.

Table 3 also displays the time-series average for the key variables: the cumulative holding returns on value-weighted industry portfolios for 5-day, 20-day and 60-day, the average industry liquidity, and the market-to-book ratio. Also of key interest are the industry relative market capitalization (*IndMVconc*) and industry relative shorted value (*IndSVconc*) which capture the economic importance of the industry in the country and the within country concentration of short sellers. Again, Hungary and Ireland have the highest industry concentration, while Canada and the United Kingdom exhibit the lowest industry concentration.

[Insert Table 3 here]

Next, we describe the cross-country difference in short sellers' market penetration and industry concentration to facilitate the interpretation of our empirical results. Figure 1 depicts the industry concentration by country for our sample of 37 countries from July 2006 to December 2014. We report zero short selling at least for a few days during our sample periods for a few countries, due to sparse coverage by IHS Markit at the beginning of the sample period. For example, at the beginning of the sample, we have very low market coverage for Brazil, which has a near 100% HHI short-sale concentration index. As the market coverage increases and the securities lending activity picks up with 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, the Philippines, and Malaysia also have spotty securities lending market coverage because of severe regulatory restrictions. Malaysia imposed a short-sale ban after the onset of the GFC, captured by the missing coverage in Figure 1 from 2008 to 2012. Since Markit Securities Finance Dataset does not measure short selling but securities borrowing, there are still a few observations for Malaysia in 2011 despite the short-sale ban. In the case of the

Philippines and Indonesia, Figure 1 depicts high concentration for the top three industries amounting to 80-100% of the total shorting activity throughout the sample period. Similarly high concentration is also observed in Thailand where the top three most shorted industries account to close to 80% of the total shorted value until 2013. In these markets, during the beginning of our sample, short selling was less practiced likely because of low institutional investors penetration in the market or because short selling was restricted to index constituents.

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 a cross-country pooled panel for the period between July 7, 2006, and December 31, 2014. While the pooled regression results can provide broad support for our hypothesis, the profitability of a global cross industry trading strategy is expected to be low because of high trading costs across the 37 markets. Thus, in section 4.2, we provide more detailed insights at the country level and report the return predictability of industry concentration within country which 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 consideration 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 in our sample of 37 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 (*Top1SVInd* dummy variable) and the top three most shorted industries (*Top3SVInd* dummy variable). Table 4 Panel B shows the industry return predictability with the two continuous

measures, namely short sellers' relative concentration and the inverse of the industry's 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. Results from Table 4 Panel A Models 1A and 2A 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. Overall, we find evidence supporting Hypotheses 1 and 1A.

[Insert Table 4 here]

Table 4 Panel B examines the information content in a more general setting using continuous measures for short sellers' industry concentration.⁸ First, we use the short sales relative capital concentration (*IndSVconc*), which is the ratio of the total industry shorted value 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 industry shorted rank measure, specifically the inverse of the industry rank (*1/SVRank*), because we want to be consistent in interpreting the signs on the coefficients across our measures. 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 number of industries (n) represented in the country. The results from Models 1B, 2B and 3B are comparable with those from 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

⁸ Results using industry's SIR, which is the ratio of the total shorted value to the total market value, are reported in Appendix Table 1.

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 significantly lower returns over the next 20-day horizon. We show only the coefficient estimates on these key short-sale concentration variables, but the full specification results are available upon request. The short-sale concentration captured by the dummy variables depicting either the most shorted industry or the top three most shorted industries are associated with significantly negative future industry returns in 33 out of our sample of 37 countries (except for Germany, Sweden, the United Kingdom, and Turkey).

[Insert Table 5 here]

Next in Table 5 Panel B, we examine the industry return predictability using two continuous measures, namely the relative industry concentration of short sellers (*IndSVconc*) and the inverse of the industry shorted rank variable (*1/SVRank*). We find that the relative dollar exposure 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 ban or naked ban has been put in place following the 2008 Global 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 undeveloped and during the first four years of the sample until end of 2009, not only was there political uncertainty but the new Turkish lira was also undergoing a reform which may discourage active institutional traders from entering the market.

4.3. Country and Global Information from Short Sellers' Industry Trades

In the last section, we consider the aggregate market implications of short sellers' capital exposure and concentration. As shown in Figure 1, in most countries short selling is concentrated in a specific industry. In smaller economies or even in developed economies like 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 may be motivated to trade in this key industry sector. Thus, we posit in Hypothesis 2 that short sellers' concentrated exposure to the country's economically most important industry (or industries) signals a downturn at the aggregate market level in the future.

[Insert Table 6 here]

In Table 6, our dependent variables are the 37 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 a realizable trading strategy or investment advice. Specifically, we want to investigate whether short sellers' geographic and industry preferences, are often discussed in the media, can provide guidance for the everyday retail investors. In

Table 6, two dummy variables are used to capture short sellers' concentration. *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.

The variables of interest are the interaction terms between short sellers' concentration and the fraction of market capitalization in the country represented by the first most shorted industry and the top three most shorted industries, $Top1c * IndMVconc_{Top1}$ and $Top3c * IndMVconc_{Top3}$. 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 market information when the targeted industries represent a significant fraction of the market.

Table 6 presents results from country regressions using about 2,300 daily observations for each country with the Fama-French 5 Global Factors (ex. U.S.) as control variables (Fama and French, 2015). Overall, the significant negative coefficient estimates on the interaction variables $Top1c * IndMVconc_{Top1}$ and $Top3c * IndMVconc_{Top3}$ support our Hypotheses 2 and 2A that high concentration of short selling in the most economically important industries predicts lower market returns.

At any point in time during our sample period, the financial sector is the most shorted industry across the 37 countries. This global concentration of short sellers on the financial sector may imply systemic financial shocks either due to a financial crisis or to the interconnectedness of the financial sector. This empirical finding probes us to examine whether the source of the short sellers' industry information originates from the local or global market. That is, we want to test whether the return predictability of short sellers' industry concentration is due to the global financial sector or to local information or both. Specifically, we explicate our analysis

from Table 4, include a new dummy variable (*GlobalEffect*) which equals one when the most shorted industry in the country is the financial sector. Table 7 reports the relevant results.

[Insert Table 7 here]

Table 7 provides support for our Hypothesis 3 that besides domestic industry information, short selling also conveys global industry information. We find that *GlobalEffect* is statistically and economically significant in all models. Our short-sale industry measure, the dummy variable for the top three most shorted industry (*Top3SVInd*) remains significant, suggesting that short sellers provide not only financial industry information but also important non-financial industry information.

In the robustness tests in Models 1B, 2B, and 3B, we exclude data from the GFC period of September 2008 to December 2009. Our results are consistent with the overall sample shown in Models 1A, 2A and 3A, suggesting that the predictability of the shorting activities in the global financial industry is not driven by the GFC.

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 SIR in the U.S. is one of the most robust market return predictors. As the above referenced studies all used U.S. data, there is significant evidence in the U.S. context that short sellers as a group of informed traders provide new material information 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. (2022)'s study 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 short sellers internationally is challenging because institutional trader penetration and the quality of accounting information which could support price discovery vary significantly across countries.

In this study, we show that while short sellers' information provisional trades at the firm level may be obstructed by market frictions 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 binding. Specifically, we find that, in a pooled global industry across 37 countries from 2006 to 2014, 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. The within country regression results show that the return predictability of short sellers is robust across countries, which is strikingly different result from Boehmer et al. (2022). In addition to the industry information, we also find 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 relate to the empirical evidence that short sellers provide industry and market information internationally. Retail investors should pay close attention to the industry shorted and market concentration featured in the media. In addition, regulators and policy makers should pay attention to 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 non-common shares or suspended shares.

Table 1 continued*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 the country and the total number of unique industries. *AveInd* provides the time-series average of the 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 lists 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 3.

The summary statistics report the time-series averages of the key variables, defined in Table 2, for each country. $IndRet_{1,5}$, $IndRet_{1,20}$, $IndRet_{1,60}$ are the 5-day, 20-day and 60-day cumulative holding period returns on the value-weighted industry portfolio. $LogIndMCap_t$ 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. $vwTurn$ is the value-weighted average turnover. $vwMtBV$ is 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 . $IndSV\%$ is the time series average percentage of the total short value contributed by the industry.

Table 3. continued

Country	IndRet _{1,5}	IndRet _{1,20}	IndRet _{1,60}	LogIndMcap	vwTurn	vwMtBV	IndMVconc	IndSVconc
Australia	0.000	0.001	0.003	9.260	0.062	2.722	0.026	0.026
Austria	0.000	-0.002	-0.004	8.284	0.026	1.812	0.040	0.036
Belgium	0.001	0.003	0.010	8.400	0.044	2.006	0.036	0.031
Brazil	0.001	0.004	0.010	9.499	0.053	2.884	0.032	0.027
Canada	0.001	0.005	0.014	9.673	0.052	2.597	0.025	0.025
China	0.003	0.013	0.042	10.886	0.371	3.447	0.028	0.026
Denmark	0.000	0.000	0.004	8.335	0.077	2.387	0.037	0.033
Finland	0.001	0.006	0.018	8.253	0.055	2.036	0.031	0.031
France	0.001	0.004	0.012	10.097	0.058	1.985	0.026	0.026
Germany	-0.002	-0.004	-0.006	9.542	0.052	2.283	0.026	0.026
Greece	-0.001	-0.004	-0.014	7.485	0.024	1.490	0.039	0.032
Hong Kong	0.002	0.009	0.029	9.927	0.055	2.162	0.027	0.026
Hungary	-0.001	-0.004	-0.010	6.990	0.051	1.679	0.087	0.056
Indonesia	0.003	0.012	0.035	8.516	0.043	4.045	0.041	0.028
Ireland	0.000	-0.001	-0.003	8.093	0.038	2.434	0.055	0.051
Israel	0.001	0.004	0.014	7.743	0.029	2.153	0.035	0.029
Italy	0.000	-0.001	0.000	9.181	0.071	1.850	0.027	0.026
Japan	0.001	0.003	0.010	10.857	0.653	1.470	0.025	0.025
Malaysia	0.002	0.008	0.024	8.394	0.040	1.686	0.030	0.027
Mexico	0.002	0.007	0.019	9.198	0.028	2.329	0.043	0.038
Netherlands	0.001	0.003	0.010	9.534	0.083	2.191	0.034	0.034
New Zealand	0.000	0.000	0.001	7.102	0.020	2.085	0.041	0.031
Norway	0.000	0.002	0.005	8.282	0.067	2.197	0.035	0.033
Philippines	0.002	0.007	0.022	8.216	0.019	2.619	0.059	0.034
Poland	0.000	0.002	0.007	7.774	0.044	2.351	0.037	0.029
Portugal	-0.001	-0.007	-0.021	8.148	0.031	1.736	0.058	0.047
Russia	-0.002	-0.011	-0.020	9.701	0.014	2.006	0.068	0.037
Singapore	0.001	0.004	0.011	8.837	0.045	2.066	0.026	0.026
South Africa	0.003	0.010	0.030	9.052	0.041	2.714	0.032	0.030
South Korea	0.001	0.005	0.017	9.248	0.184	1.663	0.027	0.026
Spain	0.000	0.000	0.000	9.642	0.078	2.774	0.031	0.030
Sweden	0.001	0.005	0.017	9.002	0.077	2.737	0.033	0.028
Switzerland	0.001	0.003	0.007	10.031	0.067	2.647	0.033	0.033
Taiwan	0.002	0.008	0.026	9.204	0.113	1.878	0.030	0.027
Thailand	0.003	0.010	0.033	8.566	0.095	2.130	0.034	0.027
Turkey	0.003	0.012	0.038	8.382	0.290	2.560	0.032	0.029
United Kingdom	0.002	0.006	0.017	10.285	0.079	2.940	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 portfolios 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 measured in percentages and calculated with a day skipping from time $t+1$. In Panel A, the shorting measures are dummy variables $Top1SVInd_{t-1,c,i}$ and $Top3SVInd_{t-1,c,i}$ which take on the value of one for when then industry (i) is at time $t-1$ topmost shorted industry or one of 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: $IndSVconc$ is the ratio of total shorted value allocated to the specific industry in the country, while $1/SVRank$ 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 control variables included are the natural logarithm of the industry total market capitalization in USD ($LogIndMCap$), the value-weighted average market-to-book ratio ($vwMtBV$) in the industry, and the value-weighted average daily turnover ($vwTurn$) in the industry. These measures are based on the average values in the previous calendar month. The $LagIndRet_{t-20}$ is the previous 20-day cumulative returns on the value-weighted industry portfolio. The panel regression analysis includes time and country fixed effect, and clustering of the standard errors by country. The statistical significance at the 10, 5, and 1 percent levels are represented by *, **, and ***, respectively.

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*** (-6.36)		-0.446*** (-5.95)		-1.280*** (-5.48)	
Top3SVInd		-0.109*** (-6.08)		-0.421*** (-6.70)		-1.170*** (-7.04)
LogIndMCap	0.056*** (4.97)	0.060*** (5.13)	0.208*** (5.83)	0.221*** (6.00)	0.538*** (5.83)	0.574*** (5.99)
vwTurn	0.047 (1.25)	0.048 (1.27)	0.158 (1.19)	0.160 (1.21)	0.458 (0.96)	0.463 (0.98)
vwMtBV	-0.031*** (-4.60)	-0.031*** (-4.64)	-0.134*** (-5.41)	-0.136*** (-5.47)	-0.447*** (-5.65)	-0.451*** (-5.72)
LagIndRet ₂₀	-0.008** (-2.55)	-0.008** (-2.56)	0.002 (0.23)	0.002 (0.23)	0.063*** (4.69)	0.063*** (4.69)
Constant	-0.359*** (-4.01)	-0.382*** (-4.16)	-1.316*** (-4.37)	-1.404*** (-4.53)	-3.110*** (-3.82)	-3.348*** (-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)
	IndRet_{t+1,t+5}		IndRet_{t+1,t+20}		IndRet_{t+1,t+60}	
IndSVconc _{t,c,i}	-0.312*** (-3.06)		-1.030*** (-3.19)		-2.657*** (-3.10)	
1/SVRank		-0.182*** (-6.96)		-0.699*** (-7.27)		-1.951*** (-6.76)
LogIndMCap	0.055*** (3.26)	0.062*** (5.22)	0.173*** (4.13)	0.229*** (6.13)	0.393*** (3.94)	0.597*** (6.14)
vwTurn	0.040 (1.42)	0.048 (1.27)	0.115 (1.19)	0.161 (1.22)	0.316 (0.88)	0.467 (0.98)
vwMtBV	-0.027*** (-3.66)	-0.031*** (-4.67)	-0.117*** (-4.56)	-0.136*** (-5.51)	-0.406*** (-5.02)	-0.454*** (-5.76)
LagIndRet ₂₀	-0.009** (-2.69)	-0.008** (-2.56)	-0.001 (-0.09)	0.002 (0.22)	0.060*** (3.93)	0.063*** (4.69)
Constant	-0.362*** (-2.72)	-0.388*** (-4.20)	-1.077*** (-3.14)	-1.425*** (-4.59)	-2.025** (-2.35)	-3.408*** (-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: The Top 1 (Top1SV) and Top 3 Most Shorted Industries (Top3CV) with Table 4 Panel A Model Specification.

		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	DK	-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	IE	-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	NL	-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	PL	-0.416***	(-2.59)	-0.159	(-1.56)
Portugal	PT	-1.121***	(-5.69)	-1.087***	(-8.16)
Russia	RU	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 the Inverse of the Industry Shorted Value Rank with Table 4 Panel B Model Specification.

		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	DK	-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	IE	-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	NL	-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	PL	-0.714***	(-2.83)	-0.953***	(-5.84)
Portugal	PT	-5.684***	(-11.36)	-1.835***	(-7.69)
Russia	RU	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

The dependent variable is the future cumulative holding period returns on Country's MSCI index 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 measured in percentages and calculated with a day skipping from time $t+1$. *Top1c* (*Top3c*) dummy variable takes on the value of one when the topmost 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}* and *IndMVconc_{Top3}* is the fraction of market capitalization in the country represented by the topmost shorted industry or the three most shorted industries, respectively. *Top1c*IndMVconc_{Top1}* and *Top3c*IndMVconc_{Top3}* are interaction variables. The panel regression analysis includes time and country fixed effect, and clustering of the standard errors by country. The statistical significance at the 10, 5, and 1 percent levels are represented by *, **, and ***, respectively.

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

Table 7. Industry Information from Short Sellers' Industry Concentration and Global Factor

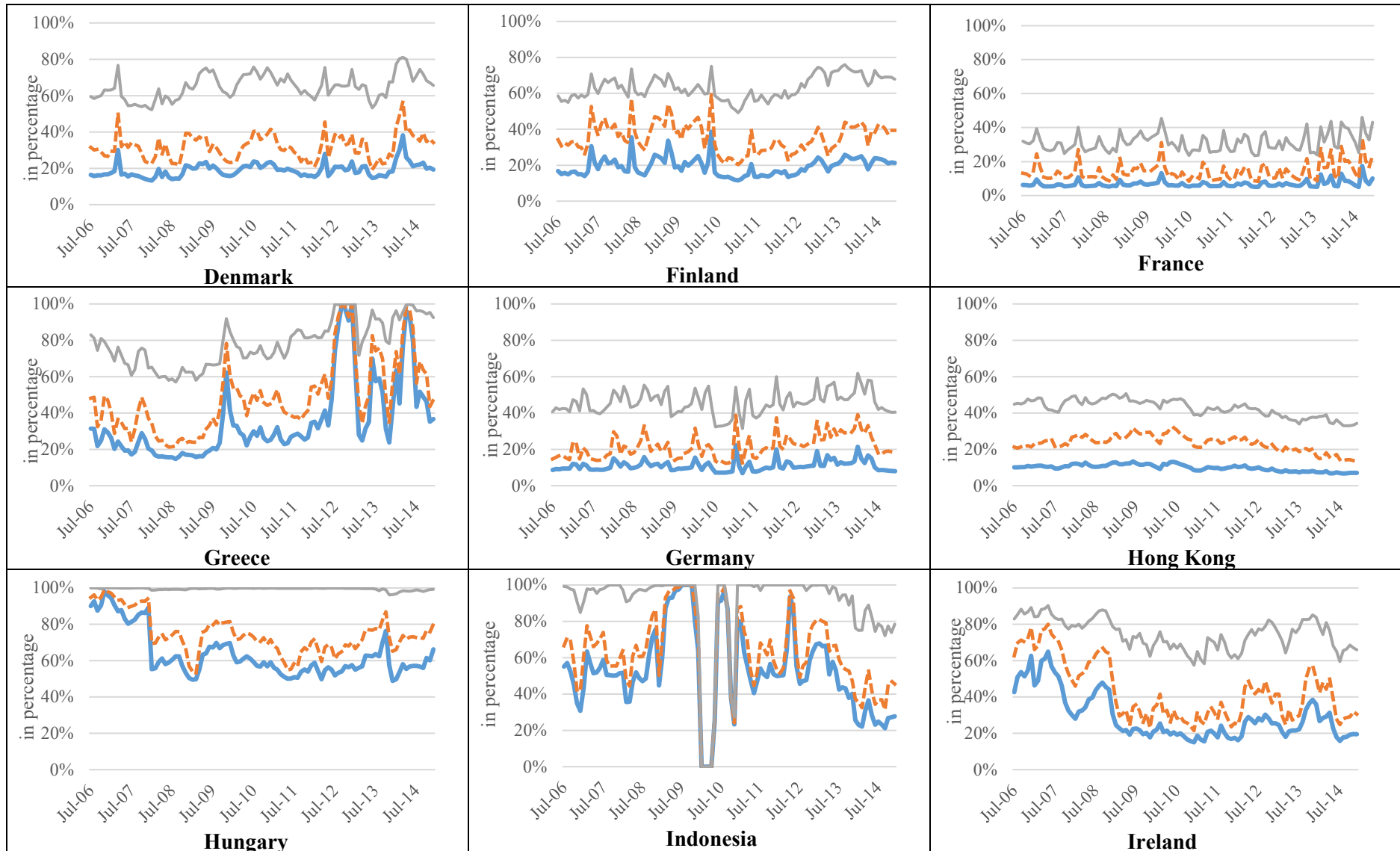
The dependent variable is the future cumulative holding period returns on value-weighted industry portfolio for 5 days in Models 1A-B, for 20 days in Models 2A-B, and for 60 days in Models 3A-B. The returns are measured in percentages and calculated with day skipping from time $t+1$. The industry shorting measures, dummy variable $Top3SVInd_{i,c,t}$ which takes on the value of one for 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 $t-1$. $GlobalEffect$ dummy variable takes on the value of one if the most shorted industry in the country is also the most frequently shorted industry across countries at the same time. The 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. The panel regression analysis includes time and country fixed effect, and clustering of the standard errors by country. The statistical significance at the 10, 5, and 1 percent levels are represented by *, **, and ***, respectively.

	(1A)	(2A)	(3A)	(1B)	(2B)	(3B)
	IndRet _{t+1,t+5}	IndRet _{t+1,t+20}	IndRet _{t+1,t+60}	IndRet _{t+1,t+5}	IndRet _{t+1,t+20}	IndRet _{t+1,t+60}
	Excl 2008 Sept - 2009 Dec					
Top3SVInd	-0.091*** (-5.44)	-0.353*** (-5.56)	-0.974*** (-5.71)	-0.099*** (-4.94)	-0.386*** (-5.16)	-1.078*** (-5.06)
GlobalEffect	-0.124*** (-2.91)	-0.477*** (-3.09)	-1.371*** (-3.16)	-0.139*** (-3.02)	-0.485*** (-3.00)	-1.388*** (-3.02)
LogSize	0.061*** (5.13)	0.228*** (6.01)	0.594*** (6.01)	0.059*** (4.69)	0.222*** (5.70)	0.587*** (5.98)
vwTurn	0.048 (1.28)	0.159 (1.22)	0.461 (0.98)	0.028 (0.69)	0.060 (0.52)	0.206 (0.49)
vwMtoB	-0.033*** (-4.54)	-0.142*** (-5.31)	-0.470*** (-5.56)	-0.028*** (-4.12)	-0.118*** (-4.87)	-0.388*** (-5.02)
LagIndRet _{t-20}	-0.008** (-2.58)	0.002 (0.21)	0.063*** (4.68)	-0.009** (-2.47)	0.002 (0.17)	0.093*** (6.26)
Constant	-0.391*** (-4.19)	-1.437*** (-4.58)	-3.442*** (-4.04)	-0.401*** (-4.00)	-1.567*** (-4.78)	-4.328*** (-5.16)
Observations	2,730,921	2,730,921	2,730,921	2,300,114	2,300,114	2,300,114
R-squared	0.072	0.227	0.335	0.048	0.169	0.290



Figure 1. Short Sales Industry Concentration

The HHI Index Measures the Percentage of the Total Shorted Value Captured by the Relative Top One and Top Three Most Shorted Industries from July 1, 2006, to December 31, 2014.



— Short Sales Industry Concentration (HHI Index) (%)

- - - The Most Shorted Industry Relative Shorted Value (%)

— The Three Most Shorted Industry Relative Shorted Value (%)



— Short Sales Industry Concentration (HHI Index) (%)
 - - - The Most Shorted Industry Relative Shorted Value (%)
 — The Three Most Shorted Industry Relative Shorted Value (%)

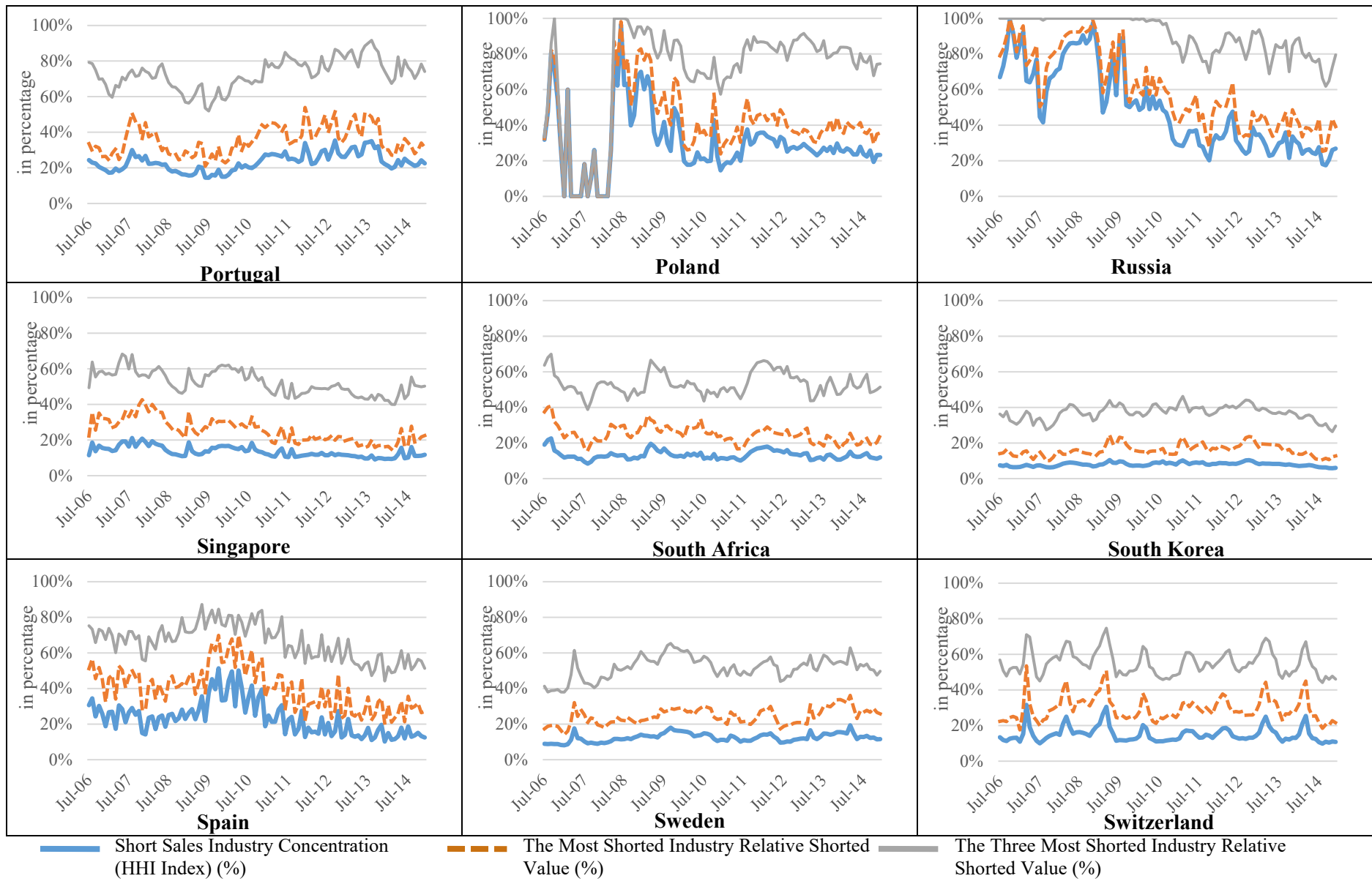
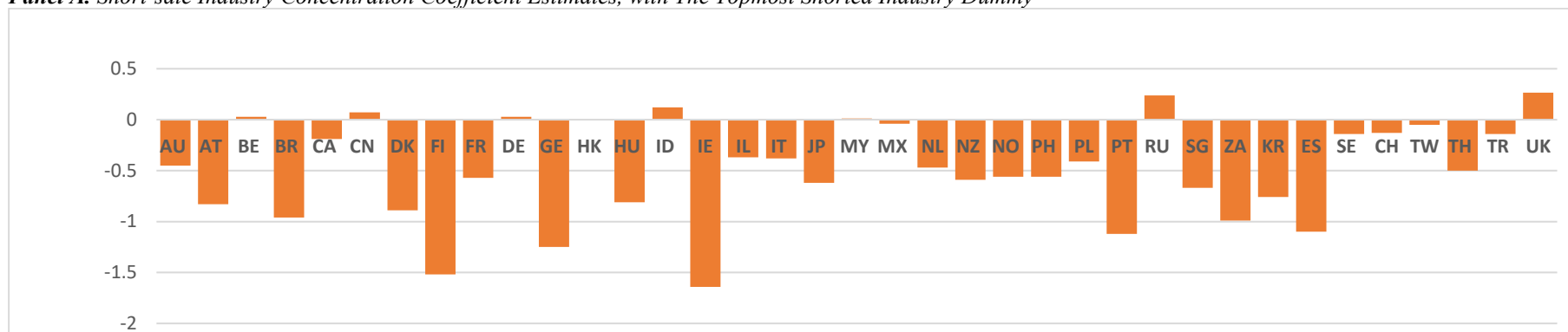




Figure 1. Short Sales Industry Concentration (continued)

The HHI Index Measures the Percentage of the Total Shorted Value Captured by the Relative Top One and Top Three Most Shorted Industries from July 1, 2006, to December 31, 2014.

Panel A. Short-sale Industry Concentration Coefficient Estimates, with The Topmost Shorted Industry Dummy



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

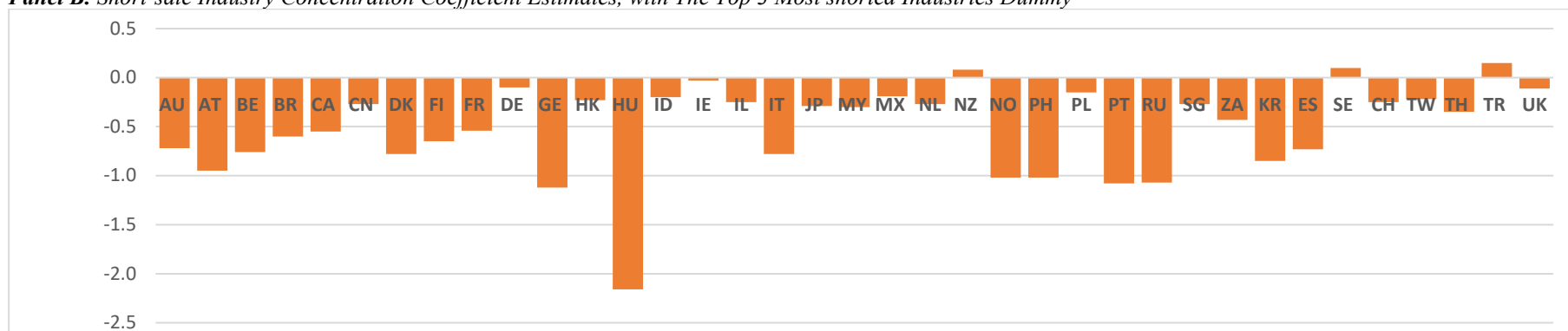
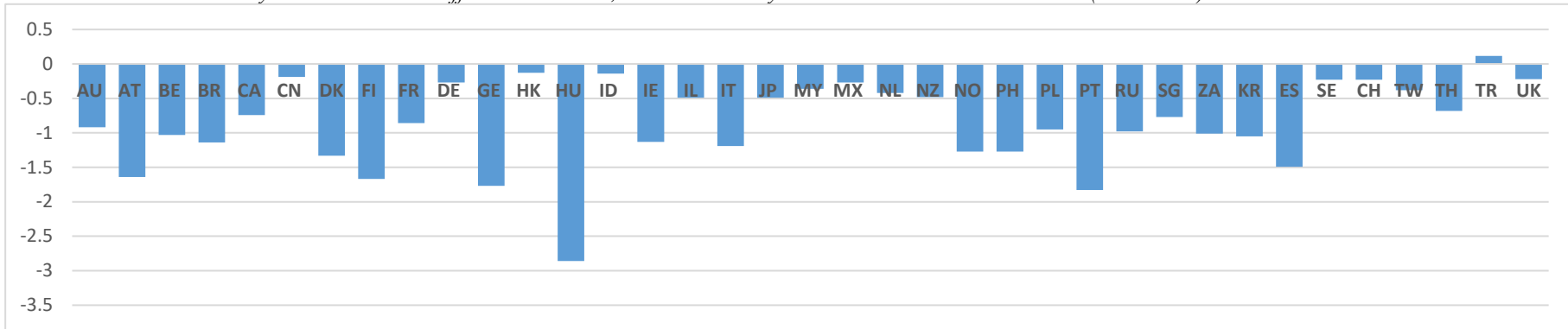


Figure 2. Return Predictability of Short-sale Concentration by Country, with Dumy Industry Measures

The figure depicts the country specific coefficient estimates on the short-sale industry concentration measure based on Table 4 Panel A model 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

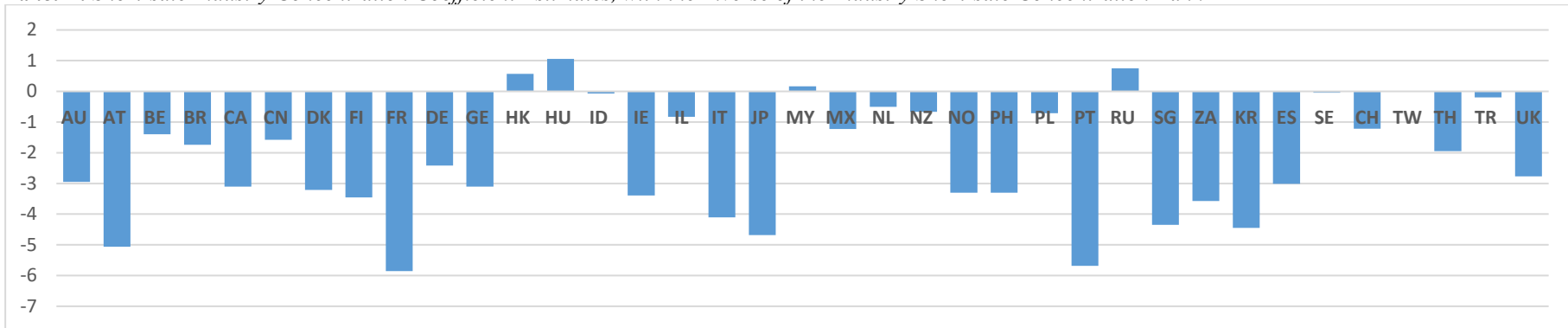


Figure 3. Return Predictability of Short-sale Concentration by Country, with Continues Industry Measures

The figure depicts the country specific coefficient estimates on the short-sale industry concentration measure based on Table 4 Panel B model specification with continuous industry measures, with the industry relative short-sale value (*IndSVconc*) and with the inverse of the industry short-sale value rank (*1/SVrank*).

Appendix Table 1. Predicting Industry Returns using Industry SIR

The dependent variable is the future cumulative holding period returns on value-weighted industry portfolios for 5 days in Models 1, for 20 days in Models 2, and for 60 days in Models 3. The returns are measures in percentages and calculated with a day skipping from time $t+1$. *Industry_SIR* is the total shorted value in an industry divided by the total market value of the industry, calculated at time $t-1$. The control variables included 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. The *LagIndRet* _{$t-20$} is the previous 20-day cumulative returns on the value-weighted industry portfolio. The panel regression analysis includes time and country fixed effect, and clustering of the standard errors by country. The statistical significance at the 10, 5, and 1 percent levels are represented by *, **, and ***, respectively.

	(1)	(2)	(3)
	IndRet_{t+1,t+5}	IndRet_{t+1,t+20}	IndRet_{t+1,t+60}
Industry_SIR	0.031 (0.15)	-0.366 (-0.51)	-1.771 (-0.85)
LogIndMCap	0.054*** (4.96)	0.200*** (5.64)	0.518*** (5.56)
vwTurn	0.046 (1.23)	0.157 (1.19)	0.462 (0.97)
vwMtBV	-0.030*** (-4.60)	-0.133*** (-5.39)	-0.443*** (-5.63)
LagIndRet ₂₀	-0.008** (-2.56)	0.002 (0.24)	0.063*** (4.72)
Constant	-0.344*** (-3.83)	-1.252*** (-4.16)	-2.919*** (-3.60)
Observations	2,730,921	2,730,921	2,730,921
R-squared	0.072	0.227	0.334