Aggregate insider trading and future market returns in the United States, Europe, and Asia

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Abstract
Using a well-established methodology to measure aggregate insider trading, this exploratory study examines the relation between aggregate insider trading and future stock market returns. Analysing a unique data set of more than 1.3 million individual insider transactions in 16,893 US, European, and Asian firms between 2003 and 2017, we provide novel results for a multitude of countries. We find that the null-hypothesis (i.e., aggregate insider trading is not related to future stock market returns and thus corporate insiders cannot forecast economy-wide trends) cannot be unanimously rejected for all 32 countries in the sample. Aggregate insider trading in the United States, Asia, China, Hong Kong, and India is coherently positively associated with future market returns according to two aggregate insider sentiment indicators. For Switzerland, Sweden, Poland, Malaysia, Singapore, and the Philippines we further find limited evidence indicating a positive association between aggregate insider trading and future index returns. On the contrary, there is some evidence that in Germany, Austria, Ireland, and Denmark aggregate insider trading is negatively associated with future market returns. Implications and further research opportunities are discussed.

KEYWORDS
forecasting abilities, insider market sentiment, insider trading, macro-information advantage, predicting market returns

1 | INTRODUCTION
It is well established that corporate insiders profitably trade shares in their own firms on US (Finnerty, 1976b; Jaffe, 1974; Lakonishok & Lee, 2001; Seyhun, 1986), European (Aussenegg, Jelic, & Ranzi, 2016; Fidrmuc, Goergen, & Renneboog, 2006), and Asian (Bris, 2005; Jaggi & Tsui, 2007) markets. It can be assumed that insiders trade for one of three distinct reasons: randomness, firm-specific factors, or market-wide factors. Based on extant academic evidence in multiple geographic regions, and the fact that outside investors trade profitably on publicly available insider transaction filings (e.g., Altana Wealth Ltd, 2018; Sabrient Systems LLC, 2018), the information advantage hypothesis can be accepted. Accordingly, insider trades can be assumed...
not to be random, but based on rational assessments. What remains is the conundrum as to whether insiders trade on firm-specific or economy-wide superior information.

If insiders base their trades predominantly on macro-economic private intelligence, it is likely that a majority of insiders possess similar information and collectively trade in a particular direction. If this is indeed the case, aggregate insider transactions should be able to forecast future market returns. The market takes into account economy-wide changes after they substantialise. If insiders traded collectively into the same direction, a positive correlation between aggregate insider transactions and future market returns should become observable. If insiders do not collectively base their trades on expectations of market-wide developments, aggregate insider trading will not be statistically significantly associated with future stock market returns, and insiders are more likely to trade for private firm-specific cash flow news.

Most evidence on insider trading is on the information content of individual firm-level transactions. Extant studies on the relation between aggregate insider trading and future market returns almost exclusively examined US SEC-regulated insider trades in the 1970s and 1980s (Chowdhury, Howe, & Lin, 1993; Lakonishok & Lee, 2001; Seyhun, 1988, 1992), and can thus be considered outdated. The scarce evidence on other, less developed, markets is limited in its geographical scope (Zhu, Wang, & Yang, 2014). Aggregate insider trading and its relation to stock market returns with a particular focus on non-US markets thus merits further analysis. Accordingly, the aim of this exploratory study is to update and extend findings on the relation between aggregate insider trading and future market returns.

The paper contributes to the literature in the following ways. This is the first study to examine aggregate insider trading and its predictive power for future market returns in a multitude of European and Asian countries. It also updates prior insights on the US market. It thereby adds substance to the discussion as to whether insiders possess superior knowledge pertaining to firm- or economy-specific developments.

By analysing a unique data set of more than 1.3 million individual insider transactions in 16,893 US, European, and Asian firms from 2003 to 2017, we find that outsiders cannot always easily distinguish whether executives, directors, and other corporate insiders trade on superior firm-specific or market-wide information. Aggregate insider trading can only coherently predict future market returns of US, Asia-combined, Chinese, Hong Kong, and Indian indices. Insiders in these countries appear to trade on economy-wide expectations. In Switzerland, Sweden, Poland, Malaysia, Singapore, and the Philippines there is a less pronounced positive association between aggregate insider trading and future market returns. Moreover, we find evidence suggesting a negative association between insider sentiment and future indices’ returns for Germany, Austria, Ireland, and Denmark. For all other countries and indices in the sample, aggregate insider trading does not coherently predict a correlation with future stock market returns. Insiders in these countries seem more likely to trade on future firm-specific cash flow news. Our findings imply that outside investors can use publicly available data to inform passive investment strategies’ decision-making for some countries to a limited extent. This study covers multiple insider sentiment aggregation horizons (during which insiders trade) as well as multiple long-term forecast horizons (during which future returns substantiate) and discusses potential reasons as to why results are heterogeneous across countries.

The paper is structured as follows. Section 2 provides a literature review. Data and methodology used are presented in Sections 3 and 4, respectively. Empirical findings are reported in Section 5, followed by a discussion in Section 6, and conclusions and future remarks in Section 7.

2 | LITERATURE REVIEW

Insider trading is defined as corporate insiders (e.g., executives, directors, and significant stockholders) buying and selling financial instruments in their own firms’ stock. In most jurisdictions, it is generally considered legal, as long as the trades are not based on material non-public information. Corporate insiders in the EU, the US, and multiple Asian countries may trade legally in their own securities, but are obligated to report their trades to the relevant market authority. Assuming that insiders are rational economic agents, who intend to maximise their private wealth, they do not trade randomly, but on superior information or knowledge of future cash flows in their firms. Their advanced insights into firms’ opportunities, threats, and the competitive position in the market allow them to perceive mispricings relative to current share prices as well as changes in cash flows (Piotroski & Roulstone, 2005). When corporate insiders deem current prices too low, they are likely to be net buyers. When prices seem too high, they will turn into net sellers.

Firm-specific insights may stem from multiple sources. Previous research claimed that insiders may base transactions on their interpretation of financial information, which may differ from analysts’ expectations, knowledge of internal forecasts, a better understanding of the company’s competitive position in the market relative to competitors, or simply a better “gut feeling”
(Cohen, Malloy, & Pomorski, 2012; Finnerty, 1976a; Pope, Morris, & Peel, 1990). Moreover, insiders benefit from firm-specific cash flow considerations related to proposed mergers (Keown & Pinkerton, 1981), new issue announcements (Karpoff & Lee, 1991), dividend announcements (John & Lang, 1991), expected R&D outcomes (Aboody & Lev, 2000; Coff & Lee, 2003), and imminent breakthrough developments and product announcements (Ahuja, Coff, & Lee, 2005; Coff, 2010). Additionally, there are studies revealing evidence of firm-level market timing abilities (Friederich, Gregory, Matatko, & Tonks, 2002) and of insiders contribution to general market price discovery efficiency on insider trading days (Aktas, de Bodt, & Van Oppens, 2008).

Overall, corporate insiders are motivated and incentivised to buy shares in anticipation of positive firm-specific news and vice versa. They are able to gather, decipher, and trade on firm-specific information. The greater the information asymmetries vis-à-vis outsiders, the greater the ability of insiders to exploit private information.

Corporate insiders do not only appear able to perceive mispricing in their own firms and to anticipate changes in their firms’ cash flows based on firm-specific information. Indeed, directors, executives, and other insiders might also base trades on their sentiment towards future economy-wide developments and the respective impact on corporate cash flows. Insiders across firms in a given country may develop similar expectations of trends in macroeconomic factors and future stock market corrections. These anticipations are likely to be reflected by aggregate insider trading, that is, the net summation of corporate insiders’ transactions across publicly traded firms. As other investors start perceiving changes in economy-wide indicators as well, they will alter their valuations and drive share prices across firms, resulting in according market returns (Seyhun, 1992). Consequently, insider sentiment in terms of aggregate insider trading would predict future stock market returns.

The connection between aggregate insider trading and its ability to forecast future market returns is likely to stem from three different sources. Insiders’ abilities to perceive unanticipated changes in macroeconomic trends earlier, to observe such changes more effectively, and to detect systematic market misvaluations induce a “macro-information advantage” relative to other investors (Seyhun, 1988; Zhu et al., 2014).

First, insiders at the operational forefront, and those well connected to insiders at other firms, have preferential access to information pertaining to, for example, price movements, capacity utilisation, and restructurings. This allows them to perceive economic trends, such as changes in inflation, aggregate demand, a country’s Gross Domestic Product (GDP), and unemployment rates before the general public, which can only access trade and commercial statistics later. Once other market participants pick up on changes in economy-wide activities as well, stock prices rise collectively (Jiang & Zaman, 2010).

Second, corporate insiders tend to possess higher levels of education (see Barker & Mueller, 2002), an improved understanding of their firms and the industry, and greater experience as to how macroeconomic trends affect their firms’ cash flows. Consider the following example. Based on executives’ knowledge of suppliers’ price alterations and industry structures, they might anticipate shifts in demand for intermediate goods. Accordingly, these insiders might sense changes in demand for a range of final goods and thus deduce economy-wide trends earlier than outside investors do (as the market value of final goods determines a country’s GDP). If such economy-wide trends apply to a substantial proportion of the total firm population, corporate insiders across many firms might perceive market-wide mispricing and trade in the same direction. Later on, outside investors might gain access to similar trade information, realise that firms’ current prices deviate from their fair values, and buy or sell shares accordingly. In other words, current aggregate insider sentiment may predict future stock market returns and a temporal connection between the two should be observable.

Third, markets may overheat (e.g., quantitative easing) or be overly bearish (e.g., market crashes/dips and overreactions) due to exogenous shocks and irrational investor behaviour. Such systematic overpricing and underpricing might be perceived by corporate insiders who could then trade their own firms’ shares accordingly. If multiple firms’ stocks suffer from a particular mispricing, insiders collectively capitalise on such prices, and their transactions tend to appear in selling or buying waves (Zhu et al., 2014). For instance, examining the stock market crash of October 1987, Seyhun (1990) presented evidence that corporate insiders did not predict the market crash, but correctly predicted strong positive market returns during the subsequent recovery. There was no increased insider sales activity before the crash, but a record number of net aggregate purchases following the crash, which indicates that collectively insiders correctly identified systematic mispricing in the market induced by outside investors’ previous overreaction. Relatedly, in February 2018, a slump of more than 8% in the S&P 500 and the Dow Jones Industrial Average was predicted by insiders, as a high aggregate volume of sales transactions prior to the drop indicated a strong bullish sentiment (Altana Wealth Ltd, 2018).

### 2.1 Empirical evidence of aggregate insider trading

There is some empirical evidence corroborating the theoretical and anecdotal grounding laid out above.
Seyhun (1988) was the first to establish that aggregate corporate insider sales and purchases can be linked with future stock market returns. Analysing US insider trades from 1975 to 1981, the results suggested that aggregate insider trading conveys information pertaining to future changes in economy-wide trends not already factored into current stock prices. The study documented a significantly positive relation between monthly aggregate insider trading and market returns during the following 2 months. Specifically, a change in the standardised aggregate net number of executives’ transaction by one SD predicted changes in future excess market returns of up to 1.7%. Moreover, the author showed that insider transactions in firms with greater market value carry a greater predictive value for future market returns. Hence, such insiders seem more informed about future macro-economic trends, and insiders in firms with greater market risk trade more on economy-wide expectations and information (Seyhun, 1988).

Analysing US insider sentiment between 1975 and 1989, Seyhun (1992) documented a strong relationship between aggregate insider trading and future stock returns in excess of 1-month Treasury Bills. The seminal paper revealed that using long-term aggregation horizons to predict long-term forecast horizons is associated with particularly strong prediction abilities. According to the author’s findings, up to 60% of future 1-year market returns’ variation can be predicted by 12-month aggregate net numbers of transactions. Moreover, Seyhun (1992) found that aggregate insider trading is positively associated with future growth rates of the Index of Industrial Production and the Gross National Product, which suggests that insiders possess some forecasting ability concerning economy-wide activity.

There is some discord in the literature as to whether insiders merely follow a contrarian investment strategy or actually trade on superior information. Chowdhury et al.’s (1993) results contradict Seyhun’s (1988, 1992) earlier findings. Analysing the short-term relation between aggregate insider transactions and market returns in 1,361 U.S. firms from 1975 to 1986, the authors documented that the predictive power of aggregate insider transactions is existent but weak. Instead, Chowdhury et al. (1993) found strong evidence for a reverse relationship. Current market returns predict aggregate insider trading, that is, high stock market returns cause insiders to sell off stock and vice versa.

Examining US insider transactions from 1976 to 1995, Lakonishok and Lee (2001) reported further findings in support of aggregate insider transactions’ predictive power for future market returns. Controlling for contrarian insider investing, they found that aggregate insider trading can predict future market returns. For instance, Lakonishok and Lee (2001) reported an 11% gap in future 12-month returns between months with very low versus those with very high net purchasing activities. Moreover, the authors showed that managers’ aggregate trading is associated with greater predictive power for future stock market returns than large shareholders’ transactions. Longer sentiment aggregation horizons and forecast horizons were both associated with greater predictive powers.

Jiang and Zaman (2010) analysed the relation between aggregate insider trading and future market returns using a novel returns model, which allowed them to distinguish between future market return components related to insiders’ superior knowledge of economy-wide factors and those related to contrarian investing. They demonstrated that insiders’ predictive skills are due to their ability to forecast unexpected future cash flow news which can be related to changes in economy-wide activity. Examining US data from 1975 to 2000, they did not find evidence suggesting that insiders act as contrarian investors.

More recently, Marin and Olivier (2008) presented additional anecdotal evidence indicating that aggregate insider trading can predict substantial future market crashes and jumps.

To the best of the authors’ knowledge there is only one study which examines the relation between insider sentiment and future market returns in emerging markets. Zhu et al. (2014) established that in China, aggregate insider trading also predicts future market returns, to an even greater extent than US insider trading does. Analysing 5,553 insider transactions between 2007 and 2011, the authors found that insider trading can forecast up to 72.7% of variation in future market returns. Furthermore, the authors showed that higher levels of managers’ operational involvement and hierarchy are associated with greater degrees of predictive power, which they attribute to more pronounced abilities to forecast macroeconomic developments and to observe systematic market misvaluation relative to other insiders. The authors also provided evidence that state-owned companies’ insiders exhibit lower abilities to predict future market returns than insiders in firms with different corporate governance structures do.

Overall, conceptual and empirical evidence suggests that insiders may effectively observe macroeconomic developments and systematic market misvaluations and trade own firm shares accordingly. Aggregate insider trading can constitute a substantial leading predictor of future stock market returns. Studies show that aggregated insider trading does not constitute a simple contrarian strategy, but that these transactions carry predictive power. Additionally, there are some groups of insiders
which are associated with greater predictive power than others.

### 2.2 Trading on firm-specific versus economy-wide information

Aggregate insider trading’s predictive ability is not a mere summation of individual insider trades on firm-specific information. Assume firm-specific news to be near-normally distributed, with positive and negative information at each respective tail of the distribution. Assume further that firm-specific news is independent of changes in economy-wide activity. If insiders trade exclusively on firm-specific knowledge, their transactions’ directions, amounts, and volumes are likely to net out in aggregate. In a given sentiment aggregation horizon, purchase transactions of insiders anticipating favourable news would be cancelled out by insider sales transactions based on unfavourable expected cash flow news. Accordingly, no distinct insider sentiment would be deducible, and aggregate insider sentiment should not predict future market returns. Instead, it would appear that transactions are predominantly based on firm-specific information.

However, if a large proportion of corporate insiders buy or sell shares in concurrent waves, trades would appear to be based on mutually shared information about future market-wide activities (cf., Seyhun, 1988; Zhu et al., 2014). It is reasonable to assume that in some countries, information asymmetries provide for greater opportunities for insiders to exploit firm-specific information. Similarly, some market structures may not provide insiders with the opportunity to perceive macroeconomic developments. For such countries, no distinct insider sentiment can be established and hence no connection between aggregate insider trading and future stock market returns can be observed. The same logic also applies vice versa.

In summary, corporate insiders possess superior information or skills allowing them to perceive mispricing in their firms’ stock, and trade accordingly. Perceived mispricing may originate from two sources: economy-wide and firm-specific expectations of changes in cash flow. Divergent insider, firm, and market characteristics across countries may cause substantial differences in insiders’ ability to trade on firm-specific or macroeconomic information, and hence the predictive power of aggregate insider trading across countries. Accordingly, in this exploratory study we do not expect homogenous results across countries, but rather aim to establish those countries in which aggregate insider trading has the potential to predict future stock market returns.

### 3 DATA SOURCES AND SAMPLE CHARACTERISTICS

Indices’ daily-closing prices to compute returns, as well as exchange rates to convert all monetary values into US Dollars, were downloaded from Bloomberg. For each country, the most common index featuring the most liquid stocks and most highly capitalised firms was chosen to represent the respective country’s stock market returns. To analyse the relationship between aggregate Europe-combined and Asia-combined insider trading and stock market returns, the EURO STOXX 50 and MSCI AC Asia ex-Japan indices were used.

Corporate insider trading data was obtained from a unique data set on which no prior published research has been carried out. The data set was constructed by Altana Wealth Limited on the basis of 2iQ Research GmbH filings and Bloomberg L.P. information. The sample includes all insider trades in listed firms, with a market capitalisation of at least USD250 million at the time of filing, domiciled in the United States, 21 European, and 10 Asian countries from 2003 to 2017. The sample consisted of three regional sets of transactions on US, European, and Asian exchanges. Both cash-market and derivative transactions were included in this study. Transactions arising from the award of stock-based executive remuneration were excluded, as these transactions are not grounded in executives’ perceptions of firm-specific or economy-wide mispricing. Also, transactions with missing data were omitted from the sample.

Table 1 shows top-level sample characteristics: the number of firms and unaggregated filings in the sample, the aggregate purchase and sales volumes, and the aggregate numbers of shares bought and sold. Firms and their associated insider transactions were assigned to a country based on the firm’s country of domicile as listed on Standard & Poor’s Compustat database. This mapping was chosen to reflect the country in which most corporate insiders are likely to reside, consume media, and interact with members of their network, which accumulates into their expectation-formation process vis-à-vis macroeconomic trends. The US sub-sample contained all insider trades on US exchanges and in firms listed abroad but domiciled in the United States. The Asia-combined and Europe-combined sub-samples were based on all insider transactions filed on Asian and European exchanges, respectively. The overall sample of insider trades in the time period ranging from 2003 to 2017 contained a total of 1,349,265 insider transactions in 6,093 US, 4,233 European, and 6,567 Asian firms. The total number of shares assessed in the overall sample amounted to 5.429 trillion shares traded by corporate insiders. Unsurprisingly, countries with lower numbers of firms in which
insider trades were conducted were also associated with lower total volumes and amounts of shares in the sample. However, a country's economy's size, in terms of GDP, was not necessarily correlated with lower numbers of firms, filings, or shares in the overall sample. The number of firms and filings also constitutes an indication as to the introduction date of insider trading regulations and the prevalence of insider trading in the respective country.

As expected, the net total number of shares (i.e., the sum of all shares bought minus the sum of all shares sold), as well as the net total volume (i.e., the volume of all buy transactions minus the volume of all sales transactions per country in the sample) tended to be negative for most countries. This suggests that insiders sell more shares than they buy, which is consistent with previous studies (Aboody & Lev, 2000), and mainly due to

| Country/Region | No. of firms | No. of filings | Aggregate Vol. Buy | Aggregate Vol. Sell | Aggregate No. Buy | Aggregate No. Sell |
|---------------|--------------|----------------|--------------------|--------------------|------------------|------------------|
| Belgium       | 94           | 5,504          | 8,598              | 11,013             | 205              | 254              |
| Austria       | 61           | 2,716          | 4,585              | 3,991              | 325              | 221              |
| Norway        | 182          | 4,746          | 17,032             | 16,801             | 6,084            | 4,605            |
| Ireland       | 56           | 1,605          | 696                | 10,772             | 260              | 22,347           |
| Denmark       | 96           | 4,412          | 3,228              | 10,044             | 306              | 320              |
| Finland       | 91           | 5,791          | 2,082              | 2,930              | 326              | 539              |
| Romania       | 23           | 2,124          | 417                | 1,136              | 8,115            | 7,787            |
| Greece        | 103          | 12,878         | 17,914             | 9,265              | 2,273            | 1,127            |
| Luxembourg    | 35           | 1,694          | 4,284              | 5,360              | 482              | 238              |
| Cyprus        | 13           | 351            | 244                | 235                | 103              | 24               |
| Turkey        | 130          | 5,214          | 10,858             | 12,049             | 4,087            | 3,855            |
| Europe        | 4,233        | 223,520        | 433,651            | 680,165            | 101,428          | 110,467          |
| Germany       | 353          | 9,785          | 15,042             | 34,932             | 1,737            | 2,512            |
| France        | 365          | 24,954         | 68,979             | 68,322             | 1,482            | 1,811            |
| UK            | 927          | 29,900         | 23,285             | 40,336             | 4,433            | 7,288            |
| Italy         | 258          | 29,416         | 72,983             | 92,188             | 32,844           | 16,554           |
| Russia        | 82           | 1,772          | 8,885              | 9,080              | 14,112           | 15,165           |
| Spain         | 158          | 16,693         | 31,547             | 42,610             | 2,238            | 4,498            |
| Netherlands   | 147          | 5,483          | 9,771              | 16,092             | 473              | 846              |
| Switzerland   | 225          | 18,764         | 68,794             | 197,863            | 718              | 2,008            |
| Sweden        | 284          | 16,083         | 18,524             | 20,306             | 1,369            | 1,751            |
| Poland        | 125          | 3,585          | 12,598             | 13,176             | 1,742            | 1,310            |
| USA           | 6,093        | 478,103        | 1,404,007          | 2,222,292          | 61,663           | 73,062           |
| Asia          | 6,567        | 223,239        | 699,211            | 964,478            | 1,137,815        | 1,384,683        |
| China         | 2,606        | 69,219         | 192,485            | 323,598            | 250,515          | 401,387          |
| Hong Kong     | 808          | 35,210         | 219,597            | 251,417            | 650,910          | 680,272          |
| India         | 599          | 26,782         | 67,375             | 73,239             | 19,176           | 16,160           |
| S. Korea      | 690          | 26,672         | 75,288             | 65,568             | 4,467            | 3,822            |
| Australia     | 623          | 9,083          | 11,875             | 134,428            | 5,192            | 78,730           |
| New Zealand   | 66           | 1,166          | 231                | 1,129              | 132              | 414              |
| Malaysia      | 305          | 25,921         | 35,544             | 38,221             | 41,372           | 43,391           |
| Singapore     | 266          | 8,677          | 81,712             | 53,360             | 63,130           | 38,551           |
| Thailand      | 236          | 14,249         | 4,488              | 7,694              | 25,784           | 46,922           |
| Philippines   | 92           | 3,954          | 1,611              | 3,675              | 4,791            | 6,211            |

Note: Aggregate volumes and numbers of shares bought and sold are in millions.
executives selling shares they were previously awarded with as a part of their remuneration packages.

4 | METHODOLOGY

The study’s methodology is adapted from the established literature on aggregate insider trading (Seyhun, 1988, 1992). In order to achieve the goal of this paper, to demonstrate the empirical relationship between aggregate insider trading and future stock market returns in multiple countries, 12 economic models per country or region (Europe and Asia) were established as follows.

For each country and region, we used three different measures to operationalise the independent variable, aggregate insider sentiment; standardised aggregate net number of transactions (SANT), standardised aggregate net number of shares (SANS), and standardised aggregate net volume of shares (SAVS). First, for each day and firm all individual insider transactions were converted into daily events as follows

\[
ENS_{d,i} = \sum_{j=1}^{J} SP_{d,i,j} - \sum_{j=1}^{J} SS_{d,i,j} \tag{1}
\]

\[
EV_{d,i} = \sum_{j=1}^{J} VP_{d,i,j} - \sum_{j=1}^{J} VS_{d,i,j} \tag{2}
\]

\[
ETD_{d,i} = \begin{cases} 1, & \text{for } EV_{d,i} > 0; \\ -1, & \text{for } EV_{d,i} < 0, \end{cases} \tag{3}
\]

where \( ENS_{d,i} \) and \( EV_{d,i} \) are the net event number of shares and volume of shares for firm \( i \) on day \( d \), respectively, \( SP_{d,i,j} \) and \( SS_{d,i,j} \) are numbers of shares purchased and sold in each individual transaction \( j \), and \( VP_{d,i,j} \) and \( VS_{d,i,j} \) are the volumes of shares purchased and sold, accordingly. The number of transactions in a given firm on a given day is denoted \( J \). If the daily-firm event’s net volume was positive, the event transaction’s direction, \( ETD_{d,i} \), equals 1, and vice versa.

Second, \( ENS_{d,i} \), \( EV_{d,i} \), and \( ETD_{d,i} \) were summed per firm and month

\[
ENS_{t} = \sum_{d=1}^{D} ENS_{d,i} \tag{4}
\]

\[
EV_{t} = \sum_{d=1}^{D} EV_{d,i} \tag{5}
\]

\[
ETD_{t} = \sum_{d=1}^{D} ETD_{d,i}, \tag{6}
\]

where \( D \) denotes the number of days in a given month, and \( ENS_{t}, EV_{t}, \) and \( ETD_{t} \) are the monthly firm-level sums of net numbers of shares, net volumes of shares, and net transaction directions, respectively. Third, within each country and region sub-sample, \( ENS_{t}, EV_{t}, \) and \( ETD_{t} \) were standardised as follows

\[
SNS_{t} = \frac{ENS_{t} - \text{mean} (ENS_{t})}{\text{sd} (ENS_{t})} \tag{7}
\]

\[
SVS_{t} = \frac{EV_{t} - \text{mean} (EV_{t})}{\text{sd} (EV_{t})} \tag{8}
\]

\[
STD_{t} = \frac{ETD_{t} - \text{mean} (ETD_{t})}{\text{sd} (ETD_{t})}, \tag{9}
\]

where \( c \) denotes the country-/region-specific sub-sample, and \( SNS_{t}, SVS_{t}, \) and \( STD_{t} \) are the standardised monthly firm-level number of shares, volume of shares, and transaction directions traded. Finally, for each country and region, standardised aggregate net number of transactions (SANT), standardised aggregate net number of shares (SANS), and standardised aggregate net volume of shares (SAVS) were computed as follows

\[
SANT_{c} = \sum_{i=1}^{C} STD_{t} \quad c = \{ \text{individual country, Europe, Asia} \} \tag{10}
\]

\[
SANS_{c} = \sum_{i=1}^{C} SNS_{t} \quad c = \{ \text{individual country, Europe, Asia} \} \tag{11}
\]

\[
SAVS_{c} = \sum_{i=1}^{C} SVS_{t} \quad c = \{ \text{individual country, Europe, Asia} \}, \tag{12}
\]

where \( C \) denotes the number of firms in a given country, and \( SANT_{c}, SANS_{c}, \) and \( SAVS_{c} \) are the 1-month aggregate insider sentiment indicators. Using standardised indicators allows for more effective interpretation as it limits the variables’ ranges, allows for improved comparison of coefficients across models, and smoothens out
variation in the respective sentiment indicator (Seyhun, 1992). Additionally, each monthly insider sentiment indicator was aggregated over 3 and 6 months \((n = \{1, 3, 6\})\) to smoothen out variability of corporate insider sentiment and to reduce the influence of short-term trends.

The dependent variables in each model are the future 1-month, 3-month, 6-month, and 12-month stock market index returns. Previous studies conceptualised excess returns of an index relative to risk-free assets as a measure of future market returns (Lakonishok & Lee, 2001; Seyhun, 1992). We used actual index-holding returns to remove a potential source of sensitivity and bias stemming from the choice of risk-free return rates. Our results thus allow for statements about the predictability of insider sentiment for future market returns (the actual relation intended to demonstrate) as opposed to future excess market returns which may differ substantially. Accordingly, index returns were defined as follows

\[
R_{t_0 + m} = \left( \frac{P_{t_0 + m, \text{max}}}{P_{t_0, \text{min}}} - 1 \right) \times 100, \quad m = \{0, 2, 5, 11\},
\]

where \(R_{t_0 + m}\) is the linear index-holding return of the forecast horizon of 1, 3, 6, or 12 months; \(P_{t_0, \text{min}}\) is the index price on the first trading day of a given month following the end of an aggregation horizon; and \(P_{t_0 + m, \text{max}}\) is the index price on the last trading day of a given month, \(m\) months after the beginning of the forecast horizon month \(t_0\). Including long-term future returns in the analysis ensures that the potential influence of short-term seasonalities in stock returns or insider trading are mitigated.

Operationally, given data availability, all four forecast horizons were calculated for the first month in the data set. Then, the four forecast windows’ start and end points were both moved 1 month ahead. This implies that forecast horizons can be overlapping. For instance, as the 12-month window is shifted 1 month ahead, the window implicitly covers 11 months of the previous \(t_0\)’s 12-month forecast window.

To establish the coefficients of interest, we ran ordinary least square regressions. A lagged return variable was introduced as an additional independent variable in each regression model to account for serially correlated residuals resulting from overlapping time periods. The lagged variable was defined as the dependent variable at \(t_{-1}\), which means that, for instance, to predict the future 6- and 12-month index returns of a forecast horizon starting in February of a given year, the lagged variables used would be the future 6- and 12-month forecast horizon returns starting in January of the same year. The regression models were set up as follows

\[
R_{t_0 + m} = \alpha_0 + \alpha_1 \sum_{k = t_0 - n}^{t_0 - 1} \{\text{SANT}; \text{SANS}; \text{SAVS}\}_k + \alpha_2 R_{t_0 + m - 1} + \epsilon,
\]

where \(R_{t_0 + m}\) are the 1-, 3-, 6-, and 12-month forecast horizons’ returns to be predicted; \(\alpha_1\) is the coefficient of interest showing the relation between aggregate insider sentiment and future index returns; the sigma sign indicates the aggregation horizon, which begins on the first trading day one \((t_0 - 1)\), three \((t_0 - 3)\), or six \((t_0 - 6)\) months prior to a forecast horizon’s starting month \(t_0\) and concludes with last trading day of the month preceding \(t_0\); \(R_{t_0 + m - 1}\) is the lagged variable, that is, the 1-, 3-, 6-, or 12-month forecast market returns starting at \(t_0\), the month preceding the focal month \(t_0\), and \(\epsilon\) is a residual error term.

5 | EMPIRICAL RESULTS

Key variables’ descriptive statistics for selected countries are reported in Table 2. For each variable the mean, SD, minimum, and maximum figures are shown. The three sentiment indicators and returns were calculated as laid out above. The number of observations \(N\) is the number of calendar months for the 1-month explanatory variable, and the number of sums for the multi-month explanatory variables, respectively. A negative (positive) mean sentiment indicator implies that in aggregate insiders were net sellers (buyers) during the period of time under consideration.

Time series regression model results are shown in Table 3. Each model predicts the dependent variable, future market return, as a function of the independent variable, insider sentiment. For each region and country, future 1-, 3-, 6-, and 12-month buy-and-hold stock market returns are regressed on the three different insider sentiment indicators reflecting aggregated transactions over 1, 3, or 6 months. Country- and region-specific returns and insider sentiment indicators are calculated as laid out in the methods part above.

In each country/region-panel, the first column demonstrates the relation between the independent variable and the following month’s return, the coefficients’ SD, and the associated sample size of individual months or aggregations of months. The following columns reveal the relation between the sentiment indicator and the following 3-, 6-, and 12-month returns, respectively. In each panel, the first row relates to the 1-month SANT sentiment indicator. The following rows show the model coefficients for SANS and SAVS indicators, respectively. The coefficients indicate the strength of the relationship
### Table 2: Key variables' descriptive statistics for all countries and regions analysed

| Statistic | Europe | Germany | France | United Kingdom | Italy | Russia | Spain | The Netherlands | Switzerland | Sweden | Poland | Belgium |
|-----------|--------|---------|--------|---------------|-------|--------|-------|----------------|-------------|--------|--------|---------|
| **SANT (n = 1)** | 178 | 326.51 | 906.91 | 121.09 | 121 | 9.76 | 41.61 | 135.12 | 78.03 | 177.05 | 134.68 | 401.03 |
| **SANS (n = 1)** | 178 | 2.45 | 32.5 | 61.88 | 121 | 0.11 | 2.46 | 24.02 | 9.00 | 13.00 | 9.00 | 131.45 |
| **SAVS (n = 1)** | 178 | 0.88 | 96.9 | 232.33 | 121 | 0.79 | 5.13 | 23.07 | 23.07 | 23.02 | 23.02 | 58.60 |
| **Rt (m = 0)** | 178 | 0.20% | 5.00% | 17.00% | 121 | 12.00% | 12.00% | 12.00% | 12.00% | 12.00% | 12.00% | 12.00% |
| **Rt (m = 2)** | 178 | 1.00% | 9.00% | 5.00% | 121 | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| **Rt (m = 5)** | 160 | 4.00% | 18.00% | 9.00% | 167 | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| **Rt (m = 11)** | 160 | 4.00% | 18.00% | 9.00% | 167 | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |

(Continues)
| Statistic | $N$ | Mean | $SD$ | Min | Max | $N$ | Mean | $SD$ | Min | Max |
|-----------|-----|------|------|-----|-----|-----|------|------|-----|-----|
| SAVS ($n = 1$) | 133 | 0.62 | 11.98 | −67.57 | 82.96 | 147 | 0.82 | 10.26 | −50.76 | 49.10 |
| $R_{10 + m}$ ($m = 0$) | 133 | 0.30% | 6.00% | −25.00% | 20.00% | 147 | 0.10% | 5.00% | −23.00% | 10.00% |
| $R_{10 + m}$ ($m = 2$) | 131 | 1.00% | 11.00% | −33.00% | 35.00% | 145 | 1.00% | 9.00% | −40.00% | 29.00% |
| $R_{10 + m}$ ($m = 5$) | 128 | 2.00% | 18.00% | −46.00% | 74.00% | 142 | 2.00% | 14.00% | −49.00% | 47.00% |
| $R_{10 + m}$ ($m = 11$) | 122 | 4.00% | 26.00% | −54.00% | 78.00% | 136 | 3.00% | 22.00% | −55.00% | 56.00% |

| Country | | | | | | | | | | |
|---------|---|---|---|---|---|---|---|---|---|---|
| Norway | SANT ($n = 1$) | 161 | 12.66 | 37.61 | −47.86 | 213.79 | 159 | 11.52 | 34.63 | −97.59 | 210.97 |
| SANS ($n = 1$) | 161 | 3.96 | 25.33 | −78.26 | 235.19 | 159 | −0.37 | 14.32 | −150.64 | 40.89 |
| SAVS ($n = 1$) | 161 | 2.40 | 13.13 | −26.63 | 107.48 | 159 | 1.18 | 15.00 | −57.81 | 95.47 |
| $R_{10 + m}$ ($m = 0$) | 161 | 0.20% | 6.00% | −28.00% | 20.00% | 159 | 1.00% | 5.00% | −22.00% | 14.00% |
| $R_{10 + m}$ ($m = 2$) | 159 | 2.00% | 13.00% | −50.00% | 49.00% | 157 | 3.00% | 11.00% | −45.00% | 38.00% |
| $R_{10 + m}$ ($m = 5$) | 156 | 3.00% | 19.00% | −59.00% | 77.00% | 154 | 6.00% | 16.00% | −54.00% | 40.00% |
| $R_{10 + m}$ ($m = 11$) | 150 | 6.00% | 28.00% | −61.00% | 72.00% | 148 | 12.00% | 24.00% | −53.00% | 76.00% |

| Denmark | SANT ($n = 1$) | 160 | −0.19 | 17.18 | −163.38 | 42.65 | 137 | −46.31 | 73.16 | −276.28 | 31.49 |
| SANS ($n = 1$) | 160 | 0.12 | 2.50 | −30.64 | 1.07 | 137 | −1.69 | 12.13 | −67.43 | 59.42 |
| SAVS ($n = 1$) | 160 | −0.06 | 3.42 | −29.34 | 5.13 | 137 | −8.63 | 40.74 | −273.22 | 24.31 |
| $R_{10 + m}$ ($m = 0$) | 160 | −0.10% | 5.00% | −21.00% | 15.00% | 137 | 1.00% | 5.00% | −19.00% | 16.00% |
| $R_{10 + m}$ ($m = 2$) | 158 | 1.00% | 11.00% | −43.00% | 37.00% | 135 | 3.00% | 10.00% | −38.00% | 27.00% |
| $R_{10 + m}$ ($m = 5$) | 155 | 2.00% | 18.00% | −57.00% | 56.00% | 132 | 6.00% | 15.00% | −43.00% | 43.00% |
| $R_{10 + m}$ ($m = 11$) | 149 | 5.00% | 26.00% | −67.00% | 45.00% | 126 | 11.00% | 23.00% | −48.00% | 61.00% |

| Greece | SANT ($n = 1$) | 150 | 55.35 | 136.28 | −163.41 | 782.28 | 158 | 8.01 | 27.94 | −109.82 | 85.29 |
| SANS ($n = 1$) | 150 | 1.49 | 26.37 | −48.34 | 303.74 | 158 | 0.17 | 6.91 | −24.79 | 81.09 |
| SAVS ($n = 1$) | 150 | 2.72 | 43.76 | −56.10 | 521.88 | 158 | 0.34 | 4.36 | −17.57 | 51.45 |
| $R_{10 + m}$ ($m = 0$) | 149 | −1.00% | 9.00% | −27.00% | 22.00% | 158 | 0.10% | 5.00% | −28.00% | 12.00% |
| $R_{10 + m}$ ($m = 2$) | 147 | −2.00% | 17.00% | −41.00% | 54.00% | 156 | 1.00% | 11.00% | −47.00% | 26.00% |
| $R_{10 + m}$ ($m = 5$) | 144 | −2.00% | 25.00% | −54.00% | 65.00% | 153 | 3.00% | 17.00% | −57.00% | 49.00% |
| $R_{10 + m}$ ($m = 11$) | 138 | −6.00% | 35.00% | −66.00% | 102.00% | 147 | 6.00% | 26.00% | −60.00% | 72.00% |

| Cyprus | SANT ($n = 1$) | 86 | 1.58 | 10.32 | −36.64 | 64.05 | 111 | 34.63 | 55.55 | −145.41 | 207.80 |
| SANS ($n = 1$) | 86 | −0.26 | 4.52 | −9.18 | 36.05 | 111 | 0.90 | 5.47 | −23.74 | 33.02 |
| SAVS ($n = 1$) | 86 | 0.01 | 2.57 | −19.91 | 9.50 | 111 | 0.61 | 4.93 | −22.60 | 23.32 |
| $R_{10 + m}$ ($m = 0$) | 86 | −3.00% | 13.00% | −28.00% | 31.00% | 111 | 1.00% | 6.00% | −13.00% | 22.00% |
| $R_{10 + m}$ ($m = 2$) | 85 | −7.00% | 27.00% | −58.00% | 134.00% | 109 | 4.00% | 12.00% | −26.00% | 48.00% |
| Statistic | $N$ | Mean | $SD$ | Min | Max | $N$ | Mean | $SD$ | Min | Max |
|-----------|-----|------|------|-----|-----|-----|------|------|-----|-----|
| $R_{t \rightarrow m}$ $(m = 5)$ | 84  | $-12.00\%$ | 36.00 | $-74.00\%$ | 124.00 | 106  | 8.00  | 20.00 | $-28.00\%$ | 96.00 |
| $R_{t \rightarrow m}$ $(m = 11)$ | 83  | $-21.00\%$ | 48.00 | $-83.00\%$ | 116.00 | 100  | 15.00 | 31.00 | $-53.00\%$ | 118.00 |

USA

| Statistic | $n$ | Mean | $SD$ | Min | Max |
|-----------|-----|------|------|-----|-----|
| SANT $(n = 1)$ | 177  | $-771.26$ | 665.75 | $-2,287.44$ | 2,091.57 |
| SANS $(n = 1)$ | 177  | $-17.27$ | 71.41 | $-284.3$ | 415.05 |
| SAVS $(n = 1)$ | 177  | $-62.94$ | 153.33 | $-669.27$ | 317.13 |

Asia

| Statistic | $n$ | Mean | $SD$ | Min | Max |
|-----------|-----|------|------|-----|-----|
| SANT $(n = 1)$ | 177  | $-771.26$ | 665.75 | $-2,287.44$ | 2,091.57 |
| SANS $(n = 1)$ | 177  | $-17.27$ | 71.41 | $-284.3$ | 415.05 |
| SAVS $(n = 1)$ | 177  | $-62.94$ | 153.33 | $-669.27$ | 317.13 |

(Continues)
between the respective sentiment indicator and future market returns. The \( \alpha_0 \) intercept coefficients and \( \alpha_2 \) lagged autoregressive coefficients are not of interest for this analysis and thus omitted from the table. The first row for each country shows the results for models in which standardised aggregate net number of transactions were used. The results imply that, for instance, an increase in 1-month US SANT by 1 SD, is associated with an expected increase of future 6-month S&P 500 returns by 2\%. The second rows feature the results of models using standardised aggregate net number of shares. Considering, for instance, the United States again, results show that an increase of 1-month SANS by one SD is expected to result in a 1.07\% increase of future 12-month index returns.

### Table 2 (Continued)

| Statistic | \( N \) | Mean | SD | Min | Max | \( \alpha_2 \) (m = 0) | \( R_{\alpha_2+m} \) (m = 2) | \( R_{\alpha_2+m} \) (m = 5) | \( R_{\alpha_2+m} \) (m = 11) |
|-----------|-------|------|----|-----|-----|----------------|----------------|----------------|----------------|
| SANT (n = 1) | 167   | 15.96| 78.90 | −172.58 | 283.69 | 147              | −2.08          | 25.48          | −83.76          | 102.00          |
| SANS (n = 1)  | 167   | 1.81 | 13.72 | −139.76 | 40.62  | 147              | 0.10           | 9.84           | −60.05          | 55.43           |
| SAVS (n = 1)  | 167   | 3.43 | 15.52 | −86.11  | 91.03  | 147              | 0.25           | 10.33          | −56.02          | 55.70           |

Notes: Aggregate insider sentiment measures SANT, SANS, and SAVS only shown for \( n=1 \). Descriptive statistics for other insider sentiment aggregation horizons (\( n=[3,6] \)) can be obtained from the authors upon request. Future one-, three-, six-, and twelve-month index returns are indicated \( R_{\alpha_2+m} \) (\( m=[0,2,5,11] \)).

Comparing the three measurement instruments, it becomes apparent that SANT captures more associations between insider sentiment and future returns than the other two measurements do. Furthermore, within one country, SANT coefficients are mostly internally coherent, that is, statistically significant \( \alpha_2 \)s across time frames are of the same sign.

SANS- and SAVS-based models tend to introduce more noise than SANT-based ones. Specifically, in multiple country-specific models SANT-based figures coherently indicate a positive relation between insider sentiment and future market returns across multiple dependent and independent variables’ time frames. However, overall country-level results are rendered ambiguous as some SANS-based models indicate a negative relationship and SAVS-based ones do not feature any statistically significant coefficients.

Furthermore, transaction count-based results are the most robust to changes in \( n \). Smoothing sentiment indicators over time by summing multiple months’ standardised aggregate net number of transactions does not alter results substantially. SANS- and SAVS-based models, however, are more sensitive to smoothed values.

Another trend that can be observed is that for a given \( n \), the sentiment indicators’ time period, coefficients tend to become more positive as \( m \), the future returns’ time period, increases. In other words, SANT-based models’ forecast ability increases as the time period to be predicted increases. For instance, examining Hong Kong’s 1-month SANT \( \alpha_1 \) coefficients shows a stronger
### Table 3: Time series regression of future market returns on aggregate insider trading activity, all countries and regions

|       | m = 0 | m = 2 | m = 5 | m = 11 | m = 0 | m = 2 | m = 5 | m = 11 | m = 0 | m = 2 | m = 5 | m = 11 |
|-------|------|------|------|-------|------|------|------|-------|------|------|------|-------|
| Europe |      |      |      |       |      |      |      |       |      |      |      |       |
| SANT   | −0.001 | 0.0001 | 0.001 | 0.002** | −0.007 | 0.001 | 0.003 | −0.003 | −0.003 | −0.001 | 0.004 | 0.013** |
|        | (−0.0004) | (−0.001) | (−0.001) | (−0.001) | (−0.006) | (−0.008) | (−0.009) | (−0.01) | (−0.003) | (−0.004) | (−0.005) | (−0.005) |
|        | 170 | 168 | 165 | 159 | 177 | 175 | 172 | 166 | 164 | 162 | 159 | 153 |
| SANS   | 0.004 | −0.003 | 0.004 | 0.005 | −0.111*** | −0.048 | −0.082* | −0.119** | −0.003 | 0.001 | 0.01 | 0.006 |
|        | (−0.012) | (−0.015) | (−0.018) | (−0.018) | (−0.042) | (−0.047) | (−0.048) | (−0.007) | (−0.01) | (−0.011) | (−0.012) | |
|        | 170 | 168 | 165 | 159 | 177 | 175 | 172 | 166 | 164 | 162 | 159 | 153 |
| SAVS   | −0.004 | −0.003 | −0.002 | −0.001 | −0.01 | −0.028 | −0.007 | −0.004 | −0.004 | 0.006 | 0.012 | 0.006 |
|        | (−0.004) | (−0.005) | (−0.006) | (−0.006) | (−0.016) | (−0.022) | (−0.025) | (−0.025) | (−0.007) | (−0.009) | (−0.011) | (−0.011) |
|        | 170 | 168 | 165 | 159 | 177 | 175 | 172 | 166 | 164 | 162 | 159 | 153 |
| United Kingdom | | | | | | | | | | | | |
| SANT   | −0.001 | 0.003 | 0.005 | 0.007 | −0.003 | 0.001 | 0.005 | 0.005 | −0.011 | −0.019 | −0.012 | −0.025 |
|        | (−0.003) | (−0.004) | (−0.005) | (−0.005) | (−0.002) | (−0.003) | (−0.004) | (−0.004) | (−0.015) | (−0.021) | (−0.03) | (−0.033) |
|        | 177 | 175 | 172 | 166 | 177 | 175 | 172 | 166 | 120 | 119 | 116 | 110 |
| SANS   | 0.005 | −0.006 | 0.01 | 0.019 | 0.043 | −0.022 | 0.062 | 0.087 | −0.124 | −0.367 | −0.288 | −0.59 |
|        | (−0.008) | (−0.01) | (−0.012) | (−0.013) | (−0.037) | (−0.049) | (−0.057) | (−0.055) | (−0.248) | (−0.351) | (−0.492) | (−1.209) |
|        | 177 | 175 | 172 | 166 | 177 | 175 | 172 | 166 | 120 | 119 | 116 | 110 |
| SAVS   | 0.003 | −0.008 | 0.01 | 0.008 | −0.003 | 0.005 | 0.018 | 0.005 | −0.132 | −0.138 | −0.189 | 0.206 |
|        | (−0.007) | (−0.009) | (−0.01) | (−0.01) | (−0.011) | (−0.014) | (−0.017) | (−0.016) | (−0.118) | (−0.168) | (−0.238) | (−0.254) |
|        | 177 | 175 | 172 | 166 | 177 | 175 | 172 | 166 | 120 | 119 | 116 | 110 |
| Spain  | | | | | | | | | | | | |
| SANT   | −0.002 | 0.004 | 0.006 | 0.005 | 0.005 | −0.011 | 0.001 | 0.004 | 0.001 | 0.006** | 0.004 | 0.010** |
|        | (−0.004) | (−0.006) | (−0.007) | (−0.007) | (−0.008) | (−0.011) | (−0.013) | (−0.013) | (−0.002) | (−0.003) | (−0.004) | |
|        | 157 | 155 | 152 | 146 | 177 | 175 | 172 | 166 | 173 | 171 | 168 | 162 |
| SANS   | −0.021 | −0.023 | −0.028 | −0.047 | 0.006 | −0.021 | −0.003 | 0.004 | −0.005 | −0.001 | −0.031 | 0.005 |
|        | (−0.024) | (−0.032) | (−0.036) | (−0.037) | (−0.033) | (−0.042) | (−0.049) | (−0.049) | (−0.012) | (−0.015) | (−0.031) | (−0.033) |
|        | 157 | 155 | 152 | 146 | 177 | 175 | 172 | 166 | 173 | 171 | 168 | 162 |
| SAVS   | 0.015 | −0.033 | −0.021 | −0.017 | 0.023 | −0.051 | −0.032 | −0.02 | −0.008 | −0.009 | −0.013 | −0.006 |
|        | (−0.02) | (−0.027) | (−0.031) | (−0.031) | (−0.05) | (−0.064) | (−0.075) | (−0.076) | (−0.01) | (−0.013) | (−0.016) | (−0.017) |
|        | 157 | 155 | 152 | 146 | 177 | 175 | 172 | 166 | 173 | 171 | 168 | 162 |

(Continues)
|       | m = 0     | m = 2     | m = 5     | m = 11    | m = 0     | m = 2     | m = 5     | m = 11    | m = 0     | m = 2     | m = 5     | m = 11    |
|-------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|       | Sweden    | Poland    | Belgium   |           |           |           |           |           |           |           |           |           |
| SANT  | < 0.00001 | 0.006     | 0.024***  | 0.017**   | 0.032**   | 0.023     | 0.027     | 0.052**   | −0.005    | 0.009     | 0.003     | 0.012     |
|       | (−0.005)  | (−0.006)  | (−0.007)  | (−0.008)  | (−0.016)  | (−0.021)  | (−0.026)  | (−0.009)  | (−0.012)  | (−0.014)  | (−0.014)  |           |
|       | 176       | 174       | 171       | 165       | 132       | 130       | 127       | 121       | 146       | 144       | 141       | 135       |
| SANS  | −0.012    | −0.028    | −0.021    | −0.033    | 0.006     | 0.001     | 0.072     | 0.05      | 0.028     | −0.019    | −0.024    | −0.038    |
|       | (−0.013)  | (−0.017)  | (−0.02)   | (−0.022)  | (−0.081)  | (−0.114)  | (−0.14)   | (−0.142)  | (−0.037)  | (−0.05)   | (−0.058)  | (−0.06)   |
|       | 176       | 174       | 171       | 165       | 132       | 130       | 127       | 121       | 146       | 144       | 141       | 135       |
| SAVS  | 0.003     | −0.01     | −0.004    | 0.006     | 0.049     | 0.053     | 0.048     | −0.002    | 0.024     | 0.036     | 0.005     | −0.011    |
|       | (−0.012)  | (−0.015)  | (−0.018)  | (−0.02)   | (−0.041)  | (−0.053)  | (−0.066)  | (−0.067)  | (−0.037)  | (−0.05)   | (−0.058)  | (−0.061)  |
|       | 176       | 174       | 171       | 165       | 132       | 130       | 127       | 121       | 146       | 144       | 141       | 135       |
| Austria |          |           |           |           |           |           |           |           |           |           |           |           |
| SANT  | −0.025*   | −0.008    | 0.025     | 0.03      | −0.007    | 0.018     | −0.012    | 0.015     | −0.042*   | −0.039    | 0.014     | 0.001     |
|       | (−0.013)  | (−0.019)  | (−0.023)  | (−0.023)  | (−0.013)  | (−0.018)  | (−0.02)   | (−0.022)  | (−0.024)  | (−0.033)  | (−0.039)  | (−0.054)  |
|       | 160       | 158       | 155       | 149       | 158       | 156       | 153       | 147       | 159       | 157       | 154       | 148       |
| SANS  | 0.003     | −0.017    | 0.002     | −0.067**  | 0.018     | 0.014     | −0.007    | 0.044     | 0.066     | −0.405*   | −0.166    | −0.09     |
|       | (−0.018)  | (−0.026)  | (−0.031)  | (−0.031)  | (−0.03)   | (−0.042)  | (−0.047)  | (−0.051)  | (−0.168)  | (−0.225)  | (−0.265)  | (−0.233)  |
|       | 160       | 158       | 155       | 149       | 158       | 156       | 153       | 147       | 159       | 157       | 154       | 148       |
| SAVS  | 0.006     | −0.019    | 0.001     | −0.107*   | 0.056**   | 0.007     | −0.002    | −0.012    | −0.023    | −0.367**  | −0.074    | −0.043    |
|       | (−0.036)  | (−0.05)   | (−0.06)   | (−0.059)  | (−0.028)  | (−0.041)  | (−0.045)  | (−0.049)  | (−0.123)  | (−0.164)  | (−0.194)  | (−0.171)  |
|       | 160       | 158       | 155       | 149       | 158       | 156       | 153       | 147       | 159       | 157       | 154       | 148       |
| Denmark |          |           |           |           |           |           |           |           |           |           |           |           |
| SANT  | −0.003    | −0.006    | −0.01     | −0.003    | −0.006    | −0.004    | 0.014     | −0.001    | 0.039     | 0.029     | 0.102***  | 0.033     |
|       | (−0.006)  | (−0.008)  | (−0.009)  | (−0.01)   | (−0.009)  | (−0.012)  | (−0.014)  | (−0.015)  | (−0.025)  | (−0.034)  | (−0.039)  | (−0.047)  |
|       | 136       | 134       | 131       | 125       | 159       | 157       | 154       | 148       | 140       | 138       | 135       | 129       |
| SANS  | 0.002     | −0.080*   | −0.061    | −0.117**  | 0.009     | −0.076*   | 0.021     | 0.002     | 0.017     | −0.408*   | −0.204    | −0.129    |
|       | (−0.034)  | (−0.048)  | (−0.056)  | (−0.058)  | (−0.033)  | (−0.045)  | (−0.054)  | (−0.056)  | (−0.171)  | (−0.232)  | (−0.27)   | (−0.315)  |
|       | 136       | 134       | 131       | 125       | 159       | 157       | 154       | 148       | 140       | 138       | 135       | 129       |
| SAVS  | −0.003    | −0.025*   | −0.011    | −0.018    | −0.005    | −0.021    | 0.012     | −0.015    | 0.021     | −0.008    | 0.043     | 0.029     |
|       | (−0.01)   | (−0.014)  | (−0.017)  | (−0.017)  | (−0.024)  | (−0.033)  | (−0.039)  | (−0.041)  | (−0.074)  | (−0.103)  | (−0.119)  | (−0.139)  |
| m = 0 | m = 2 | m = 5 | m = 11 | m = 0 | m = 2 | m = 5 | m = 11 | m = 0 | m = 2 | m = 5 | m = 11 |
|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| Greece | Luxembourg | Cyprus |
| SANT | −0.012** | −0.004 | 0.013* | 0.017** | −0.001 | 0.018 | 0.019 | 0.045* | −0.061 | −0.101 | 0.164 | 0.1 |
| (−0.005) | (−0.007) | (−0.008) | (−0.008) | (−0.015) | (−0.02) | (−0.024) | (−0.025) | (−0.139) | (−0.233) | (−0.229) | (−0.209) |
| 147 | 145 | 142 | 136 | 157 | 155 | 152 | 146 | 85 | 84 | 83 | 82 |
| SANS | −0.03 | 0.013 | 0.014 | 0.044 | −0.089 | −0.033 | 0.046 | 0.081 | 0.07 | 0.227 | 0.32 | 0.193 |
| (−0.027) | (−0.035) | (−0.039) | (−0.042) | (−0.059) | (−0.08) | (−0.097) | (−0.093) | (−0.311) | (−0.522) | (−0.52) | (−0.489) |
| 147 | 145 | 142 | 136 | 157 | 155 | 152 | 146 | 85 | 84 | 83 | 82 |
| SAVS | 0.0004 | −0.012 | 0.01 | −0.004 | −0.165* | −0.028 | 0.141 | 0.171 | −0.244 | −0.568 | −0.4 | −0.389 |
| (−0.016) | (−0.021) | (−0.023) | (−0.026) | (−0.094) | (−0.128) | (−0.153) | (−0.146) | (−0.548) | (−0.918) | (−0.914) | (−0.841) |
| 147 | 145 | 142 | 136 | 157 | 155 | 152 | 146 | 85 | 84 | 83 | 82 |
| Turkey | USA | Asia |
| SANT | 0.011 | 0.009 | 0.014 | 0.012 | 0.001 | 0.002*** | 0.003*** | 0.003*** | −0.001 | 0.002*** | 0.004*** | 0.006*** |
| (−0.011) | (−0.016) | (−0.02) | (−0.03) | (−0.005) | (−0.001) | (−0.001) | (−0.001) | (−0.001) | (−0.001) | (−0.001) | (−0.001) |
| 110 | 108 | 105 | 99 | 176 | 175 | 172 | 166 | 176 | 174 | 171 | 165 |
| SANS | −0.01 | 0.069 | 0.057 | 0.037 | −0.001 | 0.003 | 0.01 | 0.015** | 0.003 | 0.004 | 0.009 | 0.014** |
| (−0.115) | (−0.163) | (−0.202) | (−0.298) | (−0.004) | (−0.006) | (−0.007) | (−0.004) | (−0.006) | (−0.006) | (−0.007) |
| 110 | 108 | 105 | 99 | 176 | 175 | 172 | 166 | 176 | 174 | 171 | 165 |
| SAVS | −0.08 | 0.182 | −0.031 | 0.087 | 0.001 | 0.002 | 0.003 | 0.005 | 0.005* | 0.002 | 0.006 | 0.004 |
| (−0.127) | (−0.182) | (−0.226) | (−0.337) | (−0.002) | (−0.003) | (−0.003) | (−0.003) | (−0.003) | (−0.003) | (−0.004) | (−0.005) |
| 110 | 108 | 105 | 99 | 176 | 175 | 172 | 166 | 176 | 174 | 171 | 165 |
| China | Hong Kong | India |
| SANT | −0.0001 | 0.004* | 0.003 | 0.006** | −0.003 | 0.007* | 0.013*** | 0.018*** | −0.001 | 0.002 | 0.005 | 0.013** |
| (−0.001) | (−0.002) | (−0.002) | (−0.003) | (−0.003) | (−0.004) | (−0.005) | (−0.005) | (−0.003) | (−0.004) | (−0.005) | (−0.006) |
| 155 | 153 | 150 | 144 | 168 | 166 | 163 | 157 | 135 | 133 | 130 | 124 |
| SANS | −0.01 | 0.045** | 0.004 | 0.026 | 0.005 | −0.017 | −0.005 | 0.023 | 0.003 | −0.003 | 0.018 | 0.038 |
| (−0.014) | (−0.019) | (−0.023) | (−0.029) | (−0.024) | (−0.033) | (−0.038) | (−0.041) | (−0.017) | (−0.025) | (−0.029) | (−0.028) |
| 155 | 153 | 150 | 144 | 168 | 166 | 163 | 157 | 135 | 133 | 130 | 124 |

(Continues)
**TABLE 3** (Continued)

|        | m = 0 | m = 2 | m = 5 | m = 11 | m = 0 | m = 2 | m = 5 | m = 11 | m = 0 | m = 2 | m = 5 | m = 11 |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |

**South Korea**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **Malaysia**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |

**The Philippines**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |

**Australia**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |

**New Zealand**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |

**Singapore**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |

**Thailand**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |

**The Philippines**

|        |       |       |       |        |       |       |       |        |       |       |       |        |
|--------|-------|-------|-------|--------|-------|-------|-------|--------|-------|-------|-------|--------|
| **SAVS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANT** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
| **SANS** |       |       |       |        |       |       |       |        |       |       |       |        |
|         |       |       |       |        |       |       |       |        |       |       |       |        |
In this particular case, all else being equal, if $SANT_1$ increases by one SD, future 6-month HSI returns are expected to rise by 2.06% whereas future 12-month HSI returns are expected to rise by 2.85%.

6 | DISCUSSION

In our sample, we find evidence consistent with what Zhu et al. (2014) consider the insiders’ “macro-information advantage” for some countries. The regression results indicate that in the United States, Asia-combined, China, Hong Kong, and India, aggregate insider trading can coherently predict future market returns. Insiders seem able to observe and trade on market-wide activities and trends in these countries. This ability may be due to insiders obtaining macroeconomic information earlier, analysing information more effectively, and perceiving systematic stock market mispricing better than other market participants. In the aforementioned countries and regions, insider sentiment forecast abilities are also economically significant. An increase in aggregate insider buying by 1 SD is associated with index return increases of around 2%. Market participants wishing to implement a low-cost tool to forecast stock market returns can use publicly available insider filings to deduce insider sentiments for these countries.

In contrast, our data suggests that insiders in all the other countries and regions considered do not appear to factor macroeconomic expectations and information into their trades. Insiders in these countries rather seem to base their trades predominantly on firm-specific information. Insiders hence seem to be more effective in obtaining and trading on cash flow news related to their own firms. Accordingly, in these countries, market participants are not able to use aggregate insider trading as a tool to forecast future market returns.

There are three (market, firm, and insider level) categories of reasons which may provide potential explanations as to why aggregate insider trading does not predict market returns in these countries. First, from a market-level perspective there may be differences in insider trading regulation implementation and enforcement allowing insiders in the second set of countries to trade on firm-specific cash flow information without fearing a high risk of litigation. Differences in firm-level abnormal returns have previously been ascribed to regulatory differences (Fidrmuc, Korczak, & Korczak, 2013), and it is likely that such differences also become noticeable on an aggregate country level.

Other aspects that may harm insiders’ ability to trade on macroeconomic expectations include the level of
market maturity and efficiency. In modern times, all market participants have fast access to a plethora of information and means to analyse data. It is thus likely that in some countries insiders’ macro-information advantage relative to other investors has vanished as every market participant trades on the same (publicly) available data. Moreover, the degree of specialisation in a given economy might be positively associated with insiders’ forecasting abilities as specialised firms may tend to have more interactions with other firms than non-specialised ones, allowing them to gather macroeconomic information through frequent interaction.

Second, extant research suggests an impact of firm size (Lakonishok & Lee, 2001; Seyhun, 1988), firm market risk (Seyhun, 1988), and governance and ownership structures (Zhu et al., 2014) on the predictive power of aggregate insider trading. It is possible that some of the results presented above are influenced by these firm characteristics. For instance, Lakonishok and Lee (2001) argued that insiders in smaller companies have greater predictive power. It is possible that in the sample, countries that do not reveal a significant association between insider sentiment and market returns feature an unproportionally large number of big firms.

Third, prior research indicated that managers exhibit higher predictive power than large shareholders (Lakonishok & Lee, 2001), and that levels of hierarchy and operational involvement are positively correlated with insiders’ predictive power (Lakonishok & Lee, 2001; Zhu et al., 2014). It may be possible that in the present sample, countries that do not reveal significant correlations between insider sentiment and market returns feature a relatively high amount of transactions made by large shareholders and insiders of low hierarchical levels. Additionally, in countries for which future returns can be predicted by aggregate insider trading, corporate insiders might be better interconnected, allowing them to gather and deduce macroeconomic information more effectively. All these aforementioned aspects may also interact differently across countries.

In line with Lakonishok and Lee (2001) we find that the models’ forecast ability becomes of greater magnitude as the forecast horizon increases. This increase is likely due to insiders observing trends very early, which only substantiate and become noticed by outside investors over the course of time. Another noteworthy pattern in the results is that models for smaller economies in terms of market activity, number of firms, and GDP tend to reveal more significant relations between aggregate insider trading and market returns than those for larger economies. This trend may be due to insiders in smaller countries being more interconnected, which allows them to perceive macroeconomic trends more effectively as their access to economy-wide information increases.

The nonuniform nature of SANS- and SAVS-based models is in line with previous studies (Seyhun, 1992). Extant research demonstrated that insider transactions in smaller firms are associated with greater abnormal returns (Lakonishok & Lee, 2001), which implies that insiders in such firms tend to possess greater firm-specific insights. Directors in larger firms, who tend to possess less and trade less frequently on less firm-specific information, tend to buy and sell higher numbers and volumes of shares, which results in SANS- and SAVS-based models being biased towards these firms. The fact that these models provide less conclusive evidence than SANT-based ones suggests that large-firm insiders do also not possess superior economy-wide information.

Our findings are generally consistent with past studies. Seyhun (1988) showed that a 1 SD change in aggregate insider trading predicts changes in future excess market returns of up to 1.7%. We documented that an increase in 1-month US SANT by 1 SD is associated with an expected increase of future 6-month S&P 500 returns by 2%. Similar to Seyhun (1992), we find that using standardised aggregate net number of shares as an indicator for insider sentiment produces more noisy future return predictions than the standardised aggregate net number of transactions. Our findings pertaining to China and other less mature markets (i.e., India and the Philippines) are in line with Zhu et al. (2014).

Apart from the novelty of our data and the geographical breadth of our sample, the main strength of our exploratory study lies in the methodological rigor applied. By defining three distinct insider trading measures we avoid potential biases arising from using only one single indicator. For instance, aggregate dollar volume as a measure of aggregate trading might be influenced by large firms and a small number of large transactions, whereas the transaction count may be less biased. Monthly insider sentiment indicators are smoothened out to reduce the variability of corporate insider sentiment and to reduce the influence of short-term trends. Sentiment aggregations of 1, 3, and 6 month(s) are examined, as opposed to other studies (e.g., Chowdhury et al., 1993) which used short-term sentiment aggregation horizons as short as 1 week. A similar logic applies to long-term forecast horizons, chosen to mitigate the potential influence of seasonalities. Moreover, we use buy-and-hold returns as opposed to, for instance, excess returns, as the dependent variable in order to analyse the actual predicted relation and to avoid one potential source of bias introduced by choosing appropriate risk-free assets. One potential weakness of our study is the high level of analysis. We do not consider differences in transactions, insiders, or firm types. For instance, Chowdhury et al. (1993) showed that aggregate insider purchases have a greater predictive power than aggregate insider sales. We did not effectively account for such potential differences.
7 CONCLUSION AND FUTURE RESEARCH

This study examined aggregate insider transactions in the US, 21 European, and 10 Asian countries. We found that only insiders in the United States, Asia, China, Hong Kong, and India can coherently predict future market returns. Insiders in these countries and regions seem to trade on economy-wide expectations, whereas in other countries in the sample, insiders appear to trade predominantly on firm-specific private information. For the aforementioned countries, investors can use aggregate insider trading as an effective tool to make assumptions about future stock market returns and thereby use insider sentiment to inform passive or index investing strategies. On the contrary, in countries in which aggregate insider trading is uncorrelated with future market returns, insiders appear to rather trade on firm-specific information. Accordingly, investment strategies focusing on the use of individual insiders’ trading filings to invest in particular stocks may be more profitable. The findings imply that naively mimicking all insiders transactions is not necessarily a profitable investment strategy.

This high-level study does not examine transaction (e.g., buy vs. sell), firm (e.g., size, risk), or insider (e.g., hierarchical level, operational involvement) characteristics. The discussion section of this paper provides multiple reasons as to why insider sentiment in terms of aggregate insider trading may not be an accurate predictor for some countries in the sample. Multiple empirically testable hypotheses can be developed from our discussion. We leave this to further research.

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DATA AVAILABILITY STATEMENT

Data available on request from the authors - The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTES

1 A list of indices used for each country can be obtained from the authors upon request.

2 A list of all exchanges and countries represented in the (sub-)samples can be obtained from the authors upon request.

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