Journal of Financial Economics

Strategic insider trading and its consequences for outsiders: Evidence from the eighteenth century☆

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ARTICLE INFO

JEL classification:
G11
G12
G14

Keywords:
Insider trading
Financial history
Asymmetric information

ABSTRACT

This paper uses hand-collected historical data to provide empirical evidence on the strategic trading behavior of insiders and its consequences for outsiders. Specifically, we collect all equity trades of all insiders and outsiders in an era without legal restrictions on insider trading and a market where trading is non-anonymous. We find that access to private information creates a significant gap between the post-trade returns of insiders and outsiders. Consistent with theory, insiders capitalize on their information advantage by hiding their identity and timing their trades. Both experienced and inexperienced outsiders face expected losses due to this strategic insider trading.

1. Introduction

Information asymmetry is inherent to trading and will always remain a threat to the fairness and integrity of financial markets. It is therefore important to understand how informed investors exploit their information advantage and how their trading behavior affects uninformed investors. A large body of theoretical work predicts that informed agents prefer to trade on markets that offer greater anonymity to reduce their execution costs.[1] Theoretical models further predict that informed investors strategically time their trades to minimize price impact (see, e.g., Kyle, 1985; Collin-Dufresne and Fos, 2016). However, testing these predictions empirically is challenging because it is difficult to distinguish informed from uninformed trades and because insiders' opportunities to trade on private information are restricted by legislation.[2] Similar issues also plague the vast empirical literature that studies the profitability of insider trading using a sample of disclosed insider trades.[3] Moreover, this existing work examines informed trading solely from the perspective of insiders and does not consider the consequences of insider trading for outsiders.

☆ Toni Whited was the editor for this article. For helpful comments and suggestions, we thank the editor, two anonymous referees, Jonathan Berk, Fabio Braggion, Robert Bruner, William Goetzmann, Jens Jackwerth, Peter Koudijs, Albert Menkveld, Roberto Ricco, and participants at the American Finance Association (AFA) Annual Meeting, the European Finance Association (EFA) Annual Meeting, the CEPR European Summer Symposium in Financial Markets, and the Federal Reserve Board Workshop on Monetary and Financial History, as well as seminar participants at Bocconi University, Tilburg University, Otto Beisheim School of Management, and the University of Sankt Gallen.

[1] See, for example, Roëll (1990), Admati and Pfleiderer (1991), Fishman and Longstaff (1992), Forster and George (1992), and Rindi (2008).

[2] Some empirical studies on informed trading use a sample of illegal insider trades obtained from SEC investigations (e.g., Meulbroek, 1992; Ahern, 2017; Kacperczyk and Pagnotta, 2019; Ahern, 2020). However, such samples are incomplete and subject to potential selection bias. Augustin et al. (2019) document that the SEC initiated a litigation for only 10% of the takeover deals in their sample with informed option trading activity, and Blackburne et al. (2021) report that many SEC investigations are undisclosed. In addition, prosecuted insider trades may be more profitable because this could strengthen the SEC's case that these transactions are based on private information.

[3] In the U.S., all trades by company directors, officers, key employees, and principal shareholders owning more than 10% of a company's equity must be reported to the SEC within two business days on Form 4. These reports do not distinguish between informed and uninformed trades and are the source of data for almost all empirical studies on the profitability of insider trades, including, for example, Seyhun (1986), Jeng et al. (2003), Cohen et al. (2012), and Ali and Hirshleifer (2017).

Received 14 July 2022; Received in revised form 13 November 2024; Accepted 15 November 2024

Available online 16 December 2024

In this paper we use hand-collected historical data to provide empirical evidence on the trading behavior of insiders and its consequences for outsiders. Specifically, we seek answers to three basic questions. First, how valuable is access to material and non-public information for corporate insiders who can trade freely on this information? Second, do insiders strategically hide their identity and time their trades to capitalize on their information advantage? Third, what are the financial consequences of such strategic insider trading for outsiders?

Our sample includes the daily holdings and transactions of all shareholders of three companies that comprise more than 40% of the early 18th century London stock market. We observe the identity of every buyer and seller and various trader characteristics such as occupation and home address. We further collect information about the composition of the board of directors for each firm and classify each trader as either insider or outsider for a firm in a given year based on board membership. We also retrieve the minutes of all board meetings to obtain insight into the private information that board members had access to.

This historical data set offers three main advantages over modern data. First, we can better identify the value of private information to insiders, because there were no legal restrictions on insider trading during our sample period. Because we also observe directors' trades in shares of other firms, we can assess if any performance differences between insiders and outsiders are driven by information asymmetry or by differences in trader characteristics. Second, we can test the prediction of microstructure models that investors choose to conceal their identity when trading on private information, because trading in the market that we study was non-anonymous and because we can classify trades as informed or uninformed. This also allows us to test the prediction that insiders trade more in times of higher liquidity. Third, we can measure the expected losses for outsiders due to insider trading, because we observe all transactions of every insider and outsider with counterparty identity.

We first examine the value of private information. We start with an analysis of corporate events that were first discussed in board meetings and later published in newspapers. We find that directors buy (sell) unusually large amounts of shares before the publication of positive (negative) company news. Furthermore, stock prices increase (decrease) on average by 4.5% over the five-day period after positive (negative) news is discussed in the board.

The information asymmetry between insiders and outsiders should lead to a gap in their trading performance. We test this hypothesis empirically by regressing trader- and company-specific post-trade returns on insider trading dummies. We find that the post-trade returns of insiders are indeed significantly higher than those of outsiders. The outperformance ranges from 1.5% to 3% per trade over a monthly and quarterly horizon, respectively, and is driven by share purchases. This performance gap is robust to controlling for trader fixed effects that absorb unobserved trader characteristics such as financial literacy. These findings indicate that insiders outperform outsiders because they have access to valuable private information.

To allow for the possibility that some non-directors may also have access to non-public information, we augment the set of insiders with various investor types: blockholders, brokers, employees, neighbors of directors, nobles, and politicians. We find that the one-month post-trade returns of these potential insiders significantly exceed those of outsiders. However, their returns are generally smaller than those of directors, particularly over the quarterly horizon. This suggests that the most valuable information is concentrated among directors.

The superior profitability of insiders' trades raises the question why outsiders were willing to trade with insiders, given that trading was in principle not anonymous in the market that we study. Specifically, buyers and sellers met in person to effect the transfer of shares and thus observed the identity of their *direct* counterparty. Moreover, it was publicly known who was sitting on the board of a firm and thus more likely to be informed. Directors therefore had a strong incentive to conceal their identity when trading on private information. Insiders in our sample could hide their identity by collaborating with an intermediary who reverses her transaction with the insider by trading with an outsider. For example, an insider can anonymize a sell transaction by selling stocks to an intermediary who then sells these stocks to an outsider. Although the outsider observes the identity of the intermediary, she does not know that the intermediary is unwinding a transaction with an insider. The outsider is thus unaware that she *indirectly* trades with an insider. Motivated by this idea, we classify a trade as strategically hidden if the counterparty reverses her transaction. Because an insider is more likely to camouflage his trades that are based on private information, we expect hidden insider trades to be more profitable than non-hidden trades. We find that the anonymized trades of directors earn 1.7% (0.7%) higher returns over the next month (quarter) than their non-anonymized trades. This outperformance suggests that insiders indeed choose to strategically conceal their identity when trading on material and non-public information.

Insiders also have an incentive to strategically time their informed trades. In particular, the model of Collin-Dufresne and Fos (2016) predicts that investors with long-lived information trade more aggressively when a stock's noise trading volume and liquidity are higher. Using our trade anonymity measure as an ex-ante proxy for trade informativeness, we find strong empirical support for the prediction that insiders time their informed trades. Specifically, a one-standard-deviation increase in uninformed volume is associated with a 20% increase in the number of shares traded by an informed director. In contrast, we find no relation between the size of a director's uninformed trades and a stock's noise trading volume. We further show that the strategically timed trades of insiders are much more profitable than their trades on days with low noise trading volume. A director's trade on a day when a stock's uninformed volume is one standard deviation above its mean is 1% (monthly horizon) to 5% (quarterly horizon) more profitable than his trade on a day with average uninformed volume. The superior profitability at the longest horizon is consistent with the prediction that insiders time their trades when their private information is long lived.

In the last part of our analysis, we zoom in on the consequences of insider trading for outsiders. We estimate the expected loss for outsiders due to insider trading by multiplying the unconditional probability that an outsider trades with an insider by the average loss she incurs when doing so. The average loss is defined as the difference in average post-trade return between an outsider's trades with an insider and her trades with another outsider. Expected outsider losses from trading with a director are two (seven) basis points per transaction over the one-month (one-quarter) period after the trade. For comparison, the brokerage fee in our sample period is 25 basis points per trade. Expected losses increase to 14 (monthly) and 25 (quarterly) basis points when we expand the group of insiders with former and future board members, blockholders, brokers, employees, neighbors, nobles, and politicians.

Because informed insider trades are typically more profitable than uninformed insider trades, we separately estimate an outsider's expected loss due to informed insider trading. We classify a trade as informed if it is strategically hidden and if the ex-post trade return exceeds a prespecified threshold. Using a threshold of zero, the expected loss for outsiders due to trading with informed directors is two basis points per transaction over the next month and four basis points over the next quarter. Expected losses increase to 13 (27) basis points per transaction over the one-month (one-quarter) period after the trade when expanding the set of insiders with the other potentially informed traders. Expected losses are smaller at higher return thresholds because the increase in profitability of informed trades is more than offset by the decrease in likelihood of trading with an informed insider.

As a final step, we explore which outsiders are more prone to trade with insiders. We find that outsiders with more trading experience and a better understanding of financial markets are less likely to trade directly with directors. They are even more reluctant to trade with directors on days when directors are more likely to exploit their

information advantage, such as board meeting days and days with high noise trading volume. These results indicate that more experienced and knowledgeable traders are better able to identify directors and thus to avoid trading with them. However, when directors choose to strategically hide their identity, both experienced and inexperienced outsiders can be harmed by informed insider trading.

Our study adds to the literature on the strategic trading behavior of informed investors. A large body of theoretical work predicts that informed investors prefer to trade on venues with less transparency to minimize price impact (e.g., Roëll, 1990; Admati and Pfleiderer, 1991; Fishman and Longstaff, 1992; Forster and George, 1992; Rindi, 2008).[4] We contribute to this literature by testing empirically if insiders choose to strategically hide their identity when trading on private information in a market that is non-anonymous.

Another strand of theoretical literature predicts that informed investors strategically time their transactions to minimize price impact. Using eighteenth-century data, Koudijs (2015) presents empirical evidence consistent with Kyle (1985)'s prediction that informed agents spread their trades over time. Collin-Dufresne and Fos (2016) extend Kyle (1985)'s model by making noise trading stochastic and predict that informed insiders trade more aggressively when noise trading volume is high. Using data from 13D filings by activist investors, Collin-Dufresne and Fos (2015) show empirically that informed investors are more likely to trade when abnormal volume is high and make significant profits from their informed trades.

We extend this work in two directions. First, we test the prediction that liquidity timing is more pronounced for an insider's *informed* trades than for his *uninformed* trades. This analysis allows us to rule out the possibility that insiders always trade more aggressively when liquidity is high, irrespective of whether their trades are informed or not. Second, we examine if timed insider trades are more profitable over longer horizons, because waiting is only feasible if private information is long lived. By comparing the profitability of timed and untimed insider trades, we rule out the possibility that insiders earn higher returns on timed trades because they have superior investment skill rather than access to private information.

Our work is also related to the empirical literature that studies the profitability of insider trades. Seyhun (1986) uses an event-study approach and finds evidence of significant abnormal returns following disclosed insider trades. In contrast, using self-reported insider trades in Norway, Eckbo and Smith (1998) find no evidence of positive abnormal performance. Cohen et al. (2012) and Ali and Hirshleifer (2017) split insider trades into two groups and show that opportunistic trades are much more profitable than routine trades.

We contribute to this literature in two ways. First, we strengthen the empirical identification of the relation between insiders' information advantage and the profitability of their trades. Specifically, because we also observe directors' trades in stocks of other firms, we can control for trader fixed effects to rule out that performance differences between insiders and outsiders are due to differences in investor ability rather than information asymmetry. Second, we provide empirical evidence on the consequences of insider trading for outsiders. Because we observe all transactions of all insiders and outsiders in a company's stock, we can quantify the losses that outsiders are expected to incur due to trading with insiders.

The paper proceeds as follows. Section 2 describes the historical setting and the companies in our sample. Section 3 provides an overview of our data sources and discusses our insider definitions. Section 4 presents the empirical results and Section 5 concludes.

2. Historical setting

The early 18th century London stock market consisted of a few stocks, and newspapers typically quoted daily prices for the largest companies (Bank of England, East India Company, South Sea Company, Million Bank, and Royal African Company). In late 1719 and early 1720, two new insurance company stocks were floated: the Royal Exchange Assurance and London Assurance. These public offerings were followed by a widespread enthusiasm for public equity and share trading. Entrepreneurs proposed more than 100 new companies in the spring of 1720 and the market witnessed a flurry of IPOs. Except for the two insurance companies, however, all new initiatives were nipped in the bud by the Bubble Act that was passed on 11 June 1720. While the Act was supposed to terminate all speculative endeavours, the summer of 1720 became a textbook example of a bubble. The episode is commonly referred to as the South Sea Bubble. We describe the events that played a key role in the formation and burst of the South Sea Bubble in Appendix A. Since the two insurance companies were the only new companies that survived the turbulent year 1720, the post-bubble market consisted of the same shares as the pre-bubble market plus the two insurance companies. The three companies for which we were able to collect all share transactions, i.e., the Bank of England, East India Company, and Royal African Company, collectively represented more than 40% of the market in terms of pre-bubble capitalization (Anderson (1801, pp. 90–95)).

2.1. Trading

Trading typically took place in coffee houses close to the London Stock Exchange. Similar to today's markets, an investor who wanted to buy or sell stocks contacted a broker who in turn contacted another broker or market maker for price quotes. The broker then executed the transaction at the best possible price for the client and charged a fixed 25 basis points brokerage fee per transaction.[5] All transactions were recorded by the transfer clerk in the company's ledger and transfer books. Trading was not anonymous because both the buyer and seller had to be present in person in the company transfer office to effect the transfer of stock by signing the transfer book and exchanging money from the buyer to the seller.

2.2. Companies

2.2.1. Bank of England

The Bank of England (BoE) is known today as the central bank of the United Kingdom. However, in the early 18th century it acted as a private bank with strong ties to the government. In January 1720, the Bank pulled the short straw in the bidding war with the South Sea Company for the right to convert government debt into stocks. While the South Sea share price bubbled heavily in 1720, the Bank was considered one of the safer assets in the turbulent bubble market.[6] Fig. 1 shows that Bank share prices only doubled in 1720, while some other companies such as the London Assurance witnessed an eightfold increase. Despite its lower share price volatility, the Bank did contribute to the bubble by allowing shareholders to borrow money cheaply through the collateralization of their Bank shares. Braggion et al. (2023) show that shareholders who collateralized stocks were more likely to ride the bubble and take speculative positions in new share issues.

[4] Garfinkel and Nimalendran (2003) show empirically that trades by corporate insiders in stocks listed on exchanges with less anonymity lead to larger changes in proportional effective spreads than trades in markets with more anonymity. Linnainmaa and Saar (2012) show that broker identity information can be used as a signal about the identity of investors and document that frictions in the economic environment such as commission discounts prevent informed investors from using multiple brokers to hide their identity.

[5] The loan book of the Bank of England documents a few loan defaults where the Bank sells collateralized shares to cover the losses on the loan. For each transaction a brokerage fee of 25 basis points was charged.

[6] For example, stockbroker Peter Crellius wrote on 16 January 1720: "the general opinion is that they [shares] will all continue to rise. Bank shares are not mounting as rapidly as the others, but opinion ranks them the safest of all: most of the speculation is falling on the South Seas." (Wilson (1941, p. 124)).

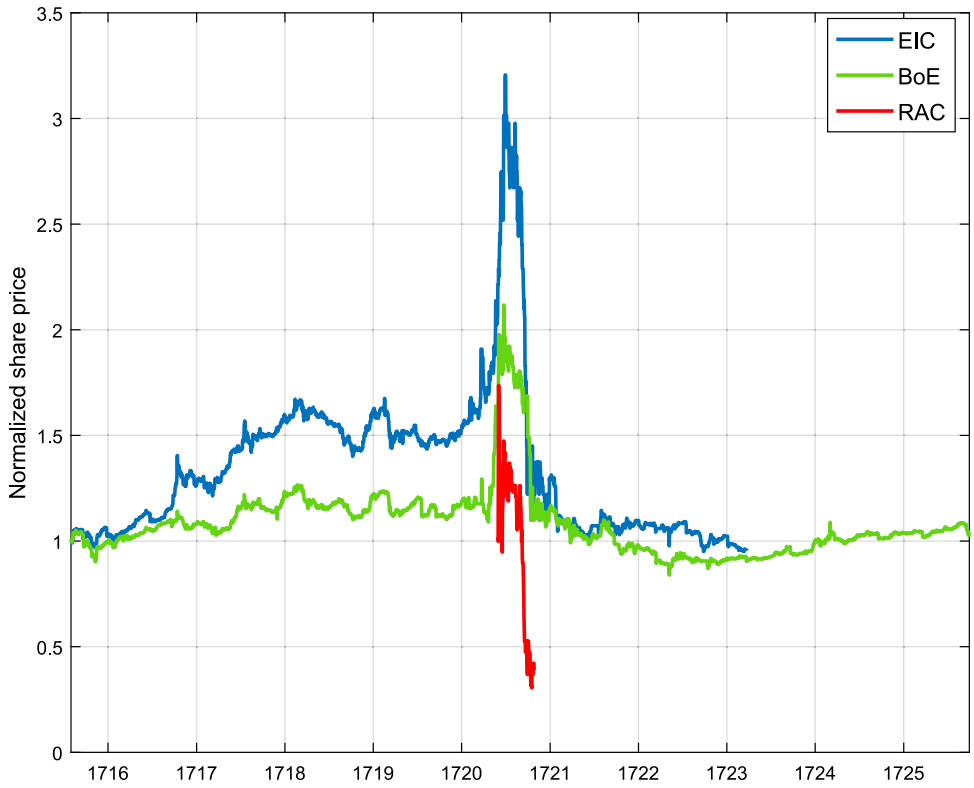

Fig. 1. Normalized share prices.
This figure shows normalized daily share prices for the Bank of England (BoE), East India Company (EIC), and Royal African Company (RAC). Each company's share price series is normalized by dividing by its first observation. The sample period is 1 August 1715 to 29 September 1725 for the BoE, 1 August 1715 to 25 March 1723 for the EIC, and 28 May 1720 to 27 October 1720 for the RAC.

As explained in Appendix A, the Bank also played an important role in the unwinding of the bubble by bailing out the South Sea Company. As the largest private lender in the market, the Bank was probably the only candidate for such a large-scale operation. However, the bailout also jeopardized the Bank as it was forced to call outstanding loans immediately to raise cash for the bailout, including the loans on collateralized Bank shares. The unexpected call forced borrowers to sell their shares in other companies to raise cash for their loan repayments. The credit contraction thus triggered a price-liquidity spiral that spilled over to other companies. In line with the predictions of Brunnermeier and Pedersen (2009), investors were confronted with market-wide drops in stock prices and a severe liquidity drought after the loans had been called on 6 October 1720.

2.2.2. East India Company

The East India Company (EIC) was chartered in 1600 and received a monopoly to trade commodities with the East Indies. Although the company held a monopoly in Britain, it faced fierce competition from the French Compagnie des Indes Orientales and the Dutch East Indies Company. The EIC was important for the British government as it was responsible for 30% of Britain's import. This figure also illustrates how tightly the company was connected to the state. Over the course of the bubble year, East India Company stock prices doubled and then dropped by two-thirds when the bubble burst (see Fig. 1).

2.2.3. Royal African Company

The Royal African Company (RAC) obtained a royal charter in 1672 and received the British monopoly on trade along the west coast of Africa. In May 1720, the company undertook a major refinancing operation (Carlos et al., 2002). It quadrupled the book value of its equity capital by issuing new shares, known as "engrafted shares".[7] In July 1720, the company followed the example of the South Sea Company and Bank of England and offered its shareholders the opportunity to borrow cash using RAC shares as collateral. In synchrony with the shares of other firms, the stock price began to tumble in the late summer of 1720 (see Fig. 1).

3. Data

We retrieve data from three sources. Our primary source are the Bank and East India ledger books and Royal African transfer files that record daily stock holdings and transactions. We collect the Bank ledger books for the period 1 August 1715 to 29 September 1725, East India ledger books from 1 August 1715 to 25 March 1723, and Royal African engrafted share transfer files from 28 May 1720 to 27 October 1720. Our second data source are the board meeting minutes for each of these companies that discuss the day-to-day business and contain information about a company's board composition and dividend payments. The third data source is the newspaper Castaing's Course of the Exchange that publishes daily share prices.

3.1. Stock ledgers and transfer files

The Bank and East India ledger books record every stock transaction with trader identities and each shareholder's daily equity holdings in trader-specific accounts. An individual trader may have multiple

[7] The old and engrafted shares were slightly different because holders of old shares were entitled to a £10 dividend in April 1721, whereas holders of engrafted shares were not. Nonetheless, prices of old and engrafted shares were highly correlated and after the dividend payment newspapers reported only one price.

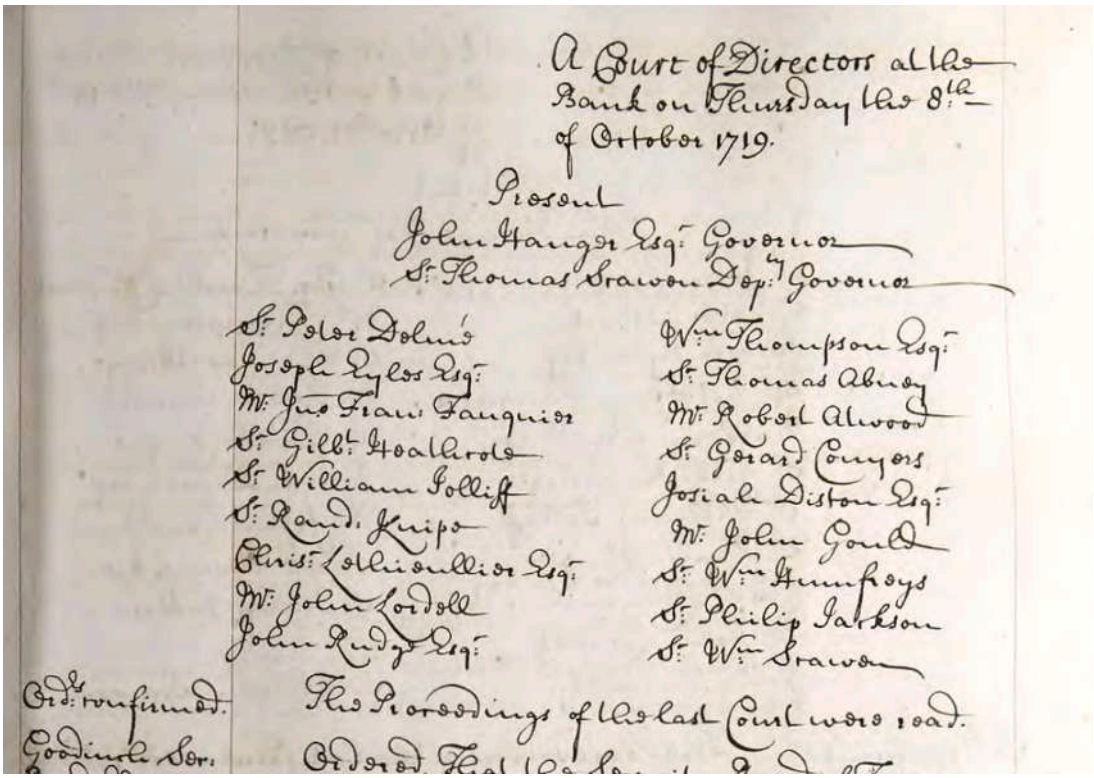

Fig. 2. Board meeting presence Bank of England.
This figure shows an excerpt from the minutes of a Bank of England board meeting on October 8th, 1719. It lists the names of the governor, deputy governor, and directors present at the meeting. This information was retrieved from the BoE website: https://www.bankofengland.co.uk/about/people/court-of-directors.

accounts over time that are all linked to a unique trader-specific ledger index entry showing shareholder characteristics such as home address, occupation, and title. We retrieve all buys and sells for every account with accompanying transaction details: date, transaction amount, and buyer and seller identities. Unfortunately, the Royal African ledger books have not survived. However, by using the transfer files we are able to reconstruct all transactions and holdings of the engrafted Royal African shares issued in 1720.

The main advantages of the ledger and transfer file data are their completeness and high level of detail. Because every Bank and East India transaction is recorded multiple times (in the ledger accounts of the buyer and seller and in the transfer file), we are able to cross-check each transaction to ensure high data quality. We show an example of a ledger book account and transfer file for the Bank of England in Figures A1 and A2 in the Online Appendix.

3.1.1. Shareholder characteristics

We also retrieve shareholder characteristics from the ledger indexes in which background information is recorded in an unsystematic manner. Most likely, company clerks did not systematically document titles, home addresses, and occupations of shareholders because the characteristics served to uniquely identify a shareholder. As a result, we typically observe many details for John Smith (e.g., "woollen draper from Lombard Street in London"), but we know little about Baron Philip van Borselle because there is only one such baron. Table A1 in the Online Appendix gives an overview of the most common trader characteristics in our sample. We find that many traders live in London close to the stock exchange. Among the foreigners, the Dutch are the largest group. The table further shows that merchant, draper, and goldsmith are the most popular occupations among shareholders. Approximately 2% of the traders carry a title, most commonly Baron, Baronet, Knight, and Earl.

3.2. Board meeting minutes

Our default insider definition classifies board members of the Bank, East India, and Royal African as insiders for the years that they serve on the board of their respective companies. A trader can thus be an insider for a company in one year and an outsider for that company in another year. Similarly, in a given year, a trader can be an insider for one company and an outsider for another. The board of directors consists of a governor, deputy governor, and 24 directors that were elected by a general court of all shareholders. The Bank scheduled one board meeting per week and the other two boards met twice a week. In case of urgencies, companies planned ad-hoc meetings in between the regularly scheduled meetings.

We retrieve director names from the minutes of the board meetings. The structure of these minutes is similar across companies.[8] Each report is dated and first lists the names of all directors present at the meeting (see Fig. 2). It then proceeds with a reading and approval of last meeting's minutes and a discussion of the most pressing issues at that moment. The Bank board typically discussed loans and repayment conditions, whereas the other two boards discussed colonial developments and the arrival of ships and cargo. Appendix B gives eight examples of material issues that were discussed in board meetings and later covered in newspapers. These examples provide insights into the day-to-day business of each company.

[8] Board meeting minutes of the Bank (so-called Court of Directors meetings) are available on the Bank website: https://www.bankofengland.co.uk/about/people/court-of-directors. For the East India we collect board minutes from the British Library, East India Company Minutes of the Court of Directors IOR/B/54-60. Minutes of the Royal African board are obtained from Treasury Papers, Class T70, National Archives, Kew, UK: The Minute Book of the Royal African Company Court of Assistants (T70/90) and Minute Book of the General Court (T70/101).

Twice a year each board decided how much dividend would be paid to shareholders. After that decision was made, the company closed its books and stopped recording stock transactions to determine each shareholder's dividend claim.[9] The meticulous recording of transactions with trader identities was also necessary to determine which shareholders were eligible to elect new board members. Investors with at least £500 in nominal holdings were eligible to vote.[10] Companies also imposed lower bounds on shareholdings for election candidates. For instance, to qualify as a candidate, Bank directors were required to hold at least £2,000 nominal in Bank stock. Investors had to own at least £3,000 nominal to be a candidate for the position of deputy governor and £4,000 for the position of governor. For the East India and Royal African Company, governor, deputy governor, and director candidates had to hold at least £2,000 nominal in stock of their company. Elections were held once a year and newspaper advertisements were placed to call shareholders to vote. Figures A3 and A4 in the Online Appendix provide examples of board meeting minutes that discuss the scheduling of board elections and the announcement of voting results.

3.3. Summary statistics

Panel A of Table 1 presents descriptive statistics on investor trades and holdings. Our sample consists of 14,200 shareholders, split into 14,081 outsiders and 119 insiders (directors).[11] The Bank and East India Company have 53 and 51 board members with positive shareholdings over the sample period, respectively. The Royal African sample includes 21 directors that hold positions in their company because the sample period is much shorter and covers only one board. Board members often enter and leave the board multiple times during our sample period. The total number of unique board members (119) is smaller than the sum across companies (125) because some individuals hold directorships in multiple companies.

Table 1 further shows that most investors trade at least once during the sample period. The total number of buy and sell transactions is 100,603 for outsiders and 1,673 for insiders. For days with positive trading volume, the average total transaction volume per day is £67,353 for the group of outsiders and £6,406 for the group of insiders. Average holdings per shareholder are much larger for insiders (£13,112) than for outsiders (£2,633), which indicates that insiders tend to hold larger stock portfolios than outsiders.

Panel B of Table 1 provides information on monthly and quarterly post-trade returns. The average return over the one-month period following an insider's trade (1.40%) exceeds the return after an outsider's trade (−0.02%). The difference in trade performance between insiders and outsiders widens to 4.27% over the quarterly horizon. These descriptive statistics provide preliminary evidence that company directors have better timing ability than outsiders.

A key benefit of our data set is the ability to observe investors' trades in multiple firms. Fig. 3 shows that 2,645 investors trade shares in two companies and 218 investors trade in all three firms. We can thus compare a director's performance when investing in the company where he serves on the board to the return he earns on investments in other companies.

[9] We find no evidence of insider trading around dividend announcements because dividends were very predictable. For example, prior to 1720, 15 of the 17 dividend payments in our sample were exactly equal to 4%, and after 1720, all dividends were equal to 3%.

[10] See Carlos and Neal (2006) for the BoE, Scott (1903) for the RAC, and Sutherland (1952) for the EIC.

[11] We exclude from the sample a small number of transactions that involve share issuances of the Bank of England and the Royal African Company. In the issue of Bank shares, the Bank of England itself sold the new shares. The Royal African Company used an underwriter (Joseph Taylor) to sell the entire issue of 15,690 new shares (Carlos et al. (2002, p. 68)). Hence, the counterparty for the traders who bought these newly issued shares is either a company or an underwriter and not a typical insider or outsider.

3.4. Alternative insider definitions

Our default definition labeled *Board* classifies directors as insiders for a company during the years they serve on its board. However, some non-board members may also have access to material and non-public information. These traders can have direct access to company information because they are involved in the firm's operations (e.g., employees) or indirect access due to information leakage by directors (e.g., to their neighbors). We allow for this possibility by expanding our insider definition in various ways. Our first alternative, $Board + Pre\&Post\ Board$, also defines directors as insiders during the years prior to joining the board and after leaving the board. This generalization captures potentially valuable information flows from current directors to former and future directors. Second, we expand the set of insiders beyond directors and consider the following investor groups as potentially informed: employees, blockholders, politicians, brokers, nobles, and neighbors of directors.

We allow for the possibility that employees have access to private information with our *Employee* definition that classifies shareholders employed at a company's headquarters as insiders for that company. This increases the total number of insiders for the Bank, East India, and Royal African Company by 38, 9, and 4, respectively. We further consider blockholders as potential insiders. Our *Blockholder* definition classifies the five traders with the largest shareholding in a company in each month as insiders. This yields a total of 22, 26, and 8 additional insiders for the Bank, East India, and Royal African Company, respectively.

We also allow for the possibility that politicians trade on inside information because the companies in our sample have strong ties with the government. Jagolinzer et al. (2020) find strong evidence of a relation between political connections and informed trading by corporate insiders in modern financial markets. Our *Politician* insider definition includes all members of the British parliament during our sample period. We find that 289, 167, and 70 members of parliament hold shares in the Bank, East India Company, and Royal African Company, respectively. Private information may also be acquired by traders who are very active in the market, such as stock brokers. Our *Broker* definition accounts for this possibility by defining brokers as insiders. This leads to an expansion of the insider group by 68 Bank, 40 East India Company, and 21 Royal African Company investors.

The upper class may also have access to valuable information. Our *Noble* definition therefore classifies Dukes, Marquises, Earls, Viscounts, and Barons as insiders. This increases the total number of insiders for the Bank, East India Company, and Royal African Company by 117, 56, and 38, respectively. Information spillovers may also occur on the neighborhood level. For instance, Ahern (2017) shows that insiders often live close to each other and are connected through social relationships. Our *Neighbor* definition refers to the group of traders who live in the same neighborhood (ward) as a company's board member and trade at least once in the same direction (buy or sell) within five days after the director's trade. Adding these traders to the default set enlarges the group of insiders with 93 for the Bank, 113 for the East India Company, and 13 for the Royal African Company.

3.5. Prices and dividends

We obtain stock price data from the newspaper Castaing's Course of the Exchange and retrieve dividend payments from the minutes of the board meetings to compute stock returns. We fill in gaps in the stock price series by carrying the last observed price forward, but only for gaps that are less than one month long. Fig. 1 plots the evolution through time of share prices, normalized by dividing by the first observation for each company in our sample. The figure highlights the impact of the South Sea Bubble in 1720 when prices quickly doubled before suddenly collapsing a few months later when the bubble burst.

Table 1
Descriptive statistics on investor trades and performance.

	Outsiders				Insiders			
	BoE	EIC	RAC	All	BoE	EIC	RAC	All
	Panel A: Trading activity and investor holdings							
Total # of shareholders	10,408	4,941	2,052	14,081	53	51	21	119
Total # of traders	9,732	4,682	1,919	13,278	47	33	14	90
Total # of transactions	56,553	37,630	6,420	100,603	863	704	106	1,673
Mean # of daily transactions	33	23	131	44	2	2	4	2
SD # of daily transactions	34	25	107	58	2	2	3	2
Mean daily volume (# shares)	288	239	688	401	27	33	30	36
SD daily volume (# shares)	337	297	745	520	40	63	32	61
Mean daily volume (£)	42,352	47,647	74,369	67,353	3,952	7,066	3,351	6,406
SD daily volume (£)	55,239	74,441	96,155	104,257	5,753	18,212	4,238	15,263
Mean holdings/shareholder (£)	2,161	2,918	1,203	2,633	15,394	10,091	4,565	13,112
SD holdings/shareholder (£)	4,520	6,661	3,308	6,426	25,417	18,086	5,791	22,670
	Panel B: Post-trade returns							
Mean monthly return (%)	−0.03	−0.02	0.00	−0.02	1.69	1.25	−0.12	1.40
SD monthly return (%)	10.11	11.14	28.70	12.28	10.78	13.34	24.33	13.05
Mean quarterly return (%)	−0.07	−0.06	−0.20	−0.07	4.44	3.32	9.48	4.20
SD quarterly return (%)	16.49	20.56	58.87	21.29	18.40	25.53	57.15	24.70

This table reports summary statistics for our sample. We collect all share transactions and holdings of all investors for the Bank of England (BoE) for the period 1 August 1715 to 29 September 1725, for the East India Company (EIC) for the period 1 August 1715 to 25 March 1723, and for the Royal African Company (RAC) for the period 28 May 1720 to 27 October 1720. We split the sample into outsiders and insiders. An investor is classified as an insider for a company for the years he serves on its board of directors. We report statistics for each company and across all three companies. Total number of shareholders is the total number of unique shareholders. Total number of traders is the total number of unique traders. Total number of transactions is the total number of buy and sell transactions. Mean (SD) number of daily transactions is the time-series average (standard deviation) of the total number of buy and sell transactions per day. Mean (SD) daily volume is the time-series average (standard deviation) of the total buy and sell volume per day, expressed in number of shares or in pounds. Descriptive statistics for transactions and volume are computed based on trading days with positive volume. Mean (SD) holdings per shareholder is the average (standard deviation) of the market value of daily holdings across shareholders. Mean (SD) monthly (quarterly) return is the average (standard deviation) of one-month (one-quarter) post-trade returns. Post-trade returns are defined as the stock return over the one-month and one-quarter period after the trade. Returns on sell trades are multiplied by −1 to facilitate comparison with buy trades.

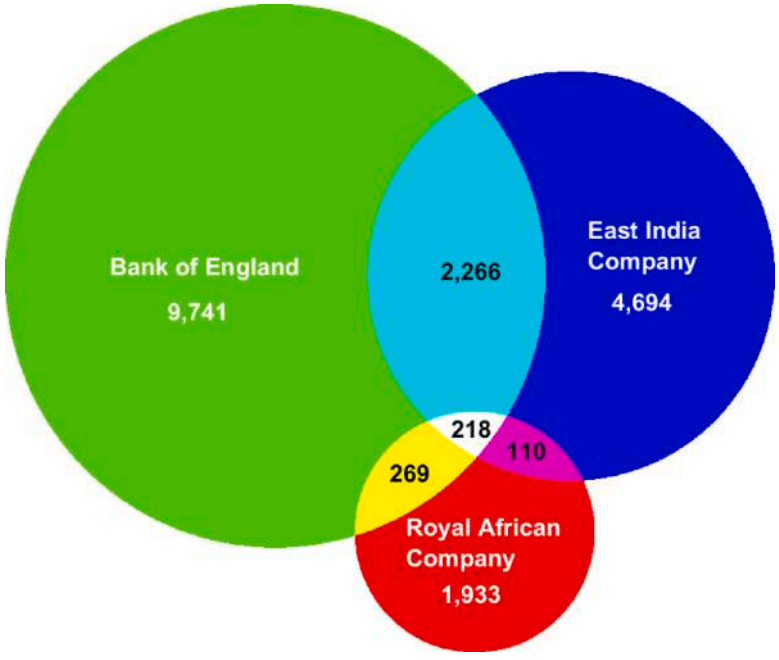

Fig. 3. Number of active traders per company.
This figure shows the number of active traders (i.e., trade at least once) in each of the companies in our sample, with overlapping areas indicating that traders are active in more than one company.

4. Results

4.1. Insider trading: An event study

In this section we give insight into the type of private information that board members had access to. Specifically, we analyze eight examples of non-public events that were discussed in board meetings of the Bank of England and the East India Company. We select company-specific events that were publicly discussed in newspapers after the board meeting, which suggests that they were sufficiently important and interesting for a broader audience.[12] Appendix B provides a description of each event. Our analysis aims to answer two questions: Did directors trade on material and non-public information obtained in board meetings? If so, what is the effect of the private information shared in board meetings on stock prices?

We address the first question by regressing insider and outsider trading activity in Bank and East India shares on a dummy that takes a value of one (minus one) on days on which the board of directors discusses positive (negative) news. Following Meulbroek (1992), we control for the public announcement of the news by including a dummy that is equal to one (minus one) on the day that the positive (negative) news is published in the newspaper. We measure trading activity as the net of daily buy and sell volume divided by the sum of buy and sell volume. We retrieve board discussion days from the company's board minutes and announcement days from the British Library's newspaper archive. We consider one-day and five-day event windows. For the five-day window, the board and news dummies are also nonzero on the four days following the meeting and announcement days.

Table 2 reports the regression results. We find that directors increase (decrease) holdings in their own company stock when good (bad) news is discussed in board meetings. Specifically, column 1 in panel A shows that net insider purchases as a fraction of total insider trades go up (down) by 82% on days with positive (negative) board news. Over the five-day event window (column 5), the average effect is 89% per day. These results are statistically significant at the 1% level and robust to controlling for news announcements (columns 2 and 6).[13] Board discussions have a smaller and opposite impact on the trading activity of outsiders. On days when positive (negative) news is shared in the board, we observe a 5 percentage points decrease (increase) in standardized net outsider purchases.

Next, we study the relation between information shared in board meetings and prices. In particular, we regress daily Bank and East India stock returns on the dummy variables for board meeting days and newspaper reporting days. We again consider one-day and five-day event windows. For the five-day window, the coefficients on the dummy variables capture the average effect of the news events on daily returns in the event window. We control for the return on the day prior to the meeting to rule out the possibility that the board first observes stock price changes and then discusses events that could have triggered those changes.

The results reported in panel B of Table 2 show that a company's stock return is more than 2% higher (lower) on days when positive (negative) news is discussed in a board meeting. Over a five-day window, the average effect is approximately 0.90% per day, which means that the cumulative effect over five days equals 4.50%. The one-day effect is significant at a 10% level and the five-day effect at a 1% level. Both effects are robust to controlling for lagged returns and newspaper announcement dummies. Collectively, the findings in Table 2 support the conjecture that insiders trade on material information acquired in board meetings.

4.2. Do insiders outperform outsiders?

If board membership improves a trader's access to valuable, non-public information, then we expect that insiders have higher trading returns than outsiders. We test this hypothesis by regressing trader- and company-specific post-trade returns on insider dummy variables. Post-trade returns are defined as the stock return over the one-month or one-quarter period after each trade. Returns on sell trades are multiplied by −1 to facilitate comparison with buy trades. The insider dummy variable equals one for an insider's trade and zero for an outsider's trade. We also create separate insider dummy variables for buy and sell trades. An important benefit of this transaction-level analysis is that it allows us to control for trader fixed effects. Doing so rules out the possibility that any return differences between insiders and outsiders are driven by time-invariant trader characteristics such as IQ and financial literacy rather than information asymmetry. We further control for the stock return over the one-month period prior to the trade to ensure that our results are not driven by some traders following short-term momentum or reversal strategies.[14]

Panel A in Table 3 presents results for the one-month horizon. Column 1 shows that post-trade returns of board members are 1.58% higher than those of outsiders. This return difference is significant at the 1% level. At a quarterly horizon (panel B), the outperformance of insiders is even larger (4.35%). We also find some evidence of information spillovers to former and future board members. Specifically, column 2 shows that in the years prior and post a trader's board membership, the return gap between insider and outsider trades ranges from 0.47% (t-statistic = 0.89) at the monthly horizon to 1.56% (t-statistic = 1.87) at the quarterly horizon. As expected, classifying a director as insider in both board and non-board years yields results that are in between those for the board and non-board years (column 3). The strong outperformance of board members is robust to the inclusion of trader fixed effects in column 4. In columns 5 and 6 we zoom in on buy and sell transactions. We find that the superior trading performance of insiders is driven by purchases, consistent with results documented by Lakonishok and Lee (2001) and Jeng et al. (2003).

Thus far, we have classified a company's directors as insiders. However, this definition may be too narrow because some other traders may also have access to private information. We therefore now examine the trading performance of the potential insiders defined in Section 3.4: blockholders, brokers, employees, neighbors, nobles, and politicians.

The results in panel A of Table 4 show that the monthly post-trade returns of brokers, employees, neighbors, nobles, and politicians are significantly higher than those of outsiders. The outperformance ranges from 0.5% for neighbors to 1.7% for employees. At the quarterly horizon (panel B), the outperformance ranges from 0.9% for nobles to 1.6% for employees but is only statistically significant for brokers and neighbors. In contrast, the outperformance of board members is more than 4% per quarter and significant at the 1% level. Overall, these findings suggest that some non-board members may also have access to material and non-public information. However, the trading returns of these potential insiders are generally smaller than those of board members, particularly over the quarterly horizon.

[12] This requirement limits the number of events that we can study for two reasons. First, many events are not material enough to be covered in newspapers. Second, many newspapers did not survive. Thus, even if the events were discussed in the public press, we would not be able to observe that three centuries later.

[13] For robustness, in addition to t-statistics computed based on standard errors clustered by date, we also report t-statistics computed based on Driscoll and Kraay (1998) standard errors that are robust to autocorrelation, cross-sectional dependence, and heteroskedasticity. This does not change our findings.

[14] Our conclusions do not change when also controlling for one-year momentum. We do not include the one-year momentum control in Table 3 as we would lose the RAC because of its short sample period.

Table 2
Board meetings and insider trading.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Net trading activity							
Event window	One day				Five days			
	Insiders		Outsiders		Insiders		Outsiders	
Board meeting	0.82	0.82	−0.05	−0.05	0.89	0.90	−0.06	−0.06
	(3.95)	(3.94)	(−1.67)	(−1.67)	(9.79)	(9.83)	(−1.53)	(−1.53)
	[3.95]	[3.93]	[−1.67]	[−1.67]	[10.26]	[10.33]	[−1.47]	[−1.48]
News announcement		−0.32		−0.03		0.34		−0.02
		(−0.61)		(−0.90)		(1.08)		(−1.35)
		[−0.60]		[−0.90]		[1.28]		[−1.94]
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.22	0.15	−0.02	−0.04	0.94	0.96	0.18	0.18
# Obs.	844	844	3,330	3,330	844	844	3,330	3,330
	Panel B: Stock returns							
Event window	One day				Five days			
Board meeting	2.17	2.17	2.16	2.16	0.93	0.92	0.87	0.87
	(1.65)	(1.65)	(1.64)	(1.64)	(2.57)	(2.55)	(2.44)	(2.41)
	[1.65]	[1.65]	[1.64]	[1.64]	[2.57]	[2.55]	[2.49]	[2.48]
News announcement		−0.46		−0.55		0.33		0.30
		(−0.66)		(−0.73)		(1.11)		(1.01)
		[−0.66]		[−0.73]		[1.44]		[1.35]
Stock return$_{t-1}$			0.08	0.08			0.08	0.08
			(1.72)	(1.74)			(1.65)	(1.64)
			[1.83]	[1.85]			[1.74]	[1.73]
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.44	0.44	1.08	1.09	0.40	0.43	0.99	1.02
# Obs.	5,576	5,576	5,574	5,574	5,576	5,576	5,574	5,574

This table reports results for an event study that examines the effect of information shared in board meetings on net insider and outsider trading activity (panel A) and on stock returns (panel B). The events are eight corporate events and decisions that were discussed during board meetings of the BoE and the EIC. Appendix B provides a description of each event. The event date is the day on which the board meeting takes place. We classify each trader as either insider or outsider for a firm in a given year based on board membership. We show estimation results for panel regressions of daily insider and outsider trading activity (panel A) and daily stock returns (panel B) on a constant and a dummy variable that takes a value of one (minus one) on days when the company's board of directors discusses positive (negative) news. In columns two, four, six, and eight, we also include a dummy that takes a value of one (minus one) on the day when the positive (negative) news is published in the newspaper. If a board meeting or news announcement occurs on a non-trading day, the dummy variables take a value of one on the next trading day. We consider one-day and five-day event windows. For the five-day window, the board and news dummies are also nonzero for the four days following the board meeting and newspaper announcement, respectively. We measure daily trading activity as the net of buy and sell volume in shares divided by the sum of buy and sell volume. In each regression we control for company fixed effects. In columns three, four, seven, and eight in panel B, we also control for the stock return on the previous day. The t-statistics in parentheses are based on standard errors clustered by date. The t-statistics in brackets are computed based on Driscoll and Kraay (1998) standard errors with 10 lags that are robust to autocorrelation, cross-sectional dependence, and heteroskedasticity.

4.3. Strategically hidden insider trades

The superior profitability of insider trades raises the question why outsiders were willing to trade with insiders, given that trading was not anonymous in the market that we study. Moreover, it was publicly known who was a board member of a firm and thus more likely to be better informed. Directors therefore had a strong incentive to hide their identity when trading on material and non-public information. A possible solution to insiders' anonymity problem is to collaborate with a friendly intermediary who reverses her transaction with the insider by trading with an outsider. For example, an insider can anonymize a sell transaction by selling stocks to an intermediary who then sells these stocks to an outsider. Similarly, an insider can hide a purchase by instructing an intermediary to buy stocks from an outsider and then sell these stocks to the insider. In both cases, the outsider effectively trades with the insider without observing his identity. In this section we exploit this idea to identify strategically hidden insider trades and examine the profitability of these trades.

We classify a transaction as hidden if the counterparty reverses her trade. A counterparty reverses a sale by buying at least the same number of shares in the five-day period preceding her sell transaction. A counterparty reverses a purchase by selling at least the same number of shares in the five-day period following her buy transaction. We expect the anonymized trades of insiders to be more profitable than their non-anonymized trades because an insider has a stronger incentive to hide his identity when trading on private information.

We study the profitability of hidden and non-hidden insider trades by regressing post-trade returns on dummy variables for insider trades and reversed trades and the interaction between these dummies. The reversed trade dummy takes a value of one if the counterparty reverses her trade. Table 5 presents the results for monthly and quarterly post-trade horizons. We find that the anonymized trades of directors earn 1.7% (0.7%) higher returns over the next month (quarter) than their non-anonymized trades (columns 1 and 4). The monthly return difference is statistically significant at the 1% level and robust to the inclusion of company fixed effects. When expanding the insider definition to include a director's non-board years, the superior profitability of anonymized trades is also significant at the quarterly horizon (columns 2 and 5). The effect becomes weaker in economic magnitude if we expand the insider definition with blockholders, brokers, employees, neighbors, nobles, and politicians but remains statistically significant at the 5% level (columns 3 and 6).

The findings in Table 5 lend support to the hypothesis that insiders conceal their identity when trading on non-public information. However, the results are also consistent with the idea that an insider's counterparty infers informed selling and reacts by trading in the same direction as the insider (sell), thereby reversing her transaction.[15] In this case, there is no collaboration between the insider

[15] This alternative interpretation does not apply to insider buys because the counterparty first buys the shares from an outsider before she sells them to the

Table 3
Do insider trading returns exceed outsider trading returns?

	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Monthly horizon			
Ins_{Board}	1.58	1.59				
	(2.68)	(2.69)				
$Ins_{Pre\&Post\ Board}$		0.47				
		(0.89)				
$Ins_{Board+Pre\&Post\ Board}$			1.12	1.72		
			(3.04)	(2.47)		
$InsBuy_{Board}$					2.44	
					(2.62)	
$InsSell_{Board}$						−0.01
						(−0.03)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Trader FE	No	No	No	Yes	No	No
Adj. R^2	0.02	0.02	0.02	4.89	22.51	22.44
# Obs.	98,526	98,526	98,526	94,793	49,263	49,263
			Panel B: Quarterly horizon			
Ins_{Board}	4.35	4.37				
	(3.46)	(3.47)				
$Ins_{Pre\&Post\ Board}$		1.56				
		(1.87)				
$Ins_{Board+Pre\&Post\ Board}$			3.19	2.86		
			(4.00)	(2.22)		
$InsBuy_{Board}$					5.72	
					(3.17)	
$InsSell_{Board}$						1.76
						(2.13)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Trader FE	No	No	No	Yes	No	No
Adj. R^2	0.07	0.07	0.06	5.07	25.66	25.54
# Obs.	95,522	95,522	95,522	91,961	47,761	47,761

This table reports estimation results for panel regressions of trader- and company-specific post-trade returns on insider dummy variables. Post-trade returns are defined as the stock return over the one-month (panel A) and one-quarter (panel B) period after the trade. Returns on sell trades are multiplied by −1 to facilitate comparison with buy trades. Ins is a dummy variable equal to one for an insider's trade and zero for an outsider's trade. $InsBuy$ and $InsSell$ are dummy variables equal to one for an insider's buy and sell trade, respectively, and zero for an outsider's buy and sell trade. The regressions in column 5 (column 6) are estimated using only buy (sell) trades in order to compare the returns of insider buys (sells) with the returns of outsider buys (sells). We consider various insider definitions. *Board* classifies a trader as insider for a company during the years he serves on its board. *Pre&Post Board* classifies a trader as insider for a company during the years pre and post his board membership. *Board + Pre&Post Board* classifies a trader as insider for a company during both his board and non-board years. In each regression we control for the stock return over the one-month period prior to the trade. Coefficients on the prior month's stock return are not reported for brevity. We further control for company fixed effects in all regressions and for trader fixed effects in column 4. The *t*-statistics in parentheses are based on standard errors clustered by date.

and his counterparty. A non-collaborative counterparty who suspects informed insider selling could profit by trading more shares in the offsetting transaction with an outsider than in the initial transaction with the insider. To rule out this possibility, we consider an alternative definition of reversed trades. Specifically, we impose the additional constraint that the counterparty who buys shares from an insider offsets this trade by selling exactly the *same* number of shares to an outsider. If counterparties are non-collaborative, our findings should become weaker after imposing this restriction. However, the results in Table A3 in the Online Appendix show that the gains of anonymized insider trades are even larger after imposing the constraint. This evidence suggests that informed insiders indeed choose to strategically hide their identity by collaborating with intermediaries.

4.4. Strategically timed insider trades

Having found evidence that corporate insiders choose to strategically hide their identity when trading on private information, we now examine if insiders also choose to strategically time their informed trades. This analysis is motivated by the theoretical model of Collin-Dufresne and Fos (2016) that predicts that investors with private information trade more aggressively when a stock's noise trading volume and liquidity are higher. We also study the profitability of such strategically timed insider trades. If these trades are truly more informed, they should be more profitable than insider trades that are made when uninformed volume is lower. Moreover, we expect the performance gap between timed and untimed insider trades to be larger over longer horizons, because the model of Collin-Dufresne and Fos (2016) assumes that private information is long lived so that investors can wait for better liquidity.

We study if insiders are more likely to time their informed trades than their uninformed trades by regressing the log of the number of shares traded in each insider transaction on the uninformed volume on that stock. We run separate regressions for informed and uninformed trades using the anonymity measure introduced in Section 4.3 as proxy for informativeness. A stock's uninformed volume is computed as the daily volume of all trades between outsiders in that stock and standardized to have a mean of zero and standard deviation of one.

The results in panel A of Table 6 show that informed insiders trade much more aggressively when uninformed volume is high (see column 2). This finding is statistically significant at the 1% level and economically sizeable as a one-standard-deviation increase in daily uninformed volume is associated with a 20% increase in the number of shares traded by an informed director. In contrast, we find no significant relation between the size of a director's uninformed trades and a stock's noise trading volume (column 1). The degree of strategic

insider. It is thus impossible that the counterparty reverses her transaction with the insider because she infers informed buying and responds by also buying.

Table 4
Which insider groups have superior trading returns?

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Monthly horizon				
Ins_{Board}	1.58	1.52	1.63	1.59	1.60	1.59	1.37	1.38
	(2.68)	(2.63)	(2.73)	(2.69)	(2.71)	(2.70)	(2.52)	(2.58)
$Ins_{Blockholder}$		0.32						0.36
		(1.01)						(1.12)
Ins_{Broker}			1.29					1.38
			(2.81)					(2.95)
$Ins_{Employee}$				1.70				1.81
				(2.11)				(2.22)
$Ins_{Neighbor}$					0.50			0.56
					(2.17)			(2.39)
Ins_{Noble}						1.04		1.02
						(1.80)		(1.74)
$Ins_{Politician}$							1.21	1.25
							(2.70)	(2.75)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.02	0.03	0.06	0.03	0.03	0.03	0.05	0.12
# Obs.	98,526	98,526	98,526	98,526	98,526	98,526	98,526	98,526
				Panel B: Quarterly horizon				
Ins_{Board}	4.35	4.37	4.40	4.36	4.40	4.36	4.14	4.25
	(3.46)	(3.52)	(3.48)	(3.46)	(3.48)	(3.47)	(3.28)	(3.42)
$Ins_{Blockholder}$		−0.07						−0.05
		(−0.08)						(−0.06)
Ins_{Broker}			1.38					1.46
			(1.69)					(1.77)
$Ins_{Employee}$				1.57				1.69
				(1.33)				(1.43)
$Ins_{Neighbor}$					1.12			1.20
					(2.47)			(2.65)
Ins_{Noble}						0.92		0.90
						(0.86)		(0.87)
$Ins_{Politician}$							1.20	1.26
							(1.60)	(1.69)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.07	0.06	0.08	0.07	0.08	0.07	0.07	0.10
# Obs.	95,522	95,522	95,522	95,522	95,522	95,522	95,522	95,522

This table reports estimation results for panel regressions of trader- and company-specific post-trade returns on insider dummy variables. Post-trade returns are defined as the stock return over the one-month (panel A) and one-quarter (panel B) period after the trade. Returns on sell trades are multiplied by −1 to facilitate comparison with buy trades. *Ins* is a dummy variable equal to one for an insider's trade and zero for an outsider's trade. We consider various insider definitions. *Board* classifies a trader as insider for a company during the years he serves on its board. *Blockholder* classifies the five traders with the largest shareholding in a company in a given month as insiders for that company. *Broker* classifies all stock brokers trading for their own account as insiders. *Employee* classifies all traders employed at a company's headquarters as insiders for that company. *Neighbor* classifies all traders who live in the same ward and trade in the same direction as a company's board member as insiders for that company. *Noble* classifies all traders who belong to the British nobility as insiders. *Politician* classifies all traders who are members of the British parliament as insiders. In each regression we control for company fixed effects and for the stock return over the one-month period prior to the trade. Coefficients on the prior month's stock return are not reported for brevity. The *t*-statistics in parentheses are based on standard errors clustered by date.

timing by informed insiders becomes smaller if we expand the insider definition beyond directors but remains statistically significant (column 6). Moreover, the relation between trade size and noise trading volume remains weaker for uninformed insider trades (column 5).

To rule out that the positive relation between the trade size of an informed insider and a stock's uninformed volume arises mechanically due to common trends in trading activity, we reestimate the regression using abnormal volume as explanatory variable. Abnormal volume is calculated as the difference between outsider volume on a day and the average daily outsider volume on that stock over the prior month. The significant positive coefficient in columns 4 and 8 of Table 6 confirms that our finding of strategic timing of informed insider transactions is robust to the use of abnormal outsider volume instead of total outsider volume.

We study the profitability of strategically timed trades by regressing post-trade returns on an insider trading dummy, uninformed volume, and the interaction between the insider trading dummy and uninformed volume. The results in panel B of Table 6 show that insider trades executed on days with high uninformed volume earn significantly higher returns than insider trades that take place on low-volume days. Specifically, a director's trade on a day when a stock's uninformed volume is one standard deviation above its mean is 1% (monthly horizon) to 5% (quarterly horizon) more profitable than a director's trade on a day with average uninformed volume (columns 1 and 5). When uninformed volume is defined as abnormal outsider volume instead of total outsider volume, the return gap is only significant at the quarterly horizon. The superior profitability at the longest horizon is consistent with the prediction that directors time their trades when their private information is long lived.

When expanding the insider definition beyond directors we find much weaker evidence that timed insider trades are more profitable, in line with the finding in Table 4 that the trades of other insiders are less profitable and thus likely less informed than those of directors. Finally, the direct coefficient on uninformed outsider volume is negative, which means that outsider trades on days with more noise trading earn lower returns than outsider trades on other days. These transactions are less profitable because outsiders are more likely to trade with an informed insider on days with high volume due to the strategic behavior of insiders.

Table 5
Returns on strategically hidden insider trades.

Horizon	Month			Quarter		
	(1)	(2)	(3)	(4)	(5)	(6)
$Ins_{Board} \times RT$	2.44			1.46		
	(2.62)			(0.87)		
$Ins_{Board+Pre\&Post\,Board} \times RT$		2.17			2.08	
		(3.62)			(1.98)	
$Ins_{All} \times RT$			0.85			1.30
			(3.08)			(2.25)
Ins_{Board}	1.02			4.01		
	(1.89)			(3.28)		
$Ins_{Board+Pre\&Post\,Board}$		0.60			2.69	
		(1.59)			(3.29)	
Ins_{All}			0.72			0.95
			(3.22)			(2.59)
RT	−0.74	−0.77	−0.83	−0.76	−0.81	−0.94
	(−3.74)	(−3.85)	(−3.89)	(−1.51)	(−1.60)	(−1.88)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.09	0.09	0.14	0.09	0.09	0.08
# Obs.	98,526	98,526	98,526	95,522	95,522	95,522

This table reports estimation results for panel regressions of trader- and company-specific post-trade returns on dummy variables for insider trades and reversed trades. Post-trade returns are defined as the stock return over the one-month (columns 1 to 3) and one-quarter (columns 4 to 6) period after the trade. Returns on sell trades are multiplied by −1 to facilitate comparison with buy trades. Ins is a dummy variable equal to one for an insider's trade and zero for an outsider's trade. We consider three insider definitions. *Board* classifies a trader as insider for a company during the years he serves on its board. *Board + Pre&Post Board* classifies a trader as insider for a company during both his board and non-board years. *All* classifies a trader as insider if she belongs to any of the following insider groups defined in the caption of Tables 3 and 4: *Board + Pre&Post Board*, *Blockholder*, *Broker*, *Employee*, *Neighbor*, *Noble*, or *Politician*. *RT* is a dummy variable that is equal to one if the counterparty reverses her trade. A counterparty reverses a sale by buying at least the same number of shares in the five-day period preceding her sell transaction. Similarly, a counterparty reverses a purchase by selling at least the same number of shares in the five-day period following her buy transaction. In each regression we control for company fixed effects and for the stock return over the one-month period prior to the trade. Coefficients on the prior month's stock return are not reported for brevity. The *t*-statistics in parentheses are based on standard errors clustered by date.

4.5. What is the expected loss for outsiders due to insider trading?

The evidence presented thus far suggests that insiders successfully capitalize on their information advantage by strategically hiding their identity and timing their trades. In this section we examine the consequences of the information asymmetry between insiders and outsiders by quantifying how much an outsider is expected to lose due to insider trading. We measure the expected loss per transaction by multiplying an outsider's unconditional probability of trading with an insider by the average loss when doing so. The unconditional probability is computed as the number of outsider transactions with an insider divided by the total number of outsider transactions in our sample. The average loss is defined as the difference in average post-trade return between an outsider's trades with an insider and her trades with another outsider. We consider one-month and one-quarter horizons and compute expected losses due to trading with each of the insider groups defined in Section 3.4.

Table 7 presents the results. Column 1 reports the probability that an outsider trades with an insider and columns 2 and 3 show an outsider's expected loss from trading with an insider over a one-month and one-quarter horizon, respectively. We show separate results for outsider sales in columns 4 to 6 and for outsider purchases in columns 7 to 9. We document that the expected loss from trading with a director is two basis points per transaction over a one-month post-trade period and seven basis points over a quarterly horizon. The expected loss is fairly small relative to the typical brokerage fee during our sample period (25 basis points) because the unconditional probability that an outsider trades with a director is less than 2%. Comparing the expected outsider losses associated with each of the insider groups, we find that losses are largest when trading with board members, politicians, and brokers. Splitting outsider trades into buys and sells reveals that selling to board members, politicians, and blockholders is more harmful to outsiders than buying from these groups. This indicates that the buy trades of these insiders are more likely to be informed than their sell trades, consistent with our finding for board members in Table 3. In contrast, buying shares from brokers appears more harmful to outsiders than selling to them, which suggests that brokers are more successful in anticipating future stock price declines.

In the bottom row of Table 7 we classify all current and future and former board members, blockholders, brokers, employees, neighbors, nobles, and politicians jointly as insiders. Unsurprisingly, this broad insider definition leads to larger expected losses for outsiders because the probability of trading with an insider increases to 17%. Expected losses range from 14 basis points for the monthly post-trade period to 25 basis points for the quarterly horizon. Note that under this definition, the group of potential insiders consists of more than 1,000 traders. Because the average size of an insider network in Ahern (2017) and Cziraki and Gider (2021) seldomly exceeds 30 traders, the broad insider definition seems very conservative. We therefore consider the results for this expanded insider group an upper bound on the expected losses for outsiders due to insider trading in our historical sample period.

4.6. Expected outsider losses due to informed insider trading

Because informed insider trades are generally more profitable than uninformed insider trades, a potential concern with the analysis in the previous section is that by including uninformed trades, we may underestimate outsiders' expected losses. We therefore proceed by studying how much an outsider expects to lose due to strategically hidden informed insider trades.

It is notoriously difficult to classify a transaction as informed or uninformed because we typically cannot observe a trader's full information set. Prior literature has addressed this issue by proxying for informativeness using post-trade returns (e.g., Jagolinzer et al., 2020). This approach classifies insider trades as informed if the ex-post trade performance exceeds a certain profitability threshold. Although this method seems reasonable at first sight, it may misclassify some

Table 6
Uninformed volume and insider trading.

Panel A: Uninformed volume and size of insider trades								
Insider definition	Board				All			
Insider trades	Non RT	RT	Non RT	RT	Non RT	RT	Non RT	RT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Vol_{Outsider}$	0.02	0.18			0.06	0.10		
	(0.88)	(4.37)			(4.61)	(5.82)		
Abnormal $vol_{Outsider}$			−0.01	0.15			0.03	0.07
			(−0.43)	(3.34)			(2.42)	(4.60)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	1.57	10.39	1.51	9.49	1.84	4.33	1.61	3.79
# Obs.	1,286	387	1,279	383	14,049	3,888	13,934	3,861
Panel B: Uninformed volume and profitability of insider trades								
Horizon	Month				Quarter			
Outsider volume	Total		Abnormal		Total		Abnormal	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Ins_{Board} \times Vol_{Outsider}$	1.13		0.37		5.50		4.26	
	(2.00)		(0.70)		(2.79)		(2.13)	
$Ins_{All} \times Vol_{Outsider}$		0.36		−0.09		1.13		0.33
		(2.01)		(−0.58)		(3.04)		(0.88)
Ins_{Board}	1.60		1.62		4.34		4.57	
	(2.71)		(2.71)		(3.69)		(3.65)	
Ins_{All}		0.93		0.91		1.27		1.28
		(4.00)		(3.95)		(3.63)		(3.58)
$Vol_{Outsider}$	−0.02	−0.05	−0.01	0.02	−0.09	−0.18	−0.07	−0.04
	(−1.96)	(−1.79)	(−0.57)	(0.92)	(−2.33)	(−2.60)	(−1.79)	(−0.66)
Company FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.03	0.09	0.02	0.08	0.17	0.09	0.13	0.05
# Obs.	98,526	98,526	98,008	98,008	95,522	95,522	95,004	95,004

This table reports results for transaction-level analyses of the relation between the uninformed volume on a stock and the size (panel A) and profitability (panel B) of insider trades. In panel A, the size of an insider's trade in a stock is regressed on the daily uninformed trading volume on that stock. An insider's trade size is measured as the natural logarithm of the number of shares traded. Insider trades are split into reversed (*RT*) and non-reversed (*non RT*) trades using the approach described in Section 4.3. In panel B, trader- and company-specific post-trade returns are regressed on an insider trading dummy variable, uninformed trading volume, and the interaction between the insider trading dummy and uninformed volume. Post-trade returns are defined as the stock return over the one-month (columns 1 to 4) and one-quarter (columns 5 to 8) period after the trade. Returns on sell trades are multiplied by −1 to facilitate comparison with buy trades. *Ins* is a dummy variable equal to one for an insider's trade and zero for an outsider's trade. In both panels, a stock's uninformed volume is computed as the daily volume of all trades between outsiders in that stock. We consider both total outsider volume and abnormal outsider volume. Abnormal volume is calculated as the difference between outsider volume on a day and the average daily outsider volume over the prior month. All outsider volume variables are standardized to have zero mean and unit variance. We consider two insider definitions. *Board* classifies a trader as insider for a company during the years he serves on its board. *All* classifies a trader as insider if she belongs to any of the following insider groups defined in the caption of Tables 3 and 4: *Board+Pre&Post Board*, *Blockholder*, *Broker*, *Employee*, *Neighbor*, *Noble*, or *Politician*. In each regression we control for company fixed effects. In panel B we also control for the stock return over the one-month period prior to the trade. Coefficients on the prior month's stock return are not reported for brevity. The *t*-statistics in parentheses are based on standard errors clustered by date.

uninformed insider trades that are profitable ex post due to luck as informed. Similarly, some trades that are motivated by inside information could be unprofitable and therefore incorrectly labeled as uninformed.

The granularity of our data set enables us to address this issue in a different way. In particular, we define a trade as strategically hidden and informed if the counterparty reverses her trade and if the ex-post trade return exceeds a prespecified threshold. By combining the ex-ante reversion requirement and the ex-post profitability criterion, we obtain a more accurate proxy for informed trades than prior literature that identifies informed trades based on trade performance alone. For example, an uninformed insider trade that turns out to be profitable by chance is misclassified as informed based on the profitability threshold. However, given that the transaction is uninformed, the insider has little incentive to conceal the trade. By using the combination of the two informativeness measures, we observe that the insider did not conceal his trade and therefore correctly label the transaction as uninformed.

Table 8 reports an outsider's expected loss from trading with an informed insider. We consider monthly and quarterly post-trade horizons and use the reversed trade criterion and various profitability thresholds to identify informed insider trades. In the top row of each panel we define strategically hidden insider trades with positive returns over the next month or quarter as informed. Along the rows, we gradually increase the profitability threshold by one standard deviation of post-trade returns. By raising the bar we select the most profitable anonymized insider transactions for which it is most plausible that they are based on private information. Using a threshold of zero, the expected loss for outsiders due to trading with informed directors is two basis points per transaction over the next month and four basis points over the next quarter. Expected losses become smaller if we increase the return threshold because the increase in profitability of informed trades at higher thresholds is more than offset by the decrease in likelihood of trading with an informed insider. When splitting trades into buys and sells, we observe that selling to an informed director is more harmful to outsiders than buying from an informed director.

In panels C and D of Table 8 we report results for the broad insider definition that adds blockholders, brokers, employees, neighbors, nobles, and politicians as insiders. As in Table 7, expanding the group of insiders leads to larger expected losses because it increases the likelihood of trading with an insider. When the return threshold is set to zero, outsiders expect to lose 13 (27) basis points per transaction over a monthly (quarterly) horizon due to trading with this expanded group of insiders. Because a threshold of 0% is a low hurdle for trades marked as informed to be truly based on private information, we interpret these estimates as an upper bound on outsiders' expected losses due to

Table 7
Expected outsider loss from trading with insiders.

	Trade with insider			Sell to insider			Buy from insider		
	π	$E(L^{month})$	$E(L^{quarter})$	π	$E(L^{month})$	$E(L^{quarter})$	π	$E(L^{month})$	$E(L^{quarter})$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Board	1.62%	2.32 bps	7.00 bps	1.72%	4.37 bps	9.89 bps	1.52%	0.13 bps	4.09 bps
Board+Pre&Post Board	2.70%	2.85 bps	8.65 bps	2.69%	6.92 bps	14.24 bps	2.70%	−1.19 bps	3.08 bps
Blockholder	4.59%	1.72 bps	1.06 bps	5.03%	3.03 bps	5.03 bps	4.14%	−0.36 bps	−3.04 bps
Broker	3.44%	3.51 bps	4.98 bps	3.15%	1.53 bps	−1.07 bps	3.74%	5.97 bps	11.23 bps
Employee	0.54%	0.90 bps	0.78 bps	0.53%	1.53 bps	0.06 bps	0.55%	0.31 bps	1.49 bps
Neighbor	3.61%	1.16 bps	4.32 bps	3.57%	0.86 bps	5.50 bps	3.65%	1.52 bps	3.16 bps
Noble	0.93%	0.76 bps	1.74 bps	0.80%	0.78 bps	−0.03 bps	1.06%	0.95 bps	3.55 bps
Politician	3.14%	3.85 bps	6.33 bps	2.99%	11.53 bps	17.33 bps	3.28%	−3.65 bps	−4.85 bps
All	17.16%	13.52 bps	25.44 bps	16.86%	22.96 bps	34.44 bps	17.47%	4.58 bps	16.37 bps

This table reports estimates of an outsider's expected loss per transaction from trading with an insider instead of with another outsider. We use the insider groups defined in the caption of Tables 3 and 4. The insider definition *All* classifies a trader as insider if she belongs to any of these insider groups, i.e., *Board + Pre&Post Board*, *Blockholder*, *Broker*, *Employee*, *Neighbor*, *Noble*, or *Politician*. We consider one-month and one-quarter post-trade horizons. Column 1 reports the probability that an outsider trades with an insider. This probability is computed as the number of outsider transactions with an insider divided by the total number of outsider transactions in our sample. Columns 2 and 3 report an outsider's expected loss from trading with an insider instead of with another outsider. The expected loss is computed by multiplying the probability of trading with an insider by the difference between the average post-trade return on stocks traded with insiders and the average post-trade return on stocks traded with other outsiders. Column 4 reports the probability that an outsider sells to an insider and columns 5 and 6 report an outsider's expected loss from selling to an insider instead of to another outsider. The expected loss is computed by multiplying the probability of selling to an insider by the difference between the average post-trade return on stocks sold to insiders and the average post-trade return on stocks sold to other outsiders. Column 7 reports the probability that an outsider buys from an insider and columns 8 and 9 report an outsider's expected loss from buying from an insider instead of from another outsider. The expected loss is computed by multiplying the probability of buying from an insider by the difference between the average post-trade return on stocks bought from other outsiders and the average post-trade return on stocks bought from insiders.

informed insider trading. As before, expected losses decrease sharply if the profitability bar is raised. For example, when we set the hurdle to two standard deviations above zero, expected losses decrease to 7 and 15 basis points for the one-month and one-quarter post-trade periods, respectively.

4.7. Which outsiders trade with insiders?

Up until this point, we have treated outsiders as a homogeneous group of noise traders. However, the losses that these uninformed investors incur due to insider trading raise the question which outsiders trade with insiders. We answer this question by exploiting the heterogeneity among outsiders. In particular, we hypothesize that outsiders with more trading experience are more aware of the presence of informed traders in the market. Because trading was not anonymous in the market that we study and a firm's board composition was public information, we expect that these more experienced outsiders are less likely to trade with directors. We test this hypothesis by estimating a logit model at the transaction level that links various characteristics of outsiders to their probability of trading with a director.

Specifically, we regress a dummy variable equal to one if an outsider trades directly with a director on outsider characteristics. We consider two time-varying measures of trading experience, namely an outsider's cumulative number of share transactions and the cumulative number of months she has been trading. We further conjecture that company employees and investors with a better understanding of financial markets such as goldsmiths, blockholders, and brokers are also more likely to recognize board members and therefore less inclined to trade with them.[16] We also augment the regression with dummy variables for males, nobles, and politicians, because these investors are more likely to be part of the inner circle of highly placed individuals in society and thus potentially also better able to identify board members. Finally, we control for trade size because outsiders who transact larger amounts may be more likely to trade with a director due to the larger holdings and trade sizes of directors.[17] We estimate the regression using all outsider trades except for their trades with insiders that they reverse. We exclude these trades from the sample because our analysis in Section 4.3 indicates that in those transactions outsiders tend to act as intermediaries that purposefully choose to trade with an informed insider who wants to hide his identity.

The results in columns 1 and 2 of Table 9 confirm that outsiders with more trading experience are significantly less likely to trade with a corporate insider. Goldsmiths, blockholders, and brokers also have a significantly lower probability of trading with directors.[18] These findings are consistent with the hypothesis that these more experienced and knowledgeable traders are better able to steer clear of directors. As expected, outsiders who trade larger quantities of shares are ceteris paribus more likely to trade with a director.

Next, we examine if experienced and knowledgeable outsiders are even more reluctant to trade with directors on days when directors are more likely to trade on private information, such as a company's board meeting days (see Section 4.1) and days with high uninformed volume (see Section 4.4).[19] We test this hypothesis by restricting the sample to outsider transactions that take place on a company's board meeting days and to outsider transactions on days when a stock's abnormal noise trading volume exceeds the 90th percentile.

The greater magnitude of the coefficient estimates in column 3 of Table 9 indicates that experienced outsiders, brokers, and blockholders are indeed less likely to trade with directors on a company's board meeting days than on other days. The results in column 4 suggest that outsiders with more trading experience are also less inclined to trade with board members on days with high abnormal noise trading volume. These findings are consistent with the notion that these outsiders anticipate more informed trading by directors on those days.

[16] Goldsmiths in 17th and 18th century London often acted as bankers and offered services such as storage of wealth and providing loans (see, e.g., Temin and Voth, 2004).

[17] Table 1 shows that directors have much larger holdings than outsiders. Table A2 in the Online Appendix shows that the average transaction amount of a director is almost twice as large as that of an outsider.

[18] Employees are also less inclined to trade with their own company's directors but the coefficient on the *Employee* dummy is statistically insignificant due to the small number of trades by employees in our sample.

[19] The board of the BoE convened every Thursday, the EIC board every Wednesday and Friday, and the RAC board every Tuesday and Thursday. These board meeting dates were public information.

Table 8
Expected outsider loss from strategically hidden insider trades.

R^{th}	Trade with insider		Sell to insider		Buy from insider	
	π	$E(L)$	π	$E(L)$	π	$E(L)$
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Insider definition Board - Monthly horizon						
0.0 SD	0.19%	1.95 bps	0.25%	2.75 bps	0.13%	1.06 bps
1.0 SD	0.05%	1.49 bps	0.08%	2.31 bps	0.02%	0.64 bps
2.0 SD	0.03%	1.13 bps	0.05%	1.82 bps	0.01%	0.41 bps
3.0 SD	0.02%	0.79 bps	0.03%	1.23 bps	0.01%	0.34 bps
Panel B: Insider definition Board - Quarterly horizon						
0.0 SD	0.20%	4.09 bps	0.25%	5.63 bps	0.15%	2.54 bps
1.0 SD	0.07%	3.33 bps	0.09%	4.60 bps	0.05%	2.06 bps
2.0 SD	0.04%	2.62 bps	0.07%	4.09 bps	0.02%	1.14 bps
3.0 SD	0.01%	0.97 bps	0.02%	1.24 bps	0.01%	0.70 bps
Panel C: Insider definition All - Monthly horizon						
0.0 SD	1.59%	12.68 bps	1.80%	15.09 bps	1.37%	9.99 bps
1.0 SD	0.28%	8.55 bps	0.40%	11.74 bps	0.16%	5.22 bps
2.0 SD	0.17%	6.56 bps	0.24%	8.95 bps	0.10%	4.08 bps
3.0 SD	0.09%	3.99 bps	0.12%	5.55 bps	0.05%	2.39 bps
Panel D: Insider definition All - Quarterly horizon						
0.0 SD	1.61%	26.52 bps	1.83%	28.42 bps	1.40%	24.62 bps
1.0 SD	0.42%	20.10 bps	0.41%	20.11 bps	0.43%	20.08 bps
2.0 SD	0.25%	14.80 bps	0.26%	15.45 bps	0.25%	14.15 bps
3.0 SD	0.08%	5.26 bps	0.07%	5.11 bps	0.08%	5.40 bps

This table reports estimates of an outsider's expected loss per transaction from trading with an informed insider who strategically hides his trade instead of with an uninformed insider, an informed insider who does not hide his trade, or with another outsider. In panels A and B we classify a trader as insider for a company during the years he serves on its board. In panels C and D we classify a trader as insider if she belongs to any of the following insider groups defined in the caption of Tables 3 and 4: *Board + Pre&Post Board*, *Blockholder*, *Broker*, *Employee*, *Neighbor*, *Noble*, or *Politician*. We consider one-month (panels A and C) and one-quarter (panels B and D) post-trade horizons and classify an insider's trade as informed if the one-month or one-quarter post-trade return exceeds a prespecified threshold value R^{th}. We compute the standard deviation of one-month and one-quarter post-trade returns and specify return thresholds ranging from 0 to 3 standard deviations above 0%. We classify an insider's transaction as hidden if the counterparty reverses her trade in the way described in Section 4.3. Column 1 reports the probability that an outsider trades with an informed insider who hides his trade. This probability is computed as the number of outsider buy and sell transactions with an informed insider who hides his trade divided by the total number of outsider buy and sell transactions in our sample. Column 2 reports an outsider's expected loss from trading with an informed insider who hides his trade. This expected loss is computed by multiplying an outsider's probability of trading with an informed insider who hides his trade by the average loss she incurs when doing so. The average loss is defined as the difference between the average post-trade return on stocks traded with informed insiders who hide their trade and the average post-trade return on stocks traded with uninformed insiders, informed insiders who do not hide their trades, or with other outsiders. Similarly, column 3 reports the probability that an outsider sells to an informed insider who hides his trade and column 4 reports an outsider's expected loss from this sale. Column 5 reports the probability that an outsider buys from an informed insider who hides his trade and column 6 reports an outsider's expected loss from this purchase.

An outsider's ability to avoid trading with an insider crucially depends on her observing the identity of board members. As explained in Section 4.3, directors can strategically hide their identity by trading with a collaborative intermediary who offsets this transaction by trading with an outsider. Although the outsider does observe the identity of her direct counterparty in each trade, she cannot easily infer that her counterparty acts as intermediary for an informed insider, because only a small fraction of all transactions made by intermediaries involve the unwinding of trades with insiders. Moreover, intermediaries tend to avoid trading with the same outsider repeatedly. We therefore expect that an outsider's trading experience does not make her less prone to be the ultimate counterparty of an informed insider who anonymizes his trade. We test this prediction by estimating a logit regression in which the dependent variable is a dummy equal to one if an outsider trades indirectly with a director, i.e., if an outsider trades with the intermediary who reverses her trade with a director.

The insignificant coefficient on the experience measure in column 5 of Table 9 supports the prediction that experienced investors cannot avoid trading with a director who anonymizes his trade. The loadings on the goldsmith, blockholder, broker, and employee dummies are also smaller than those in column 1. Because the anonymized trades of directors are harder to detect and more profitable than their other trades, they are most harmful to outsiders.

5. Conclusion

This paper provides empirical evidence on the strategic trading behavior of insiders and its consequences for outsiders using unique hand-collected data from the early eighteenth-century London stock market. Specifically, we obtain all share transactions and holdings of all insiders and outsiders for three companies that comprise more than 40% of the market. This historical setting and the granularity of our data set allow us to provide novel insights about insider trading that are difficult to obtain with data from modern financial markets.

First, because there were no legal restrictions on insider trading in this era and because we also observe corporate insiders' trades in shares of other companies, we can better pinpoint the value of access to private information. An analysis of corporate events that were discussed privately in board meetings shows that directors increase their positions on days when good news is discussed and decrease their positions when bad news is shared. This good (bad) company news is followed by large stock price increases (decreases). The information asymmetry between insiders and outsiders creates a large gap in their trading performance. Specifically, the post-trade returns of directors exceed those of other traders by 1.5% to 3% over a monthly and quarterly horizon, respectively. The outperformance of insiders is robust to the inclusion of fixed effects that control for unobserved trader characteristics such as IQ.

Table 9
Which outsiders trade with insiders?

Trade with insider Trading days	Direct All (1)	Direct All (2)	Direct Meeting (3)	Direct Noise (4)	Indirect All (5)
Experience (Number of trades)	−0.14		−0.21	−0.19	−0.03
	(−5.44)		(−4.06)	(−4.19)	(−1.12)
Experience (Number of months)		−0.09			
		(−2.97)			
Goldsmith	−0.57	−0.80	−0.58	−0.50	−0.25
	(−3.32)	(−4.81)	(−1.72)	(−1.52)	(−1.69)
Male	−0.13	−0.21	−0.29	−0.25	0.48
	(−0.94)	(−1.57)	(−1.17)	(−1.14)	(2.91)
Trade value	0.71	0.70	0.89	0.48	0.54
	(14.66)	(14.43)	(9.22)	(6.28)	(9.34)
Blockholder	−0.44	−0.76	−1.38	−0.47	−0.27
	(−1.81)	(−3.29)	(−2.43)	(−0.96)	(−1.32)
Broker	−0.47	−0.64	−0.84	−0.28	−0.13
	(−2.05)	(−2.80)	(−1.74)	(−0.73)	(−0.65)
Employee	−0.81	−0.78	NA	NA	−0.24
	(−1.16)	(−1.11)	NA	NA	(−0.42)
Neighbor	−0.02	−0.14	0.04	0.03	−0.19
	(−0.08)	(−0.69)	(0.11)	(0.07)	(−0.99)
Noble	0.32	0.37	0.13	−0.50	0.40
	(1.25)	(1.44)	(0.24)	(−0.86)	(1.44)
Politician	0.16	0.15	0.19	0.26	−0.24
	(0.74)	(0.73)	(0.44)	(0.62)	(−1.13)
Pseudo R^2	3.21	3.01	3.81	2.40	1.65
# Obs.	100,222	100,222	33,396	27,475	100,222

This table relates various characteristics of outsiders to their probability of trading with an insider. A trader is classified as insider for a company during the years he serves on its board. The table shows results for pooled logit regressions estimated at the transaction level. In columns 1 to 4, the dependent variable is a dummy variable equal to one if an outsider trades directly with an insider. In column 5, the dependent variable is a dummy variable equal to one if an outsider trades indirectly with an insider by trading with the counterparty who reverses her trade with an insider. The independent variables are investor and trade characteristics. We consider two time-varying measures of trading experience. *Number of trades* is an outsider's cumulative number of share transactions. *Number of months* is the cumulative number of months an outsider has been trading shares. *Goldsmith* is a dummy variable equal to one if the outsider's primary occupation is goldsmith. *Male* is a dummy variable equal to one if the outsider is male. *Trade value* is the nominal value of the outsider's transaction. *Blockholder*, *Broker*, *Employee*, *Neighbor*, *Noble*, and *Politician* are dummy variables defined in the caption of Table 4. *Number of trades*, *Number of months*, and *Trade value* are expressed as natural logarithms. The regressions are estimated using all outsider transactions except for their trades with directors that they reverse in the way described in Section 4.3. The regressions in columns 1, 2, and 5 include all trading days. The regression in column 3 only includes a company's board meeting days. The regression in column 4 only includes days on which a stock's abnormal noise trading volume exceeds the 90th percentile. Abnormal noise trading volume is calculated as the difference between outsider volume on a day and the average daily outsider volume over the prior month. Estimates are not available (NA) for the *Employee* dummy in columns 3 and 4 because there are no trades between employees and directors on board meeting days and on days with high abnormal noise trading volume. The reported coefficients are the average marginal effects. The *t*-statistics in parentheses are based on standard errors clustered by date.

Second, because trading was not anonymous in this market and board membership was public information, we can test the prediction of microstructure models that investors choose to strategically conceal their identity when trading on material and non-public information. Our evidence indicates that directors camouflage their informed trades with the help of an intermediary who reverses her transaction with the director by trading with an outsider. We find that the anonymized trades of directors earn 1.7% (0.7%) higher returns over the next month (quarter) than their non-hidden trades. Using this trade anonymity measure as a proxy for trade informativeness, we also find strong empirical support for the theoretical prediction that insiders strategically time their informed trades. Specifically, we show that insiders with private information trade more aggressively when uninformed volume is high. We further document that the timed trades of directors are more profitable than their trades on days with average volume, particularly over longer horizons. This finding is consistent with the prediction that insiders wait for better liquidity when their information is long lived.

Third, because we observe all transactions of all insiders and outsiders, we can quantify outsiders' expected losses from insider trading. We find that expected losses are two (seven) basis points per transaction over the one-month (one-quarter) period after the trade. We also separately estimate outsiders' losses due to informed insider trading. We classify a trade as informed if it is anonymized and if the post-trade return exceeds a prespecified threshold. Using a threshold of zero, the expected loss for outsiders due to informed trading by directors is two (four) basis points per transaction over the next month (quarter). Outsider losses increase to 13 (monthly) and 27 (quarterly) basis points per trade when we expand the group of insiders with other potentially informed traders such as blockholders. Expected losses are smaller when the threshold is raised because the increase in profitability of informed trades is more than offset by the decrease in likelihood of trading with an informed insider. In our last analysis, we show that more experienced and knowledgeable outsiders are less likely to trade directly with insiders, particularly on days when directors are more likely to exploit their information advantage. However, when directors strategically hide their identity, both experienced and inexperienced outsiders can be harmed by informed insider trading.

CRediT authorship contribution statement

Mathijs Cosemans: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Rik Frehen:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The author declares that he has nothing to disclose. He has no relevant or material financial interests that relate to the research described in this paper. No financial support has been received. No third party was required to review the manuscript.

Appendix A. South Sea Bubble

The South Sea Company was a private company that was chartered in 1711 and received the Asiento from the British government in 1713. The Asiento comprised the exclusive right to transport slaves to plantations in South America. However, instead of foreign trade, the company focused on sovereign lending. In particular, it facilitated the conversion of illiquid and irredeemable government annuities into liquid and easily transferable South Sea shares.

In the early 18th century, the government had a large amount of high-interest rate debt outstanding. A substantial part of the debt was in the form of annuities that were tied to the life expectancy of the annuity holder and therefore hardly tradeable. Due to this illiquidity and the poor financial condition of the state, the annuities were unattractive for debtholders and traded at sharp discounts. The government also disliked the annuities because they offered few opportunities to redeem debt or defer interest and principal payments.

The South Sea Company came to the rescue by offering annuity holders the option to convert their illiquid annuities into liquid South Sea shares. The Company paid the government a fixed fee and received in return the interest payments on the annuities and the right to issue a fixed number of new South Sea shares to investors. The government gained because it received the fixed fee, paid a lower interest rate to the Company, and got the opportunity to defer payments. The profitability of the deal for the South Sea Company relied on both legs of the deal: (i) between the Company and the government; and (ii) between the Company and the annuity holders. The profitability of the second leg was sharply increasing with the market price of South Sea shares because higher share prices enabled the Company to convert outstanding annuities more cheaply, i.e., using fewer shares. As a result, it had more shares left for secondary offerings because the total number of new shares that the Company was allowed to issue was fixed. Moreover, these new offerings could be sold at higher prices. The Company thus had strong incentives to boost its share price.

Over the course of 1720, the Company issued a second, third, and fourth batch of shares. There was such enthusiasm that the price of each new issue exceeded market prices and new offerings were heavily oversubscribed. However, in the late summer of 1720, the Sword Blade Company that acted as the South Sea Company's financier defaulted on its payments and South Sea share prices started to plummet. As a result of the immediate liquidity problems, the South Sea Company had to be bailed out by its main competitor, the Bank of England.

Appendix B. Examples of private information

In this section we discuss eight examples of material and non-public information that board members had access to. These examples involve events that were discussed in board meetings of the Bank of England and the East India Company and later published in newspapers. We summarize the board discussion of each event and its related newspaper excerpt. We examine insider trading activity and stock price changes around these events in Section 4.1.

B.1. Bank of England opens margin loan facility

The Bank opens a loan facility that allows proprietors to use their shares as collateral for cash loans. Scott (1912) argues that the loan providers were well aware that credit provision would lead to stock price increases: "The effect of these loans [on stock] was to bring about a rapid rise in quotations. The increase in resources available for making purchase added to the demand; while at the same time, it was necessary for the borrowers to deposit with the company stock which had a larger market value than the sums lent on it. Thus, while the demand was increased, the supply was artificially restricted."

Bank of England board minutes, 22 April 1720: "That it be offered to the General Court on Thursday next as the opinion of this court, that it may be for the service of the Bank, to lend money to the proprietors upon this Bank stock."

Stamford Mercury, 28 April 1720: "The same day the directors of the Bank of England made a public declaration, that they would lend money to their proprietors at 5%, to be employed in trade; upon which their actions are risen 4, or 5%. This they did, because the South Sea Company offered money to their proprietors to trade with at 5% and both companies will endeavour to promote trade in general, for the good of the public."

B.2. Loan for government refinancing

The Bank of England lends the British government a sum of £2,500,000 to buy back outstanding debt, thereby lowering the interest rate on their outstanding debt. This new loan not only secured a stream of income for the Bank but also strengthened ties with the government and is therefore expected to have a positive effect on the Bank's share price.

Bank of England board minutes, 14 May 1717: "That the Bank may advance a sum not exceeding £2,500,000 for the use of the government or such part thereof as may be wanted, for redeeming public funds at an interest of 5% and at such times and in such proportions as shall be found necessary before Lady Day 1718 and redeemable by parliament."

Stamford Mercury, 23 May 1717: "The Bank has agreed to lend the government £2,500,000 at 5% for circulating Exchequer Bills at a lower rate."

B.3. Bank calls collateralized loans to stop bank run

The Bank of England calls 25% of the outstanding loans collateralized by stocks to tackle an ongoing bank run. The immediate call on share loans is a clear signal that the Bank is in financial trouble and is thus expected to affect the Bank's share price in a negative manner.

Bank of England board minutes, 29 September 1720: "That a call be made of 25% of the loans upon Bank stock to be paid out before Wednesday the 12th of October and that public notice be given thereof."

Caledonian Mercury, 6 October 1720: "... upon the whole there are great complaints of scarcity of money. The run still continues upon the Bank, who have called in 25% on the proprietors, and have resolved, that Bank notes with interest at 5% be delivered out in exchange for Bank notes, or money, its given out that the Pr. subscribed 50,000 lib today to the Bank, which its hoped will at least for the present, contribute to answer all demands upon them."

B.4. Government redeems annuities held by the Bank

The British government passing a law on February 13th, 1724 to make funds available to repay 5% annuities issued by the state and held by the Bank. The repayment leads to a reduction in sovereign debt and a capital inflow for the Bank. The new law also reduces the Bank's exposure to government default risk. This news is expected to have a positive effect on Bank stock prices.

Bank of England board minutes, 20 February 1724: "Mr. governor having now received a letter from the right honorable the speaker of the house of commons, the same was opened and read and is as followth, viz.

Gentlemen,

In obedience to the commands of the house of commons I am to acquaint you that the said house did on the thirteenth day of February instant some to the following resolution, viz.

Resolved, that towards lessening the public debts and incumbrances, the principal sum of one million seven hundred and seventy five thousands and twenty seven pounds seventeen shillings and ten pour half penny now owing to the governor and company of the Bank of England in lieu of certain exchequer bills formerly by them delivered up and controlled and which by an Act of Parliament of the third year of his majesties reign...

... was to be attended with an annuity of eighty eight thousand seven hundred fifty one pounds seven shillings and ten pour half penny, being after the rate of five pounds per cent per annum and to be redeemable by parliament upon a year notice, be paid off and redeemed at the feast of the nativity of Saint John the Baptist which shall be in the year of our Lord 1725 according to the proviso or power of redemption contained in the same article for that purpose."

Stamford Mercury, 27 February 1724: "Mr. Speaker acquainted the House, that he had given notice to the Bank of the resolution of the House on the 13th instant.

In a committee went through the bill for redeeming and paying of the annuities at 5 per cent not subscribed into the South Sea Company, and ordered the report be made on Monday next, to which day the house adjourned."

B.5. Arrival of three ships with valuable cargoes

This event is based on the arrival of news through letters carried on board of ships returning from the East Indies. Letters carried by ships were the most important source of news (see also Koudijs, 2016). The announcement of the arrival of three ships, the Marlborough, Rochester, and Prince Frederick, with valuable cargoes is positive news for the East India Company.

East India Company board minutes, 13 June, 1718: "The court being met to open the packets received from the East Indies, the following letters were now read.

Short letter from the deputy governor and council of fort Marlborough dated the 24th of October 1717 received by the Rochester inclosing her invoice.

Letter from the chief and council of Callicut, dated the first of August 1717 received via the fort St George by the Marlborough."

Stamford Mercury, 19 June 1718: "Yesterday, the East India Company received advice from the Downs, of the arrival of three of their ships laden from India, viz. the Marlborough, Rochester, and Prince Frederick; since which, the two last are come up the river and the packers have brought the cargoes of all the three to town, and are valued at £500,000 to the company, the Rochester having been out 4 years, the customs of them to his majesty, is very considerable. They advise that five East India ships more may be expected in a short time with valuable cargoes."

B.6. Proposal to buy large number of South Sea Company stocks

In December 1720, the British government tries to persuade the East India Company to buy South Sea Company stocks and annuities. In particular, the East India Company considers a proposal to convert a total nominal amount of £9,000,000 South Sea stocks into East India stocks. The nominal amount to be purchased by the East India Company vastly exceeds the existing capital base of £3,200,000. The South Sea Company is in dire straits after the burst of the bubble, and the proposal aims to restore public faith in the financial sector. The East India Company board has fierce discussions about the proposal and has to adjourn a decision. It is believed that the large scale share conversion would lead to a reduction in East India Company dividends from 10% to 8%. The proposal is thus regarded as bad news from the perspective of East India Company stockholders.

East India Company board minutes, 22 December 1720: "A proposal had been given in from the ministry, which he now caused to be read in words following viz.

That nine million of the capital stock of the South Sea Company together with an annuity of 5% per annum issuing from the Exchequer and payable weekly be ingrafted into the stock of the East India Company and added to the present capital stock of the said company amounting to three millions two hundred thousand pounds or whereabouts that every proprietor of the said nine millions so to be engrafted be intituled to a share in the capital of the East India stock at the rate of 120% for every 120 pounds in the nine million so to be engrafted each proprietor to have one hundred pounds stock in the East India Company the remaining 20% part of the nine million making in the whole one million and a half to be reserved for the common benefit and advantage of the East India Company.

That it is generally believed they will by said proposal and some other advantages they are to have thereupon be enabled to divide 8% to all their adventurers whereas hitherto they have often divided less. That the East India Company as is well known do divide 10% per annum."

Caledonian Mercury, 3 January 1721: "Yesterday there was a general court of the East India Company about the proposal to restore public credit: but the objections were so strong and general against acceptance, chiefly on account, that should they comply to the same; it would lessen dividend from 10% to 8% that the court adjourned to Tuesday, in expectation of better terms to be offered to them."

B.7. French buying up large quantities of goods in India

News arrives that French ships with immense sums of money are buying up large amounts of goods in India. This leads to scarcity of goods and is perceived as bad news for the East India Company.

East India Company board minutes, 2 November 1716: "The following letters received by The Queen, were now read."

Stamford Mercury, 8 November 1716: "By the East India ship, the Queen of Peace, now come in, there is advice that 5 French ships of 40 guns are come into India from the South Seas, with immense sums of money on board, that they buy up great quantities of heavy goods, such as pepper, saltpetre, red earth, copper, tin, coffee and tea, but few silks or callicoes, because they are prohibited in France; and that they were endeavouring to buy two large ships at Batavia, but could not be admitted. 'Tis expected that they sail for Europe in a short time, and go for London or Venice, not for France or Spain, where they would be seized; if they arrive, they have sailed around the globe."

B.8. Sinking of ship leads to large losses

The board of the East India Company is notified via a letter that the van Sittart merchant ship sank close to the Isle of May with a large quantity of silver on board. The wrecking of the ship is bad news for East India Company shareholders.

East India Company board minutes, 11 June 1719: "The chairman acquainted the directors that calling them together thus suddenly was occasioned by a letter brought this morning from captain Hyde late commander of the van Sittart dated at the Isle of May the 15th of April 1719 giving an account of the said ship being cast away the 2nd of March last upon the Norwest point of the said island which letter was now read."

Pue's occurrences, 20 June, 1719: "London, June 11 and 13. The Van Cittern an East India merchant ship of 550 tuns worth £100,000 is cast away on the Isle of May, having split on a rock, but there were only 4 or 5 of the crew drowned; she was outward bound and had a great quantity of silver on board."

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