Inside the Network:
Trading of Inside and Outside Stocks by Corporate Insiders

April 2014

Henk Berkman*
Department of Accounting and Finance
University of Auckland Business School
Auckland, New Zealand
h.berkman@auckland.ac.nz

Paul Koch
School of Business
University of Kansas
Lawrence, KS
pkoch@ku.edu

P. Joakim Westerholm
Sydney University School of Business
University of Sydney
Sydney, Australia
peter.westerholm@sydney.edu.au

*Corresponding author. This version is preliminary. Please do not cite without permission. We thank Euroclear and the Finnish Office of the Data Protection Ombudsman for recognizing the value of this research project.

Inside the Network:
Trading of Inside and Outside Stocks by Corporate Insiders

ABSTRACT

Members of corporate boards earn significant abnormal returns, both when they buy their company's own stock as an insider, and when they buy stocks for which they are not classified as an insider. As outsiders, corporate directors earn larger abnormal returns when they buy stocks for which they have an interlocking board connection, and when they have higher status within the network of corporate boards. We also find similar trading inclinations and even greater performance for the family members of directors, indicating that the benefits of access to the corporate network spill over to the family networks of insiders.

Key words: Informed trading, insider trading, information asymmetry, market efficiency, interlocking board, corporate director network, family network, social network analysis

JEL classification: G14, G19

I. Introduction

We extend prior research on insider trading by showing that corporate directors outperform when they buy outside stocks, where they are not classified as an insider. The likelihood of trading a particular outside stock, and the performance of such trading, are especially high when the director has a connection to the company through interlocking directorships.[1] Even when there is no such interlock connection, director purchases of outside stocks generate significant abnormal returns, especially when the director has a central position in the corporate network.

We also find that the family members of directors outperform when they buy shares of the company for which their related director is an insider, or when they buy outside stocks with which their related director has an interlock connection. In fact, these family trades generate mean cumulative abnormal returns (CARs) more than twice the size of the analogous trades by directors themselves. Family trades in unconnected stocks also outperform, but not by as much as their trades in inside or interlock stocks. This evidence indicates that the benefits of access to information through the corporate network spill over to the family networks of board members.

Our data on stock trading by board members are obtained by merging two databases. The first source is publicly available data on transactions by insiders of firms listed on the Nasdaq OMX Helsinki Exchange. The second source is the Euroclear Finland Ltd. database, which contains daily changes in the shareholdings of all registered Finnish investors. We identify 466 insider accounts in Euroclear, by matching known insider trades from the public register with similar trades by accountholders in the Euroclear database who have the same year of birth. After identifying this group of director accounts, we use the Euroclear database to identify all trades in these accounts, including both insider trades and trades in outside stocks.

[1] Trades are classified as having an interlock connection when directors trade in the stock of a company where they are not registered as insider, but for which a current co-board member is an insider.

We also establish the interlock connections among directors and measure the status of each director within the corporate network, for every year in our sample period. For this task, we use the Virre database of the National Board of Patents and Registration of Finland, which provides membership lists of the Board of Directors for each listed firm in Finland. These data enable construction of the network of all Finnish board members every year.

Finally, we also identify investors who are likely to have a family relationship with the directors in our sample. For all individual accounts in the Euroclear database, we have an id number that represents the surname of the accountholder, without revealing this surname. With this information, we identify the accounts of likely family members by linking trades of each director to similar trades made through accounts with the same surname and postcode.[2]

After identifying the 466 director accounts, their status in the network, and the accounts of likely family members, we construct a final dataset that contains all their trades over the period 1997 to 2011. We then classify all trades by directors or their family members into five categories, according to the scheme illustrated in Figure 1. First, we separate trades according to the connection of the director to the stock traded, as insider trades in the director's own company or trades in outside stocks. We then classify trades in outside stocks into those with an interlock connection versus those with no such connection. Finally, we further classify all unconnected trades according to the status of the director within the network of corporate boards. The resulting five categories are: (i) insider trades, (ii) interlock trades, and unconnected trades when the director has (iii) high status, (iv) moderate status, and (v) no status as a board member.[3]

[2] After identification of directors and their family members, we discard the surnames from our database and retain only the associated identification numbers. In addition, we present only aggregate statistics so that it is impossible to attribute any specific behavior or performance to particular individuals.

[3] We identify the 466 director accounts in our sample using information on insider trading that is publicly available during the period, 2005 to 2010, whereas we examine all of their trades over the entire sample period, 1997 to 2011. This latter period encompasses years when some directors did not serve on boards.

We conduct four sets of analysis. First, we examine how the likelihood of a director trading a given stock depends on the director's connection to that stock, and his or her position in the network. We find that directors are more likely to trade stocks for which they serve as an insider, or have an interlocking board connection. We also document that directors concentrate their trading in fewer unconnected stocks if they have higher status in the director network, suggesting that better access to firm specific information motivates them to be more selective. Similar results prevail for family members. These results are consistent with the view that directors and their family members actively seek to benefit from the director's comparative information advantage.

Second, we analyze the trading performance of directors. We find that purchases are consistently followed by significant positive mean CARs over the following weeks and months. For example, we corroborate other work in this area by showing that insider purchases are followed by an average CAR of 2.5% after three months and 6.9% after one year.[4] In addition, we go beyond prior work to demonstrate that this superior stock-picking skill is not limited to stocks for which the director is an insider. For example, purchases of outside stocks where directors have interlocking directorships generate a mean CAR of 3.0% after three months and 4.8% after one year. We also find that, for outside stocks where there is no insider or interlock connection, directors perform better on the buy side if they have higher status within the corporate network. On the other hand, we show that director sales of all types of stocks tend to be followed by abnormal returns that are small in magnitude and insignificant.

Third, we investigate the performance of trades by the family members of directors. We find that family members also do well when they buy inside stocks and interlocking stocks, even

[4] See Jaffe (1974), Lakonishok and Lee (2001), Rozeff and Zaman (1988), Seyhun (1986) and Ravina and Sapienza (2010) for U.S.-based evidence. Fidrmuc, Goergen, and Renneboog (2006) examine U.K. insider transactions, and Clacher, Hillier, and Lhaopadchan (2009) discuss the results of insider trading studies in several other countries.

dominating the performance of the related directors themselves. For example, when family members buy either inside stocks or interlocking stocks, they generate average CARs that accumulate to more than 17% after one year. Once again, family sales of all types of stocks are not associated with significant negative abnormal returns.

Our fourth set of tests delves deeper into the sources of this outperformance. We begin by analyzing a subset of each category of director trades that are made just before major information events, to examine whether their profits are due to superior access to short term information. Surprisingly, we find no substantive evidence that this outperformance is concentrated around earnings announcements, takeover announcements, or large price changes. Given this result, we next examine whether each category of director trades contains superior information about the longer term prospects for the operating performance of the firms traded. We find that director purchases of interlock stocks and unconnected purchases by directors with higher status: (i) predict a higher abnormal, industry-adjusted ROA over the next two years, and ii) predict earnings better than analyst forecasts up to two years later. Together, this evidence suggests that the outperformance of directors derives from superior information about the longer term prospects of the stocks they trade, obtained through access to the corporate network.

Our research contributes to two strands in the literature. First, this study adds to the extensive literature on insider trading. Most work in this area examines the cross-sectional return forecasting ability of insider trades.[5] Similar to these studies, we find that board members outperform on the buy-side when they trade in their own company's stock, but not on the sell-side. Our analysis also provides three novel contributions to this literature, indicating that: i) directors are also good at picking outside stocks in general, ii) directors perform especially well

[5] For example, see Jaffe (1974), Lakonishok and Lee (2001), Rozeff and Zaman (1988), Seyhun (1986) and Ravina and Sapienza (2010).

when they buy outside stocks with interlocking directorships, and iii) trades in unconnected stocks perform better when the director has higher status within the network of board members.

Second, we contribute to the growing literature on how information is diffused through social networks. Ozsoylev et al. (2014) identify 'empirical investor networks' composed of investors with similar trading behavior. They find that investors who are more centrally placed in these networks earn higher profits and trade prior to peripheral investors around information events. Most other studies in this area take a less general approach and focus on specific predefined networks. For example, Shiller and Pound (1989) show that the trading decisions by managers of financial institutions are influenced by communication within their peer network. Others focus on local networks and attribute the similarity of trades by investors located in the same geographic area to word-of-mouth communication within their local network.[6] Cohen, Frazzini, and Malloy (2008) present evidence suggesting that mutual fund managers earn abnormal returns based on information obtained through their educational networks.

The focus in our study is on value-relevant information obtained through the network of corporate directors, and its impact on the trading activity and performance of these directors and their family members. Our results support the view that interlocking directorships and a higher status in the corporate network enable directors to obtain valuable firm-specific information about outside stocks, which they use to earn abnormal returns. We also show that family connections should be added to the list of social networks that function as a conduit of information flow, and we extend the results in Berkman, Koch, and Westerholm (2014) to include the adult family members of insiders, in addition to underage children.[7]

[6] See Hong, Kubik, and Stein (2005), Ivkovic and Weisbenner (2005, 2007), and Brown et al. (2008).
[7] Several studies analyze the impact of the corporate director network on firm value and corporate decisions. For example, Cai and Sevilir (2012) find that acquirers obtain higher announcement returns in transactions when the acquirer and target share a common director. Larcker, So, and Wang (2013) show that firms that are more central in

This study proceeds as follows. Section II describes the institutional features of Finnish markets, discusses the data, and summarizes the attributes of the five categories of trades. Section III analyzes the likelihood of directors or their family members making different types of trades. Section IV examines the performance of director trades, while section V investigates the performance of family trades. Section VI analyzes director trading before major information events, while section VII investigates whether director trades predict longer term firm operating performance and analyst forecast errors. The final section concludes.

II. Institutional Background, Data, and Sample Characteristics

A. Institutional Background

Insider trading laws in Finland were passed in 1989 and first enforced in 1993 (see Bhattacharya and Daouk (2002)). Like most other countries in the EU, these regulations are modelled after U.S. insider trading laws. The Financial Supervisory Authority (FSA) regulates financial markets in Finland, and seeks to enforce the law by monitoring insider trading. In addition to the formal laws, insiders are restricted in their trading by guidelines for insiders issued by the Nasdaq OMX Helsinki Exchange and the Finnish Association of Securities Dealers (FASD). Moreover, most publicly listed companies in Finland have adopted their own internal insider trading guidelines, which are often more strict than those of Nasdaq OMX Helsinki and the FASD. We provide more details about Finnish insider regulations in Appendix A.

B. Data Sources and Classification of Trades

B.1. Data Sources

This study is concerned with the trading activity of corporate directors and the share price performance following their trades, conditioned on the level of their connection to the stocks

---

the corporate director network earn higher returns. Fracassi (2012) finds that the corporate investments of companies are more similar when their managers have stronger social connections.

they trade. We use three main data sources to conduct this analysis. Our first source is the set of all publicly available transactions made by insiders in Finnish listed firms during the period, July 2005 through December 2010.[8]

Our second source is the Euroclear database, which documents daily changes in the shareholdings for each registered investor in Finland. To trade on the Nasdaq OMX Helsinki, investors must register with Euroclear. Each investor is given a unique Euroclear account, even if he or she trades through multiple brokers. There have been a total of 183 Finnish stocks listed on the Nasdaq OMX Helsinki Exchange during our sample period covering 1997 to 2011.[9]

Our final main source is the Virre database of the National Board of Patents and Registration of Finland. This database contains (among other things) the composition of the Board of Directors for each listed firm in Finland. The entries record the date when people commence or end their roles on the board, enabling us to create a reliable annual dataset with the names and birth years of the board members for each listed company.[10]

We identify our sample of *all* trades made by directors, by matching known insider trades from the public register with identical trades by accountholders in the Euroclear database with the same year of birth. This merge allows us to identify 466 corporate insiders in Finland within the Euroclear database, and is described in more detail in Appendix B.

B.2. Classification of Trades

Each year we split the sample of all trades by directors into the five groups listed above, based on the classification scheme in Figure 1. First, we consider the connection between the

[8] In Finland, information is made available in a public register about insider trading over the previous five years.
[9] Grinblatt and Keloharju (2000) provide a detailed description of the Euroclear database.
[10] Our sample of directors includes the managing director and all members of the board for each firm. In our matching procedure, we require the birth year of every director in the Virre database to match the birth year of the corresponding accountholder in the Euroclear database. To ensure that the birth year of these insiders is available in the Virre database, the sample period begins in 1997 instead of 1995 (when the Euroclear database begins).

director who makes the trade and the stock traded. Trades by directors in the stock of a company where they are registered as an insider are classified as having an *Insider* connection. Trades by directors in the stock of a company where they are not registered as an insider, but for which a current co-board member is an insider, are classified as having an *Interlock* connection. Trades by directors in stocks for which they are not classified as an insider and have no interlock connection are classified as unconnected. When we determine these annual classifications, we assume that directors are insiders if they are on the board at any time during the year. This procedure will tend to over-classify directors as having an insider or interlock connection, since it uses annual data even though a director might have changed status during the year.[11]

Our classification scheme also considers the status of the director within the network of corporate board members each year. For every director in the network, we calculate four measures of centrality that are standard in network theory.[12] These measures capture different dimensions in which a node (director) can be important within a network. The first measure is *Degree Centrality*, defined as the number of first-degree links to other nodes. For each director, degree centrality is the number of other unique directors with whom a director shares a board position. *Betweenness Centrality* is the number of shortest paths in the network that pass through a given node, divided by the sum of all shortest paths in the network. If a director is on more of the shortest paths connecting directors, then that director may have a greater informational advantage. *Closeness Centrality* is defined as the inverse of the sum of the distances from a given node to all other nodes. Finally, *Eigenvector Centrality* measures a node's importance in terms of the significance of the nodes to which it is connected. A node with a higher eigenvector centrality is connected to other nodes with higher eigenvector centrality.

[11] It is likely that some beneficial network connection exists before a director enters a board, and fades out slowly after a director leaves a board. Our procedure results in a maximum lead-in and fade-out period of twelve months.
[12] See Larcker, So and Wang (2013), and http://en.wikipedia.org/wiki/Centrality#Betweenness_centrality.

Each year we obtain a proxy for the overall status of every director within the corporate network, using a two-step procedure. First, each of the four centrality measures is standardized by dividing the score for every director by its cross sectional standard deviation across all directors during the year. Second, we aggregate the four standardized measures to obtain our proxy for the director's overall status that year. We then classify the top tercile of directors every year by this aggregate score as the group with "High Status." The bottom two terciles of directors are labelled as having "Moderate Status." Finally, in addition to the trades while these directors served on corporate boards, our sample also contains trades by these same individuals that occurred before they became a director or after they left the corporate network. These trades are labelled as being associated with directors who have "No Status" in the network.

We also identify investors who are likely to have a family relationship to the directors in our sample. For each individual Finnish account in the Euroclear database, we have an identification number that represents the surname of the accountholder, without revealing the surname. This information enables us to link trades by each director account to likely family accounts with: (i) the same surname, (ii) the same postcode, and (iii) at least two trades in the same security on the same day with the same sign (buy/sell).

Finally, we obtain earnings announcement dates from Bloomberg. Merger and acquisition announcement dates are taken from SDC Platinum. Daily share prices and the number of shares outstanding are obtained from Compustat Global. The market-to-book ratios for all Finnish firms are from Worldscope. We only include stock-years if a stock has more than 200 days on which it is traded within a given year.

C. Descriptive Statistics for Different Types of Trades

C.1. Frequency and Attributes of Trades

Table 1 provides information about the relative frequency and attributes of the different categories of trades by directors or their family members. The first five rows in Table 1 provide the descriptive statistics for these categories of trades by corporate directors. The second five rows present the analogous results for trades by family members. The latter sample includes 139 accounts of family members that can be matched to 84 of the 466 directors in our sample. Note that we use the same classification labels for the different groups of trades by both directors and family members, even though this classification scheme is based on the position of the director to which the family member is matched. The last row of Table 1 summarizes the behavior of all remaining trading activity conducted by all other individual Finnish investors who are not identified as directors or their family members.

The first column of Table 1 reports the total number of trading days across all stocks and accountholders for every group of trades, while the second column gives the percentage of total trading days in the sample due to every group. Insider trades by directors account for 0.021% of the total number of stock trading days across all individual accounts, while interlock trades comprise another 0.016%. Unconnected trades made by directors with high status make up 0.057% of all stock trading days, those by directors with moderate status comprise another 0.13%, and those by directors with no status make up 0.108% of all stock trading days. The family members identified in our sample make relatively fewer trades in all categories.

Note that there are only 466 directors and 139 related family accounts in our sample, whereas there are roughly 0.5 million retail accounts in Finland that trade at least once during the sample period. The directors in our sample are approximately three times more active in the stock market than the average retail investor, with about 122 stock-trading days per director

account versus 34 trades per retail account. There are around 82 stock-trading days per family member account, making them roughly twice as active as retail investors.[13]

The third column of Table 1 shows the percent of stock-trading days in which the accountholder was a net buyer, while the fourth and fifth columns present the average number of shares bought and sold, respectively. When directors trade as an insider, they tend to buy more frequently than they sell, but the average size of their sales is more than 5 times larger than the average size of their purchases.[14] Similarly, family members tend to be buyers of inside stocks, but in smaller quantities. For the other categories of trades by directors or family members, the percent of trading days for which the accountholder is a net buyer ranges from 51.9% to 59.7%, while it is 58.1% for all other retail investors. The average size of outside trades by directors is three to five times larger than trades by retail investors, while the average size of outside trades by family members is two to four times larger. For both directors and family members, the mean trade size is substantially larger for insider trades than for interlock or unconnected trades.

The sixth column of Table 1 gives the percentage of trades within every category made by female accountholders. The proportion of stock-trading days by all directors that are attributable to female *directors* ranges from 5.7% to 7.4% across the different trade categories. These numbers are low relative to the 17.3% of all retail stock trading days that originate from females, largely due to the paucity of female directors.[15] The proportion of trades made by female *family members* is much larger, ranging from 35.5% to 62.4% across the trade categories. This evidence indicates that the female family members of directors (e.g., spouses and daughters) are much more likely to trade than the typical female retail accountholder.

[13] These figures are obtained from the 17,177,438 stock trading days across the 0.5 million retail accounts, the total of 57,243 stock trading days across the 466 director accounts, and the total of 11,361 stock trading days across the 139 family accounts.
[14] The median size of sales for insiders is approximately 3 times larger than the median size of their purchases.
[15] Just 8.8% of the directors in our sample are females.

The seventh column of Table 1 presents the mean age of the accountholders for each category of trades. The mean age for directors that are actively trading is slightly above 50 years, while the average age of all other retail investors is slightly below 50.[16] The mean age of family members is relatively low, presumably reflecting the trading activity of directors through the accounts of their children.[17]

The last column of Table 1 presents the median value (in euros) of the stock portfolios for accountholders in every trade category, as of January 5, 2005. The median portfolio value of board members with moderate or high status is more than 50%larger than the median portfolio value of directors when they are not in the network, and somewhat higher than the median portfolio value of directors trading inside and interlock stocks. The median wealth of directors is more than ten times larger than that of retail investors. Likewise, the median account size of the directors' family members is four to ten times larger than that of other retail investors. Furthermore, family members who concentrate their trading in inside stocks and interlock stocks tend to have more wealth.

C.2. Characteristics of the Stocks Sold and Bought for Each Type of Trade

In order to determine whether directors tend to follow certain investment styles or focus on stocks with certain characteristics, we analyze the attributes of the average stocks bought or sold in the different trade categories. We find that directors have a mild tendency to trade outside stocks with relatively high betas, high market-to-book ratios, and large size. They also tend to be contrarian, selling after stocks have increased in value and buying after they have decreased. For each firm characteristic, however, the difference in the mean attributes between every category

[16] In comparison, the mean age for individual U.S. accountholders is 51 years for women and 50 years for men (see Barber and Odean (2001), Table 1), and the mean age for individual accountholders in Norway is 48 years (see Døskeland and Hvide (2011), Table 1).
[17] See Berkman, Koch, and Westerholm (2014) for more evidence about trading through the accounts of children.

of director trades and all other retail trades is small in magnitude. For example, the maximum difference between the median firm attribute for any category of director trades versus that for all retail trades is less than the difference in the median characteristic across adjacent deciles of firms in general. For a detailed description of these characteristics and the results of our analysis, we refer the reader to Appendix C.

III. The Likelihood of Directors or Family Members Making Different Types of Trades

If network connections provide directors with a comparative information advantage about either inside or outside stocks, then we hypothesize that directors are more likely to trade stocks for which they have a stronger connection. Furthermore, if the information obtained through these network connections is valuable, then we expect these trades to generate abnormal returns.

An alternative view is that directors with interlock connections and directors with moderate or high status may place too much value on information obtained through the corporate network, and may be overconfident in their own competence in interpreting such information. This alternative view is supported by the evidence in Døskeland and Hvide (2011), who analyze the investment performance of individual investors (not insiders) when they trade in professionally close stocks, defined as firms within the two-digit industry of their own employment. They find that individual investors overweight their holdings in such stocks, and experience mean abnormal returns that are either zero or negative. Their evidence points to overconfidence as an explanation for the tendency of individuals to trade such stocks, as well as the resulting underperformance.

In this section we investigate these issues by examining how the likelihood of a director or family member trading any given stock depends on the director's connection to that stock and

the position of the director in the network. In the next section we examine the abnormal returns generated from this trading activity.

A. Likelihood of Trading by Directors in Different Types of Stocks

We wish to examine how the level of a director's connection to a company affects the probability of trading the shares of that company during any given year. As a first approximation, we find that the unconditional probability of a director trading as an insider during any year is 38%. This probability is calculated as the number of times that directors trade as an insider at least once during the year they are classified as an insider (1,404 times) divided by the total number of stock-year pairs for which a director is classified as an insider and active in the stock market (3,677 stock-years in our sample). The unconditional probability of a director trading an interlock stock is similarly computed as 8.1% (1,255 / 15,306), and the unconditional probability of trading an unconnected stock is 5.0%(20,428 / 405,269).[18]

We further examine how the attributes of a trade or an individual might affect the probability of trading, by estimating the following panel logit model:

$$\begin{aligned}\text{Log}\{(\text{Trade}_{i,e,y} = 1)/(\text{Trade}_{i,e,y} = 0)\} &= a_0 + a_1\,\text{Insider}_{i,e,y} + a_2\,\text{Interlock}_{i,e,y} \\ &+ a_3\,\text{Unconnected_High}_{e,y} + a_4\,\text{Unconnected_Moderate}_{e,y} \\ &+ a_5\,\text{Same_PostCode}_{i,e,y} + a_6\,\text{Industry}_{i,e,y} + a_7\,\text{Wealth}_{e,y} + \text{Age Dummies} \\ &+ \text{Director Fixed Effects} + \text{Firm Fixed Effects} + \text{Year Fixed Effects}, \qquad (1)\end{aligned}$$

where $\text{Trade}_{i,e,y,}$ = 1 if stock *i* is traded by director *e* during year *y*, and 0 otherwise;

Insider = 1 for insider stocks, and 0 otherwise;

Interlock = 1 for interlock stocks, and 0 otherwise;

Unconnected_High = 1 for directors with high status, and 0 otherwise;

Unconnected_Moderate = 1 for directors with moderate status, and 0 otherwise;

[18] This last number, 405,269, is approximately equal to the number of directors (466) times the annual average number of stocks in our database (106) times the number of years the average director is active in the stock market during our 14-year sample period (8).

Same_PostCode = 1 if the accountholder lives in same postcode as firm headquarters, and 0 otherwise;

Industry = 1 if the stock is in the same industry as the director's firm(s), and 0 otherwise;

and Wealth = percentile rank of director's account value as of June 30th in year y.

Note that the fifth category of unconnected trades made by directors with no status is the omitted group in Equation (1). In addition, we include the following age dummies: Age30 = 1 if the director is younger than 31 years; Age3140 = 1 if the director is between 31 and 40; Age4150 = 1 if the director is between 41 and 50; Age5160 = 1 if the director is between 51 and 60; and Age61 = 1 if the director is older than 60 (the omitted age dummy). Inclusion of director, firm, and year fixed effects accounts for differences in the average probability of trading across different directors, stocks, and years, respectively.

We hypothesize that the probability of a director (*e*) trading a stock (*i*) during any year (*y*) should be greater if the director has an insider or interlock connection to that stock (i.e., the coefficients, a_1 and a_2, in Equation (1) should be positive). Based on previous research, we also expect positive coefficients for a_5, a_6 and a_7, to reflect a greater probability of a director trading a stock during any year if: (i) the postcode of the company's headquarters is the same as that of the director, (ii) the stock is in the same industry as the director's expertise (proxied by the 2-digit GIC code(s) of the firm(s) where the director is on the board(s)), or (iii) the accountholder has greater wealth.[19]

The relation between the director's status in the network and the probability of trading an unconnected stock is more complicated. We expect that moderate or high status within the corporate network may provide superior access to information about *specific* unconnected stocks.

[19] For more discussion of similar issues, see Berkman, Koch, and Westerholm (2014), Døskeland and Hvide (2011), Grinblatt and Keloharju (2000), Grinblatt, Keloharju, and Linnainma (2011), and Ivkovic and Weisbenner (2005).

As a result, directors with higher status may engage in relatively high trading activity which is focused on a few such unconnected stocks. If directors focus on just a few such unconnected stocks, then they would be less likely to diversify and trade any other unconnected stocks, which would lead to negative coefficients, a_3 and a_4.

Panel A of Table 2 provides the results of this analysis for all director trades. We find that a_1 and a_2 are significantly positive, supporting the view that directors are more likely to trade stocks for which they have an insider or interlock connection. In addition, a_3 and a_4 are significantly negative, indicating that directors with high or moderate status are *less* likely to trade the typical unconnected stock. These results suggest that, as board members become better connected, they tend to focus their trading on a small number of unconnected stocks where they have a comparative information advantage, and, as a result they are less likely to trade the typical unconnected stock.[20] Also, consistent with prior work, we find that directors are more likely to trade local stocks and stocks where they have industry experience. We also find that directors tend to be more active when they have more wealth, and when they are younger.

B. Likelihood of Trading by Family Members

Panel B of Table 2 repeats the logit analysis for family trades. In this analysis, we extend Equation (1) to include the wealth of the family member, measured by the percentile rank of the family member's account value as of June 30th in each year (relative to the other 139 family accountholders). In addition, we add age dummies for the family member. We also replace the director fixed effects by family member fixed effects. Finally, we rename the postcode dummy

[20] This interpretation is reinforced in unreported analysis where we model the decision to *participate* in the market, depending on the director's status in the network. Using a model similar to (1), where the dependent variable equals 1 if the director trades at any time during the year and 0 otherwise, we find strong evidence that directors with higher status are more likely to participate in the stock market.

that equals 1 if the director (and therefore also the family member) lives in same postcode area as the firm's headquarters.

In Panel B the coefficients, a_1 and a_2, are again significantly positive, indicating that family members are also more likely to trade in stocks where the matching director is an insider or has an interlock connection. The coefficients, a_3 and a_4, are also negative (and significantly so for a_4), suggesting that family members are less likely to trade the typical unconnected stock if the related director is currently in the network of board members. The coefficients, a_5 and a_6, are insignificant, indicating no substantive tendency for family members to trade more in local stocks, or in stocks where their related director has industry experience. In addition, a_7 is significantly negative, implying that family members are less likely to trade if their related *director* has more wealth invested in the share market. Next, the director age dummies show that the likelihood of family trading is lowest when the related *director* is young, while the family age dummies show that family members are more likely to trade when *they* are younger. Finally, consistent with the results in Panel A, the family member's own wealth is positively associated with the likelihood of trading.

The results in Table 2 are consistent with the view that directors actively seek to benefit from their comparative information advantage. They are more likely to trade stocks for which they serve as an insider, or have an interlocking director connection. They also concentrate their trading in fewer unconnected stocks if they have higher status in the director network, suggesting that better access to firm specific information allows them to be more selective. We also find that the trading activity of family members reflects the relative information advantage of the corporate director they are related to. This evidence supports the notion that value-relevant stock market information is shared within the family networks of board members.

IV. Performance of Trading Activity by Directors

In this section we examine how a director's connection to a traded stock is associated with the director's stock market performance. We analyze this performance in two ways: an event study approach and a calendar-time portfolio approach.

A. Event Study Approach: When Director is More or Less Connected to the Stock Traded

In the event study approach, we first compute the daily size-adjusted abnormal return for any given stock as the actual return minus the equally-weighted return across all Finnish stocks in the same size-quintile (but excluding the stock in question). We report the mean (or median) size-adjusted cumulative abnormal returns over several time frames, where we first partition all director trades into sales and purchases, and then into the five categories depending on the connection level. For each group of trades, we first compute the average CAR for every director, and then calculate the mean (or median) of these average CARs across all directors.

A.1. Director Trades in Insider, Interlock, and Unconnected Stocks

Table 3 presents the results for insider trades, interlock trades, and all unconnected trades. The t-statistics in Table 3 are based on the standard deviation of the mean CARs averaged across all directors, for each trade category. Table 3 also presents the median of the average CAR across all directors, and the number of different directors with at least one trade for each category.

First consider the results for insider trades by directors, in Panel A of Table 3. There are 214 different director accounts that make insider sales in our sample, while 349 director accounts have at least 1 insider purchase.[21] For insider sales, over all horizons, the mean CAR is small in magnitude and never statistically significant. In contrast, following insider purchases the mean

[21] For this analysis we exclude trades where several board members buy shares on the same day, since these transactions are likely to be part of a managerial compensation plan, and are thus unlikely to be motivated by superior information. Inclusion of these trades does not materially alter the results.

CAR grows in magnitude and significance over longer horizons, accumulating to 0.8% (t-ratio = 2.5) after one month, 2.5% (t-ratio = 4.1) after 3 months, and 6.9% (t-ratio = 4.8) after one year. This evidence is similar to prior research on insider trading.[22]

Second consider the performance of interlock trades by directors, in Panel B of Table 3. From the total of 466 director accounts, 194 directors sell interlock stocks at least once during our sample period, while 205 directors buy interlock stocks. After selling interlock stocks, the mean CAR accumulates to -1.7% (t-ratio = -1.4) after six months, before diminishing in magnitude and significance over the next six months. The performance after buying interlock stocks is much stronger, with a mean CAR of 3.0% (t-ratio = 3.4) after three months, growing to 4.8% (t-ratio = 2.9) after one year.

The performance of trades by directors in all unconnected stocks is reported in Panel C of Table 3. There are 418 director accounts with unconnected sales, while 405 directors make unconnected purchases. On average, directors do not display significant stock-picking skills when they sell stocks for which they have no connection through the corporate network. However, when they buy unconnected stocks, these directors again perform significantly better than the portfolio of benchmark stocks in the same size-quintile. After one month, the mean CAR for purchases is 0.6% (t-ratio = 3.0), and after 3 months this mean CAR grows to 1.1% (t-ratio = 3.1). However, when the event window is increased to one year, the CAR declines and is no longer significant.

We have repeated this analysis in tests not reported here, excluding all trades in stocks where the postcode of the company's headquarters is the same as that of the director, or the stock is in the same industry as the director. We obtain similar results, indicating no significant

[22] For example, see Lorie and Niederhoffer (1968), Jaffe (1974), Seyhun (1986, 1998), Rozeff and Zaman (1988), Lakonishok and Lee (2001) and Ravina and Sapienza (2010).

outperformance for director sales, but significant outperformance after director purchases. For example, six months after buying insider stocks the average CAR is 3.6% (t-ratio = 2.1), six months after buying interlock stocks the average CAR is 3.3% (t-ratio = 2.7), and six months after buying unconnected stocks the average CAR is 0.9% (t-ratio = 1.7).

A.2. Director Trades in Interlock Stocks versus Unconnected Stocks

In this subsection we test the hypothesis that directors' connections in the network provide access to valuable information, by examining whether their trades in interlock stocks outperform their own trades in unconnected stocks. We first isolate the subset of director accounts that make both interlock trades and unconnected trades of the same sign (i.e., purchases or sales). There are 188 director accounts with both interlock sales and unconnected sales, while 200 accounts have both interlock purchases and unconnected purchases. We then estimate the following regression model to analyze variation in the average CAR per director, across the two kinds of purchases or sales made by each director, including fixed effects for all directors:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{ Interlock}_e + \text{Director Fixed Effects}_e + \varepsilon_{e,i}, \qquad (2)$$

where $\text{Interlock}_e = 1$ if $CAR_{e,i}$ is based on interlock trades by director *e*, and 0 otherwise. The intercept (α_0) in this regression represents the mean CAR following unconnected trades (the omitted group), averaged across all directors. The coefficient, α_1, therefore reflects the difference in the mean CAR per director between their interlock trades versus their own unconnected trades. This model is estimated separately for the samples of director sales and purchases, respectively, for the different windows.

The results are presented in Panel D of Table 3. First consider the difference in mean CARs across interlock sales versus unconnected sales, on the left side of Panel D. The coefficient, α_1, is negative for all horizons up to six months, and reaches -1.7% (t-ratio = -1.9)

after three months. Over longer windows the coefficient (α_1) becomes less significant, and even becomes insignificantly positive, at 1.4% (t-ratio = 0.7) after one year.

On the right side of Panel D, the differential performance of interlock versus unconnected purchases (α_1) is positive for all windows, and it grows in magnitude and significance for longer windows. After one year, the mean outperformance of interlock purchases accumulates to 5.5% (t-ratio = 2.9). This evidence indicates that individual directors tend to make more profitable trades when they buy stocks for which they have an interlock connection, relative to stocks with no connection.[23]

B. Event Study Approach: When Director has Higher or Lower Status

In this section we further examine the performance of all trades by directors in unconnected stocks, partitioned into those made by directors with high, moderate, or no status. The results are presented in Panels A - C of Table 4, respectively. Similar to the analysis in Table 3, we first compute the average CAR for every director in each trade subgroup, and then calculate the mean (or median) of these average CARs across all directors in the subgroup.

On the left side of Panel A in Table 4, there is no indication that sales in unconnected stocks are followed by lower CARs for the subset of directors with high status. The right side of Panel A, however, indicates that purchases by directors with high status tend to be followed by significantly positive mean CARs, which accumulate to 4.6% (t-ratio = 3.3) after one year.

Panels B and C again show no evidence of significant outperformance for sales in unconnected stocks, made by directors with moderate or no status in the corporate network. On the buy side, however, these two groups of directors display significant outperformance for

[23] Note that the difference across the mean CARs (α_1) in Panel D of Table 3 is not identical to the difference across the mean CARs in Panel B versus Panel C, because the analysis in Panel D is limited to the subset of directors who make trades of the same sign in *both* interlock stocks and unconnected stocks. A t-test of the difference in the mean CARs, for the 205 accounts in Panel B versus the 405 director accounts in Panel C, indicates that the mean CAR after interlock purchases is significantly higher, for windows extending to 3 months, 6 months, and 1 year.

windows up to three months. For example, in Panel B the mean CAR is 1.2% (t-ratio = 2.6) after three months for directors with moderate status, while Panel C reveals a mean CAR of 1.0% (t-ratio = 1.9) over the same time frame for directors with no status. When the window is extended beyond three months, this outperformance diminishes in size and significance.

Next, we further analyze how the variation in the mean CAR for unconnected trades depends on the status of the director, by estimating the following panel regression model with fixed effects for all directors:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{ Unconnected_Moderate}_e + \alpha_2 \text{ Unconnected_High}_e + \text{Director Fixed Effects}_e + \varepsilon_{e,i}, \quad (3)$$

where Unconnected_Moderate = 1 if $CAR_{e,i}$ is based on unconnected trades by directors with moderate status, and 0 otherwise;

and Unconnected_High = 1 if $CAR_{e,i}$ is based on unconnected trades by directors with high status, and 0 otherwise.

Note that the omitted group captured by the intercept in Equation (3) is the set of unconnected trades made by directors with no status (i.e., while they were not part of the corporate director network). Thus, the coefficient, α_1 (or α_2), indicates the difference in the mean CAR following unconnected trades made by directors when they had moderate (or high) status versus the mean CAR following their unconnected trades when they were not part of the network.

Results are presented in Panel D of Table 4. As before, this model is estimated separately for the samples of director sales and purchases in unconnected stocks. On the left side of Panel D, the coefficients (α_1 and α_2) are small in magnitude and insignificant. Thus, there is no significant difference in the mean CARs subsequent to sales made by directors when they had moderate or high status relative to when they had no status. In contrast, the right side of Panel D reveals significant differences in the mean performance following purchases by directors when

they had high status (α_2). After six months the mean CAR for purchases by directors with high status is 3.1% (t-ratio = 2.2) higher than the mean CAR for purchases by directors when they had no status, and this differential performance grows to 4.9% (t-ratio = 2.2) after one year.

C. Calendar Time Portfolio Approach: Analysis of Director Trades

In this section we analyze the relative investment skills of directors across the five categories of trades, using a calendar time portfolio approach. The calendar time portfolios are designed to mimic the trading behavior of the different groups of director trades. For example, a stock is included in the 'three-month director buy portfolio for insider trades' if, over the previous three-month portfolio formation period, the number of insiders who were net buyers of this stock exceeds the number of insiders who were net sellers of the stock. We pursue three alternative designs for this calendar time portfolio approach which we now discuss, in turn.

C.1. One-Day Fama-French Alphas based on a 3-month Portfolio Formation Period

Our first portfolio design proceeds as follows. First, for each trading day (t) in the sample period, we identify all director accounts (e) that trade in any given stock (i) during the preceding three months, covering calendar days, $t\text{-}90$ to $t\text{-}1$. Second, for each director account (e), we aggregate the trading activity across all trades in the stock (i) during this period, to determine whether the director was a net buyer or net seller of the stock. Third, we partition all director trades into the five categories, as: i) insider trades; ii) interlock trades, and unconnected trades by directors with (iii) high status, iv) moderate status, and v) no status. Fourth, for every trade category, on each day (t) we allocate a given stock (i) into the 'director buy portfolio' if more directors are net buyers than net sellers of that stock, or into the 'director sell portfolio' if more directors are net sellers. Finally, we calculate the equally weighted portfolio return on day t ($R_{p,t}$)

for each of the ten director portfolios (p = 1-10, representing a buy portfolio and a sell portfolio for each category of director trades).

We then analyze the 1-day return performance of these ten portfolios ($R_{p,t}$), using the Fama-French 3-factor model, as follows:[24]

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_1 (R_{m,t} - R_{f,t}) + \beta_2 HML_t + \beta_3 SMB_t + \varepsilon_{p,t}. \quad (4)$$

The dependent variable is the excess return on day t for each portfolio, p. We emphasize that the Fama-French alpha from this model (α_p) represents the risk-adjusted 1-*day* performance of the director buy or sell portfolio, formed over the previous three months. The regression results are provided in Panels A and B of Table 5 for the five director sell portfolios and the five director buy portfolios, respectively. In all Panels of Table 5, the t-statistics from the Fama-French regressions are constructed from Newey-West robust standard errors.

Panel A of Table 5 indicates that the director sell portfolios do not outperform for any of the five trade categories, since none of the alphas are significantly negative. In contrast, the director buy portfolios in Panel B have significant positive 1-day alphas for all five types of trades, which are larger in magnitude and significance for the first three trade categories. In particular, the daily alpha for the director buy portfolio of insider trades is 5.3 basis points (bp) per day (t-ratio = 2.7). This average daily outperformance corresponds to 13.3% per annum. Likewise, the alpha is 5.9 bp per day (14.8% p.a.) for interlock trades and 5.4 bp (13.5% p.a.) for unconnected trades by directors with high status (t-ratios = 2.6 and 4.1, respectively). For the buy portfolios involving unconnected stocks bought by directors with moderate or no status, we also find significant but smaller alphas of 2.6 and 2.2 bp per day (t-ratios = 2.4 and 2.1, respectively).

In Panels A and B of Table 5 we also investigate whether a director's network

[24] We follow the procedures in Fama and French (1993) to calculate their three factors, using daily data for all Finnish stocks.

connections provide valuable information, by generating two daily hedge portfolios that examine the relative performance across these director portfolios. Our first daily hedge portfolio is long the director sell (or buy) portfolio of interlock stocks and short the sell (or buy) portfolio of unconnected stocks by directors with no status. The daily alphas for this zero-cost hedge portfolio are presented near the bottom of Panels A and B. On the sell side in Panel A, the alpha for the hedge portfolio is positive at 0.6 bp per day (t-ratio = 0.3), indicating that directors do not perform substantially better when they sell interlock stocks, relative to their sales of unconnected stocks while they were not a member of the corporate network. On the buy side in Panel B, the alpha for this hedge portfolio is 3.6 bp per day (t-ratio = 1.9), indicating a marginally significant differential performance for director purchases of interlock stocks, relative to their purchases of unconnected stocks while they were not a board member.

We also generate a second daily hedge portfolio that is long the unconnected stocks traded by directors with high status, and again short the portfolio of unconnected stocks traded by directors with no status. Results are presented at the bottom of Panels A and B in Table 5. The daily alphas of this hedge portfolio indicate that, when directors sell unconnected stocks, those with high status do not substantially outperform those with no status, since the alpha is only -0.7 bp per day (t-ratio = -0.4). In contrast, on the buy side Panel B indicates significant outperformance by directors with high status, by 3.3 bp per day (t-ratio = 2.6).

C.2. One-Day Fama-French Alphas based on Alternative Portfolio Formation Periods

Next, on the left side of Panels C and D in Table 5, we present the analogous 1-day alphas for the director sell portfolios and buy portfolios, respectively, using several different portfolio formation periods that range from 7 calendar days to 365 calendar days. In Panel C there are no significant negative 1-day alphas for any of these sell portfolios, regardless of the

portfolio formation period or the category of trades. In contrast, Panel D reveals significant alphas for all categories of trades. The portfolios of interlock purchases and unconnected purchases by directors with high status consistently have the greatest degree of outperformance of all trade categories, with significant 1-day alphas that range from 4 bp per day (t-ratio = 2.5) to 12 bp per day (t-ratio = 2.4). The alpha for the insider buy portfolio is somewhat smaller and insignificant for shorter term windows up to 30 calendar days, although this alpha is significant for longer windows beyond 90 days, ranging from 2 bp per day (t-ratio = 1.7) to 5 bp per day (t-ratio = 2.6). Finally, portfolios based on unconnected purchases by directors with moderate or no status also have somewhat smaller 1-day alphas that are still significantly positive.

C.3. One-Month Fama-French Alphas based on a 3-month Portfolio Formation Period

On the right side of Panels C and D in Table 5, we also present the 1-*month* alphas based on similar analysis of the *monthly* returns for the ten director sell portfolios and buy portfolios, respectively, formed over the previous three months. Here at the start of every month, we form the director buy and sell portfolios based on the net trades by each director over the previous three months, as in Panels A and B of Table 5. However, we now only consider these ten portfolios at the start of the month, rather than daily, and the return of each portfolio is measured over the next full month. There are a total of 178 monthly observations available for this analysis over our sample period covering 1997 to 2011. We present two columns of results on the right side of Panels C and D, containing the 1-month alphas from the Fama-French 3-factor model, and the 4-factor model that also includes the momentum factor (UMD). We obtain the monthly Fama-French and UMD factors for Finland in U.S. dollars from the web site of Andrea Frazinni (see http://www.econ.yale.edu/~af227/data_library.htm), and we convert these factors into local currency returns.

The resulting 1-*month* alphas in Panels C and D of Table 5 corroborate the analysis using 1-day alphas. Once again, in Panel C there are no significant negative monthly alphas for any of the five director sell portfolios. However, in Panel D, the monthly alphas for nine of the ten director buy portfolios presented are significantly positive at the 10% level or better. The 1-month alpha is largest for inside purchases, interlock purchases and purchases of unconnected stocks by directors with high status, ranging from 0.7% per month to 1.2% per month. The monthly alphas are somewhat smaller for unconnected stocks purchased by directors with moderate status (0.4% - 0.7% per month), or no status (0.3% - 0.6% per month). Note that the magnitudes of these monthly alphas are slightly smaller than the corresponding 1-day alphas based on the 90-day portfolio formation window, after multiplying these 1-day alphas by 20 to allow comparison with monthly returns. This observation indicates that there is some value in adjusting portfolios on a daily basis.

The analysis in Table 5 corroborates our earlier conclusions that directors display significant stock picking skills on the buy side. These skills are particularly evident when directors buy inside stocks, stocks with which they have an interlock connection, and unconnected stocks when the director has a more prominent position in the corporate network.

V. Performance of Trading Activity by the Family Members of Directors

In this section we conduct similar analyses to examine the performance following trades by family members of the directors in our sample.

A. Event Study Approach: Family Trades When Related Director Is More or Less Connected

For each category of family trades, we first compute the average CARs across all family accounts associated with every director, since several family members related to the same director may engage in identical trades. We then obtain the mean (or median) of these average

family CARs across the 84 directors that have matched family members. The results are provided in Table 6.

A.1. Family Trades in Insider, Interlock, and Unconnected Stocks

The performance of family trades in inside stocks is documented in Panel A of Table 6. We identify 34 (36) director accounts for which one or more family member accounts sell (buy) a stock at least once where the related director is an insider. Similar to the results for director trades, there is no consistent evidence that these family accounts earn significant negative CARs when they sell inside stocks. On the buy side, however, the mean CARs for inside family trades are significantly positive and large in magnitude, accumulating to 12.3% after six months (t-ratio = 3.0), and 17.1% after twelve months (t-ratio = 2.6).

Next consider the performance of interlock family trades, in Panel B of Table 6. For interlock sales the mean CARs are mostly positive, and are large and significant for the 6 month and 12 month windows. The mean CARs following interlock family purchases are also positive with magnitudes that are even larger and comparable to insider purchases, accumulating to 12.5% after six months (t-ratio = 3.2), and 17.3% after twelve months (t-ratio = 3.4).

Finally, consider the performance of unconnected family trades in Panel C. Once again, for unconnected family sales there is little evidence of significant stock picking skills by family members. On the other hand, family members significantly outperform on the buy side over the next month, with a mean CAR of 1.4% (t-ratio = 2.8). For longer holding periods, however, the mean CAR is insignificant.

A.2. Family Trades in Interlock Stocks versus Unconnected Stocks

In this section we examine the benefits of access to the corporate network through the family network, by testing whether the interlock trades of family members outperform their own

trades in unconnected stocks. As before, we first isolate the subset of director accounts for which family members make both interlock trades and unconnected trades of the same sign (i.e., purchases or sales). There are 31 director accounts with family members that make both interlock sales and unconnected sales, while 42 director accounts have both interlock purchases and unconnected purchases by family members. We then estimate the panel regression model specified in Equation (2) above, and reproduced here:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{ Interlock}_e + \text{ Director Fixed Effects}_e + \varepsilon_{e,i}, \qquad (2)$$

where $\text{Interlock}_e = 1$ if $CAR_{e,i}$ is based on family interlock trades matched to director *e*, and zero otherwise.

This model analyzes the difference in the mean CARs across family members associated with this sample of directors, for the two kinds of trades made by these family members, including fixed effects for all directors. The omitted group is the set of family trades in unconnected stocks. Thus the coefficient, α_1, indicates the difference in the mean CARs across family trades in interlock stocks versus their own trades in unconnected stocks.

The results appear in Panel D of Table 6. The left side of panel D indicates that interlock family sales do not outperform unconnected family sales. For the 1 year window the results indicate that interlock sales perform significantly worse than unconnected sales (i.e., the difference in mean CARs is large and positive). However, interlock family purchases greatly outperform unconnected family purchases for windows of three months and longer. After three months, the difference in mean CARs is 7.7% (t-ratio = 3.2); after six months, 12.1% (t-ratio = 3.0), and after one year, 19.8% (t-ratio = 3.7). This evidence indicates that the benefits of access to the corporate network extend to the family members of directors, on the buy side.

In unreported analysis, we split the samples of unconnected family sales and purchases into trades where the matched directors have: i) high status, ii) moderate status and iii) no status. The average CARs for these 3 groups of trades are similar and the differences across these groups are never significant.

A.3. Relative Performance of Family versus Related Directors Who Trade Connected Stocks

It is noteworthy that the mean CARs after *family* purchases of insider stocks and interlock stocks (in Panels A and B of Table 6) are more than twice as large as the analogous mean CARs after *director* purchases of similar connected stocks (in Panels A and B of Table 3). In this section we formally test whether family members significantly outperform their related directors when they trade these connected stocks. We first isolate the subset of director accounts that have related family accounts. Next we limit the sample to accounts where both the director and a related family member make insider trades or interlock trades of the same sign (i.e., purchases or sales). There are 54 such director accounts where both the director and a related family member sell connected stocks, and there are 58 director accounts where both buy connected stocks. For this sample of trades, we estimate the following panel regression model:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{ Family}_e + \text{ Director Fixed Effects}_e + \varepsilon_{e,i}, \qquad (5)$$

where $\text{Family}_e = 1$, if $CAR_{e,i}$ is based on the subset of family trades in this sample, and zero otherwise.

This model analyzes the difference in the mean CARs between family members and their related directors, when both trade stocks to which the director is connected (either as an insider or through an interlock connection). The omitted group in Equation (5) is the set of director trades in such connected stocks. Thus the coefficient, α_1, indicates the difference in the mean CARs between family accounts versus their related directors, when both trade connected stocks.

The results are provided in Panel E of Table 6. The evidence on the left side of Panel E indicates that family sales do not outperform director sales in insider or interlock stocks. However, on the right side of Panel E, family purchases significantly outperform director purchases of connected stocks for windows of three months and longer. The difference in mean CARs (α_1) is 3.9% (t-ratio = 2.4) after three months, 6.1% (t-ratio = 2.4) after six months, and 8.0% (t-ratio = 2.1) after one year. These results show that family members significantly outperform their related directors when they trade stocks with an inside or interlock connection.

B. Calendar Time Portfolio Approach: Family Trades

In this section we analyze the relative investment skills of family members across the five categories of trades, using the calendar time portfolio approach. In this case, we generate time series that identify the daily returns on ten *family* portfolios ($R_{p,t}$ on a buy portfolio and a sell portfolio for each category of *family* trades). As before, we first estimate the Fama-French one-*day* alphas using several portfolio formation periods that range from the previous 7 calendar days to the prior 365 calendar days. We then estimate the one-*month* alphas using a three-month portfolio formation period.

First consider the one-day alphas for the different portfolio formation windows, provided on the left side of Panels A and B in Table 7, for the family sell portfolios and buy portfolios, respectively. In Panel A, the one-day alpha is negative and marginally significant only for the portfolio of family sales in inside stocks, when we use a portfolio formation window of 30 days. The resulting daily alpha is -15 bp (t-ratio = -1.9), which corresponds to a large negative annualized return of -37.8%. For all other formation periods and trade categories, the daily alphas for the portfolios of family sales are never significantly negative.

In contrast, the left side of Panel B in Table 7 reveals one-day alphas that are significantly positive, for family purchases in all five trade categories. For example, for family purchases of interlock stocks, the daily alpha is large and significant when we use portfolio formation periods of two weeks or more, ranging from 7 bp per day (18% p.a.) for the 365-day formation period, to 12 bp per day (30% p.a.) for the 30-day formation period (t-ratios = 3.5 and 3.0, respectively). Likewise, family purchases of unconnected stocks also generate positive and significant one-day alphas, although these results are generally smaller than the analogous daily alphas for interlock stocks. Finally, the one-day alphas for the family purchases of insider stocks are large in magnitude for the 30-day, 90-day, and 180-day windows, but are never significant at the .05 level. This lack of precision for the daily alphas of family insider trades is likely due to the relatively small number of insider stock purchases by the family members of directors.[25]

Next consider the 1-month alphas presented on the right side of Panels A and B in Table 7. Once again, these monthly alphas are never significantly negative for any family sell portfolio, in Panel A. However, the 1-month alphas are positive and significant at the 10% level or better for eight of the ten family buy portfolios in Panel B. Furthermore, for the three categories of family purchases of inside stocks, interlock stocks, and unconnected stocks where the related director has high status, these monthly alphas are all substantially larger than the analogous monthly alphas for the related directors themselves, from Panels C and D of Table 5. In particular, these three categories of family trades generate one-month alphas that range from 1.33% per month to 2.11% per month. The other categories of family trades in outside stocks

[25] In further unreported tests involving the one-day alphas, we form a daily hedge portfolio that is long the family buy portfolio of interlock stocks and short the buy portfolio of unconnected stocks by family members of directors with no status. This portfolio is similar to hedge portfolio 1 in Panel B of Table 5, and it produces estimated daily alphas that are significantly positive for portfolio-formation periods longer than two weeks. In contrast, the daily alphas of the other family hedge portfolios corresponding to those presented in Panels A and B of Table 5 are mostly insignificant on both the buy side and the sell side.

where the related director has moderate or no status again generate smaller monthly alphas that range from 0.37% per month to 0.62% per month, similar to the analogous director trades.

Tables 6 and 7 provide corroborating evidence that the benefits of access to information through the corporate network spill over to the family members of directors. These results indicate strong support for the value of family network connections, as well as the value of access to the corporate network.

VI. Performance of Trades by Directors Around Major Information Events

This section uses an event study approach to focus on trades made by directors during the three weeks prior to takeover and earnings announcements. In addition, we examine director trades before large price changes, which presumably reflect the arrival of substantive value-relevant information. We focus on the mean size-adjusted cumulative abnormal return on the day of and the day after each type of event (*CAR(0,+1)*).

Our sample of earnings announcements is obtained from Bloomberg and consists of 5,479 quarterly announcements made by Finnish firms over the period, 1999 to 2011. Data on mergers and acquisitions are obtained from SDC Platinum, and include 213 merger announcements for our sample of Finnish firms. Our third sample includes large price changes, which we generate by selecting the two days each year with the largest and smallest market-adjusted abnormal returns for every stock. We exclude all such major price change events if they occur within five days of an earnings or acquisition announcement, or if they occur within one month of another large price change event for the same stock with the opposite sign. This sample contains 3,677 large price change events.

For each event, we first compute the stock's size-adjusted cumulative abnormal return on the event day and the next day, *CAR(0,+1)*. We then "sign" this *CAR* for each stock for every

accountholder, depending on whether that account was a net buyer or seller in the first (or second or third) week before the event. If an account was a net buyer (i.e., shares bought exceed shares sold during the week), then the event period return for that account equals the stock's *CAR(0,+1)*. Alternatively, if an account was a net seller (i.e., shares sold exceed shares bought), then the event period return for that account equals the stock's *CAR(0,+1)* multiplied by -1.

For each event, and for every category of trades, we then calculate the mean signed *CAR(0,+1)* across all director accounts that were net buyers or sellers of the stock during week -1, -2, or -3. We then average these mean signed *CARs* across all events. The standard error of this mean signed *CAR* across all events is used to construct a t-test of the null hypothesis that the mean *CAR(0,+1)* is zero.

The results are presented in Table 8. The analysis of earnings announcements appears in Panel A, merger and acquisition announcements are presented in Panel B, and large price changes are in Panel C. Every Panel provides three sets of results, for the director trades made during each of the 3 weeks before the event date. Each set of results presents the analysis for the three types of trades in insider, interlock, and all unconnected stocks.

First consider the analysis of earnings announcements in Panel A of Table 8. The only results that are marginally significant for this event are for insider trades one week and three weeks before the earnings announcement. For the 24 earnings announcements where at least one director traded as an insider during the prior week, the average signed CAR(0,+1) is 2.0% (t-ratio = 1.7). For the 70 earnings announcements where at least one director traded as an insider in the third week before the announcement, the average signed CAR(0,+1) is 1.1% (t-ratio = 1.9). The remainder of Panel A reveals mean signed CARs that are small in magnitude and never significant at the .10 level.

Second, the results for merger and acquisition announcements in Panel B of Table 8 do not provide convincing evidence that directors exploit private information about upcoming events. While the mean signed CAR is large in magnitude for insider trades made during each of the three weeks before a takeover announcement, this statistic is based on a small number of observations in each case, and thus cannot be relied upon to make reasonable inferences.

Finally, Panel C of Table 8 presents the analysis of large price change events. The only significant result in this Panel applies to directors who trade unconnected stocks during the first week before a large price change. There are 671 such events, with an average signed CAR of 0.8% (t-ratio = 1.7).

Together, this analysis provides only weak evidence that directors tend to outperform when they trade just before major information events. The resulting CARs are typically small in magnitude and insignificant.[26] This result is consistent with our earlier analysis above, which often indicates little evidence of outperformance over the weeks immediately following director trades, but instead reveals that the exceptional performance of directors extends over horizons up to one year. Together, this evidence suggests that the outperformance of directors is due to network connections that provide access to valuable information that is longer term in nature, rather than to private information that is about to become public in the next few weeks.

VII. Firm Performance following Trading Activity by Directors

This section explores the conjecture that the outperformance of corporate directors derives from access to information about the longer term prospects of the stocks they trade, obtained through access to the corporate network. First, we examine the predictive relation

[26] We repeat this analysis for trades by family members. The only marginally significant outperformance found is for family members trading unconnected stocks during the week before earnings announcements (CAR = 2.7%, t-ratio = 1.6). For both director and family trades, our results are similar when we repeat our tests using trades made during each of the 3 months before the event, or when we only consider purchases (or sales).

between director trades in one year and the firms' industry adjusted abnormal ROA in the next two years. Then we investigate the relation between director trades in one year and analyst forecast errors in the following year.

A. The Abnormal ROA of Firms that Directors Traded in Prior Years

In this section we examine whether trading activity by directors predicts the abnormal return on assets, $Abn(ROA_{it})$, of the firms traded. We first define the return on assets, ROA_{it}, as earnings before interest and taxes for firm *i* in fiscal year *t*, divided by total assets. $Abn(ROA_{it})$ is then computed as the difference between the firm's ROA_{it} and the average ROA_t for the same fiscal year across all Finnish firms in the same Global Industry Classification (GIC) category, but excluding the firm in question. If directors are able to predict individual firm performance, then we would expect a positive mean $Abn(ROA_{it})$ for firms following stock purchases, and a negative mean $Abn(ROA_{it})$ following sales.

For each category of director trades, we use the same procedure described above to construct the buy/sell signal, based on whether more directors are net buyers or net sellers of a stock during the one or two years prior to the fiscal year pertaining to a firm's ROA. That is, we determine whether more directors are net buyers or sellers of a given stock during year t-1 (or year t-2), and we examine the firm's industry adjusted ROA over year t.[27]

For each category of director trades, we then examine how the mean $Abn(ROA_{it})$ varies across firms that were either sold or bought by directors over the previous one or two years. We split the sample into stocks that receive a sell signal or a buy signal based on director trades in year t-1 or t-2, and we estimate the following panel regression on dummy variables that categorize the five types of director trades:

[27] In Finland fiscal years end on December 31, and the ROA typically becomes public knowledge at some point during the first quarter of the following year.

$$Abn(ROA_{it}) = \beta_1 \text{ Insider}_{i,e,y} + \beta_2 \text{ Interlock}_{i,e,y} + \beta_3 \text{ Unconnected_High}_{e,y} + \beta_4 \text{ Unconnected_Moderate}_{e,y} + \beta_5 \text{ Unconnected_No}_{i,e,y} + \varepsilon_{it}, \quad (6)$$

where the right hand side variables are the respective (0,1) dummies that classify our five trade categories, as defined previously. Note that the intercept is suppressed in Equation (6), so that each dummy coefficient (β_1 - β_5) represents the average $Abn(ROA_{it})$ for each respective category of director trades from the previous year(s). The reported t-statistics are based on a panel regression with clustered standard errors by firm (*i*) and fiscal year (*t*).

We report the results in Panels A and B of Table 9, for the stocks in each trade category that were sold and purchased, respectively, during the previous one to two years. In the first two columns of Panel A or B, we present the mean $Abn(ROA_{it})$ for all stocks sold or purchased by directors in the previous year. The middle two columns present the analogous sets of results after winzorizing $Abn(ROA_{it})$ at the 5% and 95% percentiles, to address the influence of outliers. Finally, the last two columns present the results based on director trades made during the one-year period two years ago (t-2), using winzorized $Abn(ROA_{it})$.

For all three sets of results in Panel A of Table 9, the mean abnormal ROA following sales is never significantly negative. This evidence indicates that the average firm sold by directors does not experience a significantly lower ROA than the industry benchmark over the following one or two years. In contrast, the left side of Panel B reveals that the mean $Abn(ROA_{it})$ is significantly positive after director purchases, for all five trade categories. Winzorizing attenuates the magnitude of the mean $Abn(ROA_{it})$ somewhat, but the industry adjusted ROA remains significantly positive for interlock trades, as well as for unconnected trades when the director has either high or moderate status in the network, based on director trades made either in year t-1 or t-2. This evidence indicates that the buying activity of directors predicts the abnormal performance of firms over the following one to two years.

B. Analyst Forecast Errors for Firms that Directors Traded in the Previous Year

One possible concern with the analysis in the previous section is that the results could simply reflect a preference to invest in stocks with high industry adjusted ROAs, even if this outperformance is in line with market expectations. This section addresses this concern by taking a different approach, to examine whether directors have a superior ability to predict a firm's future earnings performance relative to financial analysts. If directors have such a capability, then we would expect to find positive analyst forecast errors following directors' stock purchases, and negative forecast errors following directors' sales. The analyst forecast error for a given stock (*i*) pertaining to a particular earnings announcement (*t*) is defined as follows:

$$AFE_{it} = (EPS_{it} - AF_{it}) / \left| EPS_{it} \right| ;$$

where EPS_{it} = realized earnings per share for stock *i* during year *t*;

AF_{it} = first mean analyst forecast of earnings per share for stock *i* pertaining to year *t* that is available in the IBES summary files.

Since the beginning of our sample period (1997), IBES has published summary data on mean analyst forecasts of annual earnings for 111 of our sample stocks. For these stocks, we use the earliest mean analyst forecast for each annual earnings announcement in our sample that is reported in the IBES summary file. In our sample there are 1,328 such observations on the first mean forecast of annual earnings pertaining to any given year (*t*). For each year, we obtain the decile ranks of all analyst forecast errors (AFE_{it}) for the cross section of firms, and we scale these decile ranks to range from -0.5 (for the decile with the lowest forecast errors) to +0.5 (for the decile with the highest forecast errors). The resulting scaled rank for analyst forecast errors is labelled, $Rank(AFE_{it})$.[28]

[28] Analyzing the ranks of *AFE* attenuates the influence of outliers. In addition, scaling these ranks to range from -0.5 to +0.5 results in a zero mean for *Rank(AFE)*. This scaling addresses the tendency for analysts to be too optimistic (see, for example, Livnat and Mendenhall, 2006).

Next, for each category of trades, we construct the buy signal or sell signal based on whether more directors are net buyers or sellers of this stock over the year prior to the release of the earliest mean analyst forecast pertaining to a given announcement. We emphasize that the time frame for determining whether directors are buying or selling stock (*i*) covers the four quarters before the first mean analyst forecast for a given fiscal year (*t*). Since the median period from the earliest mean forecast to the ultimate earnings announcement is twelve months, this time frame for determining our director buy/sell signal begins roughly two years prior to the eventual earnings release.

Finally, for each category of director trades, we examine how the mean scaled rank forecast error, $Rank(AFE_{it})$, varies across announcements for stocks that receive a buy or sell signal based on trades by directors over the previous year. This analysis is conducted in the same way as in the previous section, but we now use $Rank(AFE_{it})$ as the dependent variable in the panel dummy regression:

$$\begin{aligned} Rank(AFE_{it}) = {} & \beta_1 \text{ Insider}_{i,e,y} + \beta_2 \text{ Interlock}_{i,e,y} + \beta_3 \text{ Unconnected_High}_{e,y} \\ & + \beta_4 \text{ Unconnected_Moderate}_{e,y} + \beta_5 \text{ Unconnected_No}_{i,e,y} + \varepsilon_{it}, \qquad (7) \end{aligned}$$

where the right-hand side variables are the respective (0,1) dummies, as in Equation (6). Now each dummy coefficient (β_1 - β_5) represents the average scaled rank, $Rank(AFE_{it})$, for the different categories of director trades.

We report the results in Panels A and B of Table 10, for the portfolio of stocks in each trade category that were sold and purchased, respectively, by a majority of directors in the pre-forecast period. In the first two columns of Panels A and B, we present the analysis for annual earnings announcements of all stocks covered by IBES. In columns 3 and 4 (or 5 and 6), we

present the analogous results, after restricting the sample to announcements where at least five (or ten) analysts covered the firm.

For all three sets of results in Panel A of Table 10, the mean scaled rank of the analyst forecast error is never significantly negative. This evidence indicates that firms sold by directors do not significantly underperform analyst forecasts over the following year. In contrast, Panel B reveals that the mean scaled rank is significantly positive for interlock purchases, as well as for unconnected purchases when the director has either high or moderate status in the network. Furthermore, the magnitude and significance of these mean scaled forecast errors increase as we move from the analysis of all earnings announcements, on the left side of Panel B, to the subsets of stocks with a greater analyst following, on the right side of Panel B.

Together, the evidence in Tables 9 and 10 demonstrates that purchases by directors predict unexpected increases in earnings one to two years later, whether we use the average industry mean ROA or the mean analyst forecast as our benchmark. These results suggest that directors profit from access to information about the long term performance prospects for both inside and outside firms, rather than short-lived information about impending announcements.

VIII. Summary and Conclusions

We examine a comprehensive dataset that includes the trading activity in all stocks bought and sold by a large sample of corporate directors in Finland. We obtain this dataset by merging one database on Finnish insider trades with another database containing all trades by every registered investor in Finland. We also identify the trading accounts of likely family members of these directors. In addition, we assemble the network that displays the corporate connections among all directors in Finland for every year in our sample period. These data allow us to examine the performance of different categories of trades in outside stocks where there is

likely to be more or less access to valuable information through the corporate network. Thus, we are able to address directly several questions that go far beyond issues associated with the performance of legal insider trades, which have heretofore eluded empirical analysis.

We find that directors and their family members concentrate their trading in stocks where they have a comparative information advantage through corporate connections. We also demonstrate that this access to the corporate network is valuable. In general, we find that interlock purchases and purchases in outside stocks by directors with high status display extraordinary performance that is similar to the abnormal returns typically observed following legal insider trades. For family members of directors, we find evidence of even greater exceptional performance when they buy stocks where their related director is an insider or has interlock connections. This latter result clearly demonstrates that family connections should be added to the list of social networks that function as a conduit of information flow.

Further analysis shows that the outperformance of directors is not due to short term profits that are concentrated around information events, but instead originates from an ability to pick stocks that display surprisingly strong earnings reported up to two years later. Director purchases in interlock stocks, and unconnected stocks where the director has moderate or high status, tend to be followed by positive analyst forecast errors. This result implies that the group of directors has a superior ability to predict future earnings relative to analysts. Moreover, these purchases tend to be concentrated in stocks that realize future ROAs that are significantly better than the average ROA of their industry peers. Overall, our results show that interlocking board connections and a higher status within the corporate network provide access to value relevant information about firms, even when there is no formal connection to the stock traded.

References

Barber, Brad M., and Terrance Odean, 2001, Boys will be boys: Gender, overconfidence, and common stock investment, *Quarterly Journal of Economics* 116, 261–292.

Berkman, Henk, Paul D. Koch, and Joakim Westerholm, 2014, Informed trading through the accounts of children, *Journal of Finance* 69, 363-404.

Bhattacharya, Utpal, and Hazem Daouk, 2002, The world price of insider trading, *Journal of Finance* 57, 75–108.

Brown, Jeffrey R., Zoran Ivkovic, Paul A. Smith, and Scott Weisbenner, 2008, Neighbors matter: Causal community effects and stock market participation, *Journal of Finance* 63 (3), 1509–1531.

Cai, Ye, and Merih Sevilir, 2012, Board connections and M&A transactions, *Journal of Financial Economics* 103, 327–349.

Clacher, I., D. Hillier, and S. Lhaopadchan, 2009. Corporate insider trading: A literature review. *Spanish Journal of Finance and Accounting* 38 (143), 373–397.

Cohen, Lauren, Andrea Frazzini, and Christopher Malloy, 2008, The small world of investing: Board connections and mutual fund returns, *Journal of Political Economy* 116, 951–979.

Døskeland, Trond M., and Hans K. Hvide, 2011, Do individual investors have asymmetric information based on work experience? *Journal of Finance* 66, 1011–1041.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.

Fidrmuc, Jana P., Marc Goergen, and Luc Renneboog, 2006, Insider trading, news releases, and ownership concentration, *The Journal of Finance* 61 (6), 2931–2973.

Fracassi, Cesare, 2012, Corporate finance policies and social networks, University of Texas Working Paper.

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

Grinblatt, Mark, Matti Keloharju, and Juhani Linnainma, 2011, IQ and stock market participation, *Journal of Finance* 66, 2121–2164.

_____, 2012, IQ, trading behavior, and performance, *Journal of Financial Economics*, 104, 339–362.

Hong, Harrison, Jeffrey D. Kubik, and Jeremy C. Stein, 2005, Thy neighbor's portfolio: Word-of-mouth effects in the holdings and trades of money managers, *The Journal of Finance* 60, 2801–2824.

Ivkovic, Zoran, and Scott Weisbenner, 2007, Information diffusion effects in individual investors' common stock purchases: Covet they neighbors' investment choices, *Review of Financial Studies* 20, 1327–1357.

_____, 2005, Local does as local is: Information content of the geography of individual investors' common stock investments, *Journal of Finance* 60, 267–306.

Jaffe, Jeffrey F., 1974, Special information and insider trading, *Journal of Business* 47, 410–428.

Lakonishok, Josef, and Inmoo Lee, 2001, Are insider trades informative? *Review of Financial Studies* 14 (1, Spring), 79–111.

Larcker, David F., Eric C. So, and Charles C. Y. Wang, 2013, Boardroom centrality and firm performance, *Journal of Accounting and Economics* 55, 225–250.

Livnat, Joshua, and Richard R. Mendenhall, 2006, Comparing the post-earnings announcement drift for surprises calculated from analyst and time series forecasts, *Journal of Accounting Research* 44, 177–205.

Lorie, James H., and Victor Niederhoffer, 1968, "Predictive and statistical properties of insider trading," *Journal of Law and Economics* 11, (No. 1), 35-53.

Ozsoylev, Han N., Johan Walden, M. Deniz Yavuz, and Recep Bildik, 2014, Investor networks in the stock market, *Review of Financial Studies*, forthcoming.

Ravina, Enrichetta, and Paola Sapienza, 2010, What do independent directors know? Evidence from their trading. *Review of Financial Studies* 23 (3), 962–1003.

Rozeff, Michael S., and Mir A. Zaman, 1988, Market efficiency and insider trading: New evidence, *Journal of Business* 61, 25–44.

_____, 1998, Overreaction and insider trading, *Journal of Finance* 53, 701–716.

Seyhun, H. Nejat, 1986, Insiders' profits, costs of trading, and market efficiency, *Journal of Financial Economics* 16, 189–212.

Shiller, Robert J., and John Pound, 1989, Survey evidence on the diffusion of interest and information among investors, *Journal of Economic Behavior* 12, 47–66.

Figure 1. Classification Schemes based on Connection of Director to Stock and Status of Director in Network

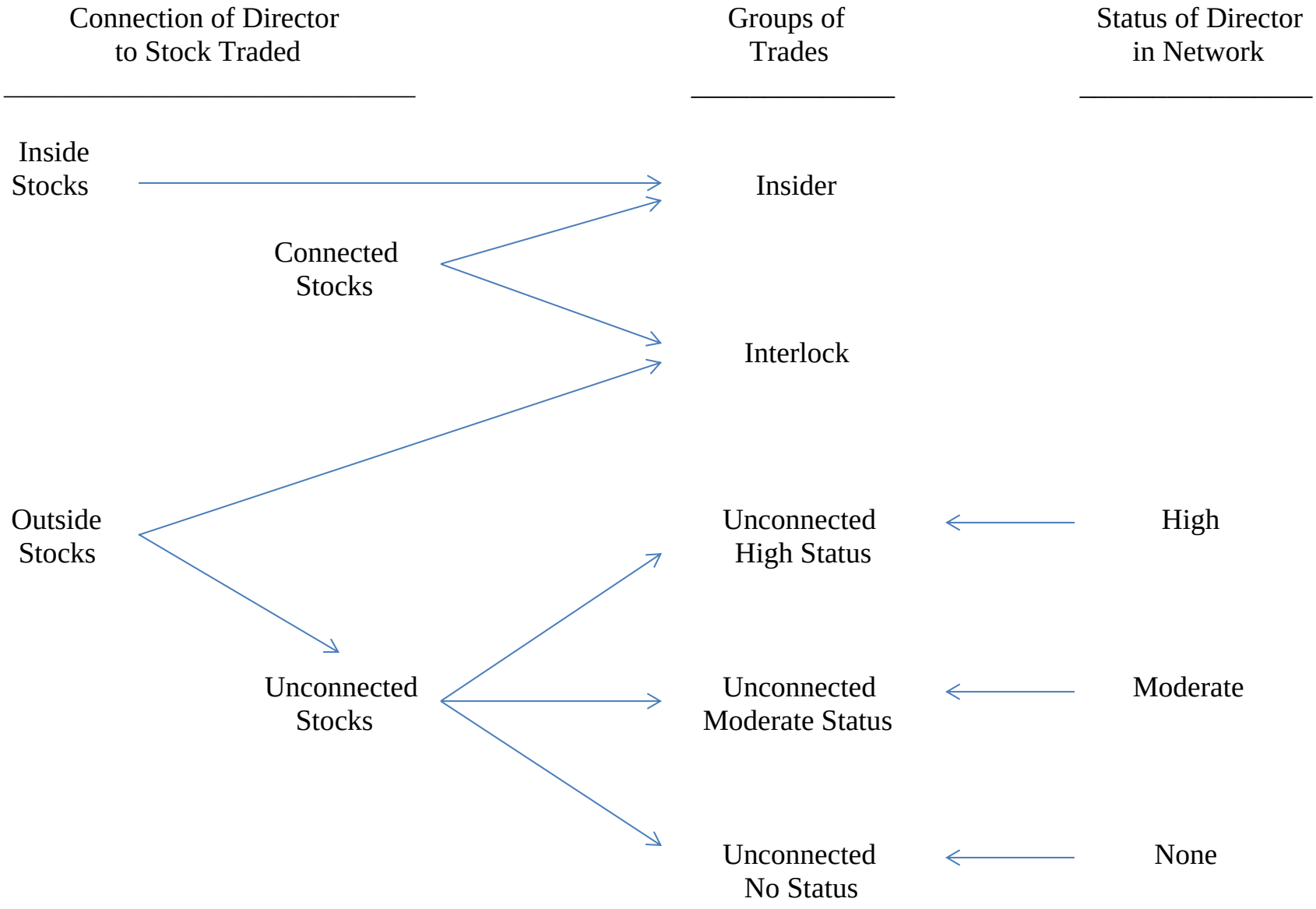

Table 1. Sample Characteristics for Different Types of Trades by Directors or Their Family Members

This table summarizes the relative frequency and attributes of different types of trades by directors or their family members. The different types of trades include: (i) insider trades in the director's own company, (ii) trades in the company of a fellow director with an interlock board connection, (iii) unconnected trades when the director has high status, (iv) unconnected trades when the director has moderate status, and (v) unconnected trades when the director has no status in the corporate network. In the bottom row, we also present the characteristics of trades by all other retail accounts in Finland that are not identified as directors or their family members. The first column reports the total number of trading days across all stocks and individual accountholders for every group of trades during the sample period covering 1997 - 2011. The second column gives the percent of total trading days by all accountholders that are attributable to every group of trades. The third column shows the percent of stock trading days in each group for which the accountholder was a net buyer. Columns 4 and 5 report the number of shares bought and sold, respectively, on the average trading day for each group. Column 6 provides the percent of stock trading days in each group made by female accountholders. The last two columns give the mean age and the median wealth (i.e., account size in € as of Jan. 5, 2005) for the accountholders who trade in every category.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
trade category (i)	# Trades (n_i)	% Trades (n_i / N)*100	% $buys_i$ (#$buys_i$ / n_i)*100	avg vol. bought (# shares traded)	avg volume sold (# shares traded)	% of Trades by Females	Mean Age	Median Wealth (€)
Director Trades								
Insider	3,614	0.021%	58.7%	11,339	63,862	6.7%	53	259,455
Interlock	2,802	0.016%	56.0%	4,413	6,946	6.2%	55	315,588
Unconnected High	9,832	0.057%	54.5%	5,339	7,449	7.4%	53	353,811
Unconnected Moderate	22,415	0.130%	57.2%	3,678	5,507	5.7%	54	356,397
Unconnected No Status	18,580	0.108%	54.2%	3,316	5,504	6.9%	50	199,037
Family Trades								
Insider	543	0.003%	65.4%	4,743	12,177	52.6%	39	146,140
Interlock	803	0.005%	59.7%	3,898	3,830	35.5%	36	245,375
Unconnected High	1,923	0.011%	58.4%	4,185	5,227	52.0%	34	91,532
Unconnected Moderate	4,437	0.026%	59.7%	2,636	3,719	62.4%	39	128,929
Unconnected No Status	3,655	0.021%	51.9%	1,953	2,350	50.0%	41	106,187
All Retail Trades	17,177,438	99.602%	58.1%	980	1,269	17.3%	49	23,161
Total Trades (N)	17,246,042							

Table 2. Likelihood of Directors or Family Members making Different Types of Trades

This Table presents the results of estimating the following panel logit model:

$$\text{Log}\{(\text{Trade}_{i,e,y} = 1)/(\text{Trade}_{i,e,y} = 0)\} = a_0 + a_1\,\text{Insider}_{i,e,y} + a_2\,\text{Interlock}_{i,e,y} + a_3\,\text{Unconnected_High}_{e,y} + a_4\,\text{Unconnected_Moderate}_{e,y} + a_5\,\text{Same_PostCode}_{i,e,y} + a_6\,\text{Industry}_{i,e,y} + a_7\,\text{Wealth}_{e,y}. \quad (1)$$

The variables are described in section III. The subscript, *i*, refers to the stock traded, while *e* points to the director associated with the trade, and *y* represents the year of the trade. This analysis reveals how the level of a director's connection to a company affects the probability of the director or his family members trading the shares of that type of company in any given year. This model also controls for: (i) the status of the director within the network, (ii) whether company headquarters are located in the same postcode as the accountholder, (iii) whether the industry of the stock traded is an area of expertise of the director, and (iv) the wealth of the accountholder. This model is estimated separately for the two samples of trades by directors and by their family members, and the results are presented in Panels A and B, respectively. We also include age dummies and fixed effects for the director or family member, the firm, and the year.

Panel A. Trades by Directors

		Coefficient	p-value
Intercept	a_0	-2.826	0.00
Insider	a_1	1.460	0.00
Interlock	a_2	0.061	0.00
Unconnected_High	a_3	-0.123	0.00
Unconnected_Moderate	a_4	-0.102	0.00
Same_Postcode_Director	a_5	0.057	0.00
Industry_Director	a_6	0.029	0.02
Wealth_Director	a_7	0.007	0.00
Age30_Director		0.217	0.00
Age3140_Director		0.137	0.00
Age4150_Director		0.061	0.03
Age5160_Director		0.009	0.62
Director Fixed Effects		Yes	
Firm Fixed Effects		Yes	
Year Fixed Effects		Yes	
% Concordant		86%	

Panel B. Trades by Family Members

		Coefficient	p-value
Intercept	a_0	-2.904	0.00
Insider	a_1	1.105	0.00
Interlock	a_2	0.164	0.00
Unconnected_High	a_3	-0.009	0.72
Unconnected_Moderate	a_4	-0.160	0.00
Same_Postcode_Family	a_5	0.015	0.55
Industry_Director	a_6	0.549	0.11
Wealth_Director	a_7	-0.002	0.00
Age30_Director		-0.353	0.01
Age3140_Director		-0.061	0.44
Age4150_Director		-0.013	0.82
Age5160_Director		-0.120	0.00
Wealth_ Family		0.005	0.00
Age30_Family		0.654	0.00
Age3140_Family		0.302	0.00
Age4150_Family		0.203	0.00
Age5160_ Family		0.226	0.00
Family Member Fixed Effects		Yes	
Firm Fixed Effects		Yes	
Year Fixed Effects		Yes	
% Concordant		85%	

Table 3. Event Study Approach: Performance by Directors Who Are More or Less Connected to the Stock Traded

Panels A - C of this Table present the mean and median cumulative abnormal returns (CARs) following different types of trades by directors. First we define the daily size-adjusted abnormal return for every stock as the actual return minus the equally-weighted mean return across all Finnish firms in the same size quintile (but excluding the stock in question). Then, for each director we calculate the mean CARs following all trades over several windows covering the next 5, 10, 20, 60, 120 and 250 trading days, respectively. We separately examine sales and purchases by each director, for three categories of trades: (i) insider trades, (ii) interlock trades, and (iii) all unconnected trades. For each group of trades, we first compute the mean CAR for every director, and then calculate the average of these mean CARs across all directors. The t-statistics are based on the standard deviation of these average CARs for each trade category. N is the number of different directors that have at least one trade, for each category.

Panel D provides the differential performance of interlock trades versus unconnected trades made by the same director. We first isolate the subset of director accounts that make both interlock trades and unconnected trades. We then estimate the panel regression model specified below in equation (2), that analyzes the mean CAR per director across the two types of sales or purchases made by each director.

Panel A. Performance of Insider Trades by Directors

CARs after Insider Sales

Window	Mean	t-stat	Median	N
(1,5)	0.0%	0.2	-0.3%	214
(1,10)	0.3%	0.8	0.0%	214
(1,20)	0.6%	1.3	0.5%	214
(1,60)	0.4%	0.4	0.2%	214
(1,120)	0.3%	0.2	0.4%	213
(1,250)	1.0%	0.5	1.8%	212

CARs after Insider Purchases

Window	Mean	t-stat	Median	N
(1,5)	0.1%	0.6	-0.1%	349
(1,10)	0.2%	0.7	0.1%	349
(1,20)	0.8%	2.5	0.4%	349
(1,60)	2.5%	4.1	1.7%	349
(1,120)	4.0%	4.2	3.5%	349
(1,250)	6.9%	4.8	5.7%	349

Panel B. Performance of Interlock Trades by Directors

CARs after Sales of Interlocks

Window	Mean	t-stat	Median	N
(1,5)	-0.2%	-0.8	-0.1%	194
(1,10)	-0.1%	-0.4	-0.1%	194
(1,20)	-0.3%	-0.7	0.5%	194
(1,60)	-1.4%	-1.7	-0.8%	194
(1,120)	-1.7%	-1.4	-0.6%	192
(1,250)	1.0%	0.6	0.0%	191

CARs after Purchases of Interlocks

Window	Mean	t-stat	Median	N
(1,5)	0.6%	2.6	0.4%	205
(1,10)	0.7%	2.5	0.3%	205
(1,20)	0.7%	1.6	0.5%	205
(1,60)	3.0%	3.4	1.3%	205
(1,120)	3.1%	2.6	2.5%	205
(1,250)	4.8%	2.9	4.3%	205

Panel C. Performance of All Unconnected Trades by Directors

CARs after Unconnected Sales

Window	Mean	t-stat	Median	N
(1,5)	-0.1%	-0.7	-0.2%	418
(1,10)	-0.1%	-0.7	-0.1%	418
(1,20)	0.0%	-0.2	-0.1%	418
(1,60)	0.0%	0.0	0.1%	415
(1,120)	-0.1%	-0.1	-0.3%	414
(1,250)	0.1%	0.1	-0.5%	414

CARs after Unconnected Purchases

Window	Mean	t-stat	Median	N
(1,5)	0.3%	4.1	0.2%	405
(1,10)	0.4%	3.6	0.3%	405
(1,20)	0.6%	3.0	0.5%	405
(1,60)	1.1%	3.1	1.0%	405
(1,120)	0.9%	1.9	1.0%	405
(1,250)	0.0%	0.1	0.1%	405

Table 3, continued

Panel D. Differential Performance of Interlock Trades versus Unconnected Trades

This Panel presents the estimates of α_1 from the following panel regression model:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{ Interlock}_e + \text{Director Fixed Effects} + \varepsilon_{e,i}, \quad (2)$$

applied to the subsample of all director accounts that make both interlock trades and unconnected trades. The coefficient, α_1, is the difference of the mean CARs across these two types of trades.

Differential Performance after Sales

Window	α_1	t-stat	N
(1,5)	-0.1%	-0.5	188
(1,10)	-0.1%	-0.2	
(1,20)	-0.5%	-0.9	
(1,60)	-1.7%	-1.9	
(1,120)	-1.8%	-1.4	
(1,250)	1.4%	0.7	

Differential Performance after Purchases

Window	α_1	t-stat	N
(1,5)	0.3%	0.6	200
(1,10)	0.2%	0.5	
(1,20)	0.3%	0.6	
(1,60)	1.6%	1.7	
(1,120)	2.5%	2.0	
(1,250)	5.5%	2.9	

Table 4. Event Study Approach: Performance of Unconnected Trades by Directors with Higher or Lower Status in the Corporate Network

Panels A - C of this Table present the mean and median CARs following trades by directors in unconnected stocks, partitioned into those made by directors with high, moderate, or no status. We calculate the mean CARs for each category of trades over several different windows covering the next 5, 10, 20, 60, 120, and 250 trading days, respectively. We separately examine sales and purchases by each director. For each group of trades, we first compute the mean CAR for every director, and then calculate the average of these mean CARs across all directors in the group. The t-statistics are based on the standard deviation of these average CARs, for each trade category. N is the number of different directors that have at least one trade, for each category.

Panel D gives the differential performance of unconnected trades by directors with high or moderate status, relative to those made by directors with no status. We obtain this information by estimating the panel regression model specified below in equation (3), that analyzes the mean CAR per director across unconnected sales or purchases by directors with different levels of status within the corporate network.

Panel A. Performance of Unconnected Trades by Directors with High Status

CARs after Unconnected Sales

Window	Mean	t-stat	Median	N
(1,5)	0.2%	0.8	0.0%	154
(1,10)	0.0%	-0.1	-0.2%	154
(1,20)	0.5%	0.8	0.1%	154
(1,60)	0.9%	1.1	0.2%	154
(1,120)	0.6%	0.6	0.3%	152
(1,250)	1.1%	0.6	-0.2%	151

CARs after Unconnected Purchases

Window	Mean	t-stat	Median	N
(1,5)	0.3%	1.6	0.1%	154
(1,10)	0.7%	2.3	0.2%	154
(1,20)	0.9%	3.0	0.5%	154
(1,60)	2.7%	4.1	2.1%	154
(1,120)	3.6%	4.1	3.1%	154
(1,250)	4.6%	3.3	3.4%	154

Panel B. Performance of Unconnected Trades by Directors with Moderate Status

CARs after Unconnected Sales

Window	Mean	t-stat	Median	N
(1,5)	0.0%	-0.1	-0.1%	305
(1,10)	-0.1%	-0.5	0.1%	305
(1,20)	0.2%	0.5	0.1%	305
(1,60)	0.5%	0.6	0.3%	304
(1,120)	0.8%	0.7	-0.3%	300
(1,250)	0.4%	0.2	0.2%	296

CARs after Unconnected Purchases

Window	Mean	t-stat	Median	N
(1,5)	0.5%	2.5	0.2%	312
(1,10)	0.7%	2.9	0.4%	312
(1,20)	0.9%	3.2	0.7%	312
(1,60)	1.2%	2.6	1.1%	312
(1,120)	0.9%	1.5	0.9%	312
(1,250)	0.8%	0.7	1.6%	311

Panel C. Performance of Unconnected Trades by Directors with No Status

CARs after Unconnected Sales

Window	Mean	t-stat	Median	N
(1,5)	0.0%	0.2	-0.1%	304
(1,10)	0.2%	1.0	0.0%	304
(1,20)	0.2%	0.7	0.1%	304
(1,60)	0.6%	1.0	0.7%	302
(1,120)	0.5%	0.6	0.9%	299
(1,250)	-0.5%	-0.3	0.4%	298

CARs after Unconnected Purchases

Window	Mean	t-stat	Median	N
(1,5)	0.4%	2.8	0.2%	282
(1,10)	0.3%	1.3	0.2%	282
(1,20)	0.5%	1.5	0.3%	282
(1,60)	1.0%	1.9	1.1%	282
(1,120)	0.2%	0.3	1.6%	282
(1,250)	-0.7%	-0.6	2.0%	282

Table 4, continued

Panel D. Differential Performance of Unconnected Trades Made by Directors with Moderate or High Status versus Those Made By Directors with No Status

This Panel presents the estimates of α_1 and α_2 from the following panel regression model:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{Unconnected_Moderate}_e + \alpha_2 \text{Unconnected_High}_e + \text{Director Fixed Effects} + \varepsilon_{e,i}, \quad (3)$$

applied to the sample of all unconnected trades by directors. The omitted group captured by the intercept is the set of unconnected trades made by directors with no status. The coefficient, α_1 (or α_2), indicates the difference across the mean CARs between the groups of unconnected trades made by directors with moderate (or high) status versus those made by directors with no status.

Differential Performance after Sales					Differential Performance after Purchases				
Window	α_1	t-stat	α_2	t-stat	Window	α_1	t-stat	α_2	t-stat
(1,5)	0.0%	-0.1	0.3%	0.7	(1,5)	0.0%	0.2	-0.3%	-0.8
(1,10)	-0.4%	-1.0	0.0%	0.1	(1,10)	0.3%	0.8	0.2%	0.4
(1,20)	-0.4%	-0.5	0.4%	0.4	(1,20)	0.2%	0.4	0.2%	0.3
(1,60)	-0.4%	-0.4	0.7%	0.5	(1,60)	0.3%	0.4	1.3%	1.3
(1,120)	0.6%	0.4	0.7%	0.3	(1,120)	0.6%	0.6	3.1%	2.2
(1,250)	0.6%	0.2	0.9%	0.3	(1,250)	2.1%	1.2	4.9%	2.2

Table 5. Calendar Time Portfolio Approach: Performance of Different Types of Trades by Directors

We build ten portfolios (*p*) each day to mimic the recent trading behavior behind the different groups of director trades (i.e., five director buy portfolios and five director sell portfolios). First, each trading day (*t*) we identify all director accounts (*e*) that trade any given stock (*i*) in the preceding three months, covering calendar days *t-90* to *t-1*. Second, for every such director account (*e*), we aggregate all trades in the stock (*i*) during this period, to determine whether that account was a net buyer or net seller. Third, we partition all trades into the five categories: i) insider trades; ii) interlock trades, and unconnected trades made by directors with (iii) high status, iv) moderate status, and v) no status. Fourth, for every trade category, on each day (*t*) we allocate a given stock (*i*) into the 'director buy portfolio' if more directors are net buyers than net sellers of that stock, or into the 'director sell portfolio' if more directors are net sellers. Finally, we calculate the equally weighted portfolio return on day *t* ($R_{p,t}$) for each of the ten director portfolios, and we analyze the performance of these ten portfolios (*p*) using the Fama-French 3-factor model. We present these regression results in Panels A and B for the director sell portfolios and buy portfolios, respectively. N is the number days in the sample period. Panels C and D provide the analogous 1-day alphas for the director sell and buy portfolios, respectively, using different portfolio formation periods that range from 7 calendar days to 365 calendar days. Panels C and D also present the 1-month alphas from similar analysis based on 1-month returns for the director sell and buy portfolios formed over the previous 3 months.

Panel A. Daily Fama-French Regressions for the Director Sell Portfolios

Dependent Variable: Daily Return on Portfolio of	Portfolio Formation Period = previous 90 calendar days				
	1-day α (%)	RM_RF	SMB	HML	R^2 / N
Insider Sales	.027	.76	.26	-.26	.30
t-ratio	1.0	34.3	7.2	-7.8	3,660
Interlocking Sales	.012	.88	.04	-.11	.41
t-ratio	0.5	41.7	1.2	-3.6	3,428
Unconnected Sales	-.001	.88	.11	-.03	.62
by Directors with High Status	-0.1	69.7	5.4	-1.4	3,766
Unconnected Sales	.001	.82	.14	-.04	.67
by Directors with Moderate Status	0.1	77.9	8.1	-2.4	3,769
Unconnected Sales	.005	.79	.14	-.09	.67
by Directors with No Status	0.4	77.3	8.5	-5.8	3,770
Hedge Portfolio 1: Long Interlock Stocks Sold by Directors, and Short Unconnected Stocks Sold by Directors with No Status					
Return on Hedge Portfolio 1	.006	.08	-.13	-.01	.02
t-ratio	0.3	2.7	-2.5	-0.2	3,429
Hedge Portfolio 2: Long Unconnected Stocks Sold by Directors with High Status and Short Unconnected Stocks Sold by Directors with No Status					
Return on Hedge Portfolio 2	-.007	.09	-.02	.07	.02
t-ratio	-0.4	4.4	-0.6	1.4	3,766

Table 5, continued

Panel B. Daily Fama-French Regressions for the Director Buy Portfolios

Dependent Variable: Daily Return on Portfolio of	Portfolio Formation Period = previous 90 calendar days				
	1-day α (%)	RM_RF	SMB	HML	R^2 / N
Insider Purchases	.053	.83	.20	.02	.44
t-ratio	2.7	49.1	7.4	0.9	3,624
Interlocking Purchases	.059	1.06	.18	-.14	.53
t-ratio	2.6	55.2	5.8	-4.9	3,540
Unconnected Purchases	.054	.95	.03	-.02	.72
by Directors with High Status	4.1	85.4	1.5	-1.2	3,767
Unconnected Purchases	.026	.91	.14	-.01	.77
by Directors with Moderate Status	2.4	101.1	10.1	-0.4	3,771
Unconnected Purchases	.022	.88	.12	-.01	.78
by Directors with No Status	2.1	102.3	9.0	-0.5	3,771
Hedge Portfolio 1: Long Interlock Stocks Purchased by Directors, and Short Unconnected Stocks Purchased by Directors with No Status					
Return on Hedge Portfolio 1	.036	.19	.06	-.14	.04
t-ratio	1.9	6.8	1.3	-2.7	3,541
Hedge Portfolio 2: Long Unconnected Stocks Purchased by Directors with High Status, and Short Unconnected Stocks Purchased by Directors with No Status					
Return on Hedge Portfolio 2	.033	.08	-.10	-.01	.05
t-ratio	2.6	5.7	-4.4	-0.5	3,767

Table 5, continued

Panel C. One-Day Alphas for the Director Sell Portfolios using Different Formation Periods, and One-Month Alphas

Dependent Variable: Return on Portfolio of	1-day Alphas (%), F-F 3 Factor						1-month Alphas (%)	
	Portfolio Formation Period (number of calendar days)						Formation Period = 3 months	
	7 days	14 days	30 days	90 days	180 days	365 days	F-F 3 Factor	F-F 3 + UMD
Insider Sales	.02	.00	.06	.03	-.01	.01	-.29	-.25
t-ratio	0.4	-0.1	1.5	1.0	-0.3	0.6	-0.7	-0.6
Interlocking Sales	-.03	.04	-.01	.01	-.02	.03	.02	.11
t-ratio	-0.5	0.8	-0.2	0.5	-1.0	1.3	0.1	0.2
Unconnected Sales	-.01	.01	.01	.00	.00	.01	.08	.15
by Directors with High Status	-0.3	0.4	0.4	-0.1	-0.2	0.8	0.3	0.6
Unconnected Sales	-.02	-.01	.00	.00	.02	.02	.12	.12
by Directors with Moderate Status	-1.1	-0.7	-0.1	0.1	1.5	2.1	0.5	0.6
Unconnected Sales	-.03	-.02	.00	.00	.02	.01	.20	.19
by Directors with No Status	-1.3	-1.5	-0.2	0.4	1.5	1.1	1.0	0.9

Panel D. One-Day Alphas for the Director Buy Portfolios using Different Formation Periods, and One-Month Alphas

Dependent Variable: Return on Portfolio of	1-day Alphas (%), F-F 3 Factor						1-month Alphas (%)	
	Portfolio Formation Period (number of calendar days)						Formation Period = 3 months	
	7 days	14 days	30 days	90 days	180 days	365 days	F-F 3 Factor	F-F 3 + UMD
Insider Purchases	.01	.05	.02	.05	.03	.02	.90	1.17
t-ratio	0.3	1.4	0.8	2.6	2.1	1.7	2.5	3.3
Interlocking Purchases	.12	.07	.08	.06	.05	.04	.78	.96
t-ratio	2.4	1.8	2.3	2.5	2.4	2.5	1.8	2.1
Unconnected Purchases	.10	.09	.06	.05	.06	.04	.73	1.01
by Directors with High Status	3.7	4.2	3.8	4.1	4.8	3.8	2.5	3.6
Unconnected Purchases	.08	.05	.04	.03	.02	.01	.43	.68
by Directors with Moderate Status	4.6	3.3	3.1	2.4	2.2	1.4	1.9	3.1
Unconnected Purchases	.06	.04	.03	.02	.02	.01	.29	.57
by Directors with No Status	3.2	2.5	2.9	2.1	1.7	1.5	1.3	3.0

Table 6. Event Study Approach: Performance by the Family Members of Directors Who Are More or Less Connected to the Stock Traded

Panels A - C of this Table present the mean and median CARs following different types of trades by the family members of directors. For all family accounts associated with each director, we calculate the mean CARs following all trades over several different windows covering the next 5, 10, 20, 60, 120 and 250 trading days, respectively. We separately examine sales and purchases by the family members of each director, for three categories of trades: (i) insider trades, (ii) interlock trades, and (iii) all unconnected trades. For each group of trades, we first compute the average CAR for the family members of every director, and then calculate the mean (or median) of these average family CARs across all directors. The t-statistics are based on the standard deviation of these mean family CARs, for each trade category. N is the number of different directors that have at least one family member trade, for each category.

Panel D provides the differential performance of interlock trades versus unconnected trades made by family members of the same director, applied to the subset of accounts where family members make both interlock trades and unconnected trades. Panel E gives the differential performance of family members versus directors when they trade inside stocks or interlock stocks, applied to the subset of trades where the family member and the related director both make similar trades in connected stocks.

Panel A. Performance of Insider Trades by the Family Members of Directors

CARs after Insider Sales

Window	Mean	t-stat	Median	N
(1,5)	0.0%	0.0	-0.4%	34
(1,10)	0.0%	0.0	0.1%	34
(1,20)	-1.4%	-1.1	-0.8%	34
(1,60)	-2.9%	-1.2	-3.6%	34
(1,120)	-3.3%	-1.0	-6.6%	34
(1,250)	0.9%	0.2	-2.0%	34

CARs after Insider Purchases

Window	Mean	t-stat	Median	N
(1,5)	2.1%	2.9	0.6%	36
(1,10)	2.6%	2.9	1.7%	36
(1,20)	2.8%	2.3	0.8%	36
(1,60)	12.1%	3.6	8.0%	36
(1,120)	12.3%	3.0	9.0%	36
(1,250)	17.1%	2.6	4.6%	36

Panel B. Performance of Interlock Trades by the Family Members of Directors

CARs after Sales of Interlocks

Window	Mean	t-stat	Median	N
(1,5)	-1.1%	-1.6	-0.4%	31
(1,10)	0.3%	0.4	-0.3%	31
(1,20)	1.6%	1.3	1.0%	31
(1,60)	3.3%	1.2	5.9%	31
(1,120)	7.8%	2.1	5.1%	30
(1,250)	11.0%	1.8	12.2%	30

CARs after Purchases of Interlocks

Window	Mean	t-stat	Median	N
(1,5)	0.7%	1.2	0.0%	42
(1,10)	1.3%	1.8	0.8%	42
(1,20)	3.0%	2.3	1.4%	42
(1,60)	8.2%	3.6	5.9%	42
(1,120)	12.5%	3.2	10.3%	42
(1,250)	17.3%	3.4	15.0%	42

Panel C. Performance of All Unconnected Trades by Family Members of Directors

CARs after Unconnected Sales

Window	Mean	t-stat	Median	N
(1,5)	0.2%	0.8	-0.1%	82
(1,10)	0.4%	1.0	0.1%	82
(1,20)	0.7%	1.0	0.2%	82
(1,60)	0.4%	0.3	-0.1%	82
(1,120)	0.6%	0.4	-1.1%	82
(1,250)	-4.7%	-1.5	-2.7%	82

CARs after Unconnected Purchases

Window	Mean	t-stat	Median	N
(1,5)	0.6%	1.9	0.3%	78
(1,10)	1.1%	2.6	0.7%	78
(1,20)	1.4%	2.8	0.9%	78
(1,60)	0.8%	1.3	0.2%	78
(1,120)	1.4%	1.4	0.4%	78
(1,250)	0.1%	0.1	-1.4%	78

Table 6, continued

Panel D. Differential Performance of Interlock Trades versus Unconnected Trades by the Family Members of Directors

This Panel presents the estimates of α_1 from the following panel regression model:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{ Interlock}_e + \text{Director Fixed Effects} + \varepsilon_{e,i}, \qquad (2)$$

applied to the subsample of all director accounts where family members make both interlock trades and unconnected trades. The coefficient, α_1, is the difference of the mean CARs across the two types of trades.

Differential Performance after Sales

Window	α_1	t-stat	N
(1,5)	-0.9%	-1.2	31
(1,10)	0.3%	0.4	
(1,20)	1.3%	0.9	
(1,60)	3.0%	1.0	
(1,120)	7.2%	1.5	
(1,250)	14.3%	2.1	

Differential Performance after Purchases

Window	α_1	t-stat	N
(1,5)	0.3%	0.5	42
(1,10)	0.6%	0.7	
(1,20)	2.0%	1.4	
(1,60)	7.7%	3.2	
(1,120)	12.1%	3.0	
(1,250)	19.8%	3.7	

Panel E. Differential Performance of Family Members versus Directors when Both Trade Stocks with an Insider or Interlock Connection

This Panel presents the estimates of α_1 from the following panel regression model:

$$CAR_{e,i} = \alpha_0 + \alpha_1 \text{ Family}_e + \text{Director Fixed Effects} + \varepsilon_{e,i}, \qquad (5)$$

applied to the subsample of all trades where the family member and the related director both make similar trades in connected stocks. The coefficient, α_1, indicates the difference of the mean CARs across family accounts versus director accounts, when both make similar trades in stocks with an insider or interlock connection.

Differential Performance after Sales

Window	α_1	t-stat	N
(1,5)	0.1%	0.1	54
(1,10)	0.5%	0.7	
(1,20)	-0.2%	-0.2	
(1,60)	0.0%	0.0	
(1,120)	0.5%	0.2	
(1,250)	3.3%	0.6	

Differential Performance after Purchases

Window	α_1	t-stat	N
(1,5)	0.6%	1.3	58
(1,10)	1.1%	1.8	
(1,20)	0.6%	0.7	
(1,60)	3.9%	2.4	
(1,120)	6.1%	2.4	
(1,250)	8.0%	2.1	

Table 7. Calendar Time Portfolio Approach: Trades by Family Members

In this approach, we build a set of ten portfolios (*p*) each day that mimic the recent trading behavior behind the different groups of trades by family members of directors (i.e., five family buy portfolios and five family sell portfolios). First, each trading day (*t*) we identify all family accounts that trade any given stock (*i*) during the preceding days, *t-x to t-1*, where the portfolio formation period (*x*) ranges from 7 to 365 calendar days. Second, for all related family members' trades in the stock (*i*) during this period, we determine whether the families were net buyers or net sellers. Third, we partition all trades into the five categories: i) insider trades, ii) interlock trades, and unconnected trades made by the family of directors with (iii) high status, iv) moderate status, and v) no status. Fourth, for every trade category, on each day (*t*) we allocate a given stock (*i*) into the 'family buy portfolio' if more family accountholders are net purchasers rather than net sellers of that stock, or into the 'family sell portfolio' if more family accounts are net sellers. Finally, we calculate the equally weighted portfolio return on day *t* ($R_{p,t}$) for each of the ten family portfolios (*p* = 1-10), and we analyze the return performance of these ten portfolios, using the Fama-French 3-factor model. On the left side of Panels A and B, we present the 1-day alphas from the 3-factor model for the family sell portfolios and buy portfolios, respectively, using the different portfolio formation periods. On the right side of Panels A and B, we provide the analogous 1-month alphas from similar analysis based on 1-month returns for the family sell and buy portfolios formed over the previous three months.

Panel A. One-Day Alphas for the Family Sell Portfolios using Different Formation Periods, and One-Month Alphas

Dependent Variable: Return on Portfolio of	1-day Alphas (%), F-F 3 Factor						1-month Alphas (%)	
	Portfolio Formation Period (number of calendar days)						Formation Period = 90 days	
	7 days	14 days	30 days	90 days	180 days	365 days	F-F 3 Factor	F-F 3 + UMD
Insider Sales	-.03	-.10	-.15	-.06	-.03	.05	-.78	-.57
t-ratio	-0.2	-0.8	-1.9	-1.0	-0.7	1.5	-0.6	-0.5
Interlocking Sales	-.05	.00	.01	.03	.02	.01	.98	.77
t-ratio	-0.7	-0.1	0.4	0.9	0.7	0.5	1.8	1.4
Unconnected Sales	-.05	-.06	-.03	-.04	-.03	.01	-.05	.35
Directors with High Status	-0.8	-1.3	-0.8	-1.4	-1.4	0.5	-0.1	0.7
Unconnected Sales	.00	-.03	.02	.00	.02	.02	.07	.08
Directors with Moderate Status	0.1	-0.7	0.7	0.1	1.4	1.3	0.2	0.2
Unconnected Sales	.08	.07	.03	.00	.01	.01	.03	.17
Directors with No Status	1.7	1.9	0.8	-0.2	0.6	0.8	0.1	0.4

Table 7, continued

Panel B. One-Day Alphas for the Family Buy Portfolios using Different Formation Periods, and One-Month Alphas

Dependent Variable: Return on Portfolio of	1-day Alphas (%), F-F 3 Factor						1-month Alphas (%)	
	Portfolio Formation Period (number of calendar days)						Formation Period = 90 days	
	7 days	14 days	30 days	90 days	180 days	365 days	F-F 3 Factor	F-F 3 + UMD
Insider Purchases	.00	.03	.12	.08	.05	.00	1.43	2.11
t-ratio	0.0	0.3	1.1	1.6	1.2	0.1	1.8	2.8
Interlocking Purchases	.07	.12	.12	.08	.08	.07	1.45	1.59
t-ratio	0.9	2.2	3.0	3.1	3.5	3.5	3.1	3.3
Unconnected Purchases	-.05	.00	.02	.04	.05	.02	1.33	1.82
Directors with High Status	-0.8	-0.1	0.5	1.8	2.5	1.4	2.3	3.3
Unconnected Purchases	.13	.06	.06	.02	.03	.02	.37	.53
Directors with Moderate Status	4.0	2.5	3.0	1.5	2.4	2.0	1.3	1.9
Unconnected Purchases	.10	.08	.06	.02	.03	.02	.38	.62
Directors with No Status	2.4	2.9	3.1	1.1	1.9	1.9	1.3	2.2

Table 8. Event Study: The Performance of Different Types of Trades by Directors Prior To Major Information Events

Panels A - C of this Table present event study analysis of the performance of trades made by directors during the three weeks prior to three kinds of events: earnings announcements, takeover announcements, and large price changes. We consider all events where at least one director trades during one of the three weeks before the event. In the text we further discuss the criteria for selecting the sample for each kind of event. We give the mean size-adjusted cumulative abnormal return on the day of and the day after each type of event, CAR(0,+1), for three types of trades by directors: insider trades, interlock trades, and all unconnected trades.

Panel A. Earnings Announcements

		Mean CAR(0,+1)	t-statistic	# of Events with ≥ 1 trade
1 Week Before	Insider Trades	2.0%	1.7	24
	Interlock Trades	0.2%	0.4	148
	Unconnected Trades	0.0%	0.1	1298
2 Weeks Before	Insider Trades	0.6%	0.6	38
	Interlock Trades	-0.2%	-0.4	148
	Unconnected Trades	-0.1%	-0.5	1262
3 Weeks Before	Insider Trades	1.1%	1.9	70
	Interlock Trades	0.0%	-0.1	149
	Unconnected Trades	0.1%	0.6	1284

Panel B. Merger and Acquisition Announcements

1 Week Before	Insider Trades	3.1%	1.0	3
	Interlock Trades	-1.6%	-2.0	3
	Unconnected Trades	1.3%	1.2	31
2 Weeks Before	Insider Trades	6.2%	3.5	2
	Interlock Trades	-1.1%	-1.5	5
	Unconnected Trades	-1.8%	-0.8	34
3 Weeks Before	Insider Trades	24.2%	1.5	2
	Interlock Trades	-6.4%	-1.4	3
	Unconnected Trades	-1.0%	-0.4	39

Panel C. Large price Changes

1 Week Before	Insider Trades	0.0%	0.0	60
	Interlock Trades	0.0%	0.0	62
	Unconnected Trades	0.8%	1.7	671
2 Weeks Before	Insider Trades	1.3%	0.7	57
	Interlock Trades	-1.4%	-0.9	57
	Unconnected Trades	0.3%	0.7	672
3 Weeks Before	Insider Trades	0.8%	0.5	57
	Interlock Trades	-1.1%	-0.8	71
	Unconnected Trades	0.3%	0.7	638

Table 9. The Abnormal ROA of Firms that Directors Traded in Prior Years

In Panels A and B, we present the average industry-adjusted abnormal return on assets, *Abn(ROA$_{it}$)*, for the firms involved in the different categories of director sales and purchases, respectively, in the two years after those trades. First, we measure the abnormal ROA by considering the ROA of firm (*i*) in year (*t*), *ROA$_{it}$* , and subtracting the mean ROA for all firms in the same industry (GIC code), excluding the firm in question, for the same fiscal year. Second, for the stocks comprising each category of trades by directors, we construct the buy signal or sell signal based on whether more directors are net buyers or sellers of the stock over the one or two years *prior* to the fiscal year of the ROA measurement. Finally, we compute the mean *Abn(ROA$_{it}$)* for the firms involved in the director sell and buy portfolios, respectively, associated with each category of trades, by estimating the following panel dummy regression:

$$Abn(ROA_{it}) = \beta_1 \text{Insider}_{i,e,y} + \beta_2 \text{Interlock}_{i,e,y} + \beta_3 \text{Unconnected_High}_{e,y} + \beta_4 \text{Unconnected_Moderate}_{e,y} + \beta_5 \text{Unconnected_No}_{i,e,y} + \varepsilon_{it}, \quad (6)$$

where the right-hand side variables are (0,1) dummies that identify the stocks in the respective director sell and buy portfolios associated with each category of trades. The t-statistics are based on a panel regression with clustered standard errors by firm (*i*) and year (*t*). The first two columns of Panels A and B present the resulting coefficients, which represent the mean *Abn(ROA)* across the firms that comprise the director sell or buy portfolios, respectively, for each category of trades made in year t-1. In columns 3 and 4 (or 5 and 6) we present the analogous results after winzorizing the *Abn(ROA$_{it}$)* at the 5% and 95% levels across all firms in year t-1 (or t-2). Estimates in **bold** are significant at the .10 level or better.

Panel A. Mean Abnormal ROA of Firms in the Two Years Following Director Sales

Based on:		all trades in year t-1		year t-1, Winzorized		year t-2, Winzorized	
Trade Category		*Abn(ROA)*	t-ratio	*Abn(ROA)*	t-ratio	*Abn(ROA)*	t-ratio
Insider	β_1	1.9%	1.0	0.7%	0.7	0.4%	0.4
Interlock	β_2	**2.2%**	1.7	1.1%	1.2	0.0%	0.0
Unconnected_High	β_3	0.9%	0.7	-0.1%	-0.1	0.5%	0.5
Unconnected_Moderate	β_4	0.6%	0.5	-0.5%	-0.6	-0.2%	-0.2
Unconnected_No Status	β_5	0.7%	0.4	-0.1%	-0.1	0.1%	0.1
n = # of firm obs in panel		1,199		1,199		1,047	

Panel B. Mean Abnormal ROA of Firms in the Two Years Following Director Purchases

Based on:		all trades in year t-1		year t-1, Winzorized		year t-2, Winzorized	
Trade Category		*Abn(ROA)*	t-ratio	*Abn(ROA)*	t-ratio	*Abn(ROA)*	t-ratio
Insider	β_1	**2.8%**	2.5	0.9%	1.3	0.7%	1.1
Interlock	β_2	**3.9%**	3.4	**2.0%**	2.4	**1.7%**	1.9
Unconnected_High	β_3	**4.4%**	4.4	**2.2%**	4.2	**1.4%**	2.0
Unconnected_Moderate	β_4	**3.2%**	2.6	**1.6%**	2.4	**1.4%**	1.8
Unconnected_No Status	β_5	**2.8%**	2.8	**1.0%**	1.7	0.8%	1.4
n = # of firm obs in panel		1,641		1,641		1,465	

Table 10. Analyst Forecast Errors for Firms that Directors Traded the Prior Year

In Panels A and B, we present the mean adjusted decile rank of the analyst forecast error, *Rank(AFE$_{it}$)*, for the firms involved in the different categories of director sales and purchases, respectively, in the year following those trades. First, every year (*t*) we sort the cross section of Finnish earnings announcements into deciles by the analyst forecast error (*AFE$_{it}$*), and we scale these decile ranks to range from -0.5 (for lowest *AFE* decile) to +0.5 (for highest *AFE* decile). Second, for the stocks comprising each category of trades by directors, we construct the buy signal or sell signal based on whether more directors are net buyers or sellers of the stock over the year *prior* to the release of the *earliest* mean analyst forecast associated with an announcement. Finally, we compute the mean *Rank(AFE$_{it}$)* for the firms involved in the director sell and buy portfolios, respectively, associated with each category of trades, by estimating the following panel dummy regression:

$$Rank(AFE_{it}) = \beta_1 \text{ Insider}_{i,e,y} + \beta_2 \text{ Interlock}_{i,e,y} + \beta_3 \text{ Unconnected_High}_{e,y} + \beta_4 \text{ Unconnected_Moderate}_{e,y} + \beta_5 \text{ Unconnected_No}_{i,e,y} + \varepsilon_{it}, \quad (7)$$

where the right-hand side variables are (0,1) dummies that identify the stocks in the respective director sell and buy portfolios associated with each category of trades. The t-statistics are based on a panel regression with clustered standard errors by firm (*i*) and year (*t*). The first two columns in Panels A and B present the resulting coefficients estimated across all Finnish earnings announcements, which represent the mean adjusted ranks, *Rank(AFE*), for the stocks in each category of director trades made in year t-1. Columns 3 and 4 (or columns 5 and 6) present analogous results for the subset of announcements with at least five (or ten) analysts covering the announcement. Estimates in **bold** are significant at the .10 level or better.

Panel A. Mean Rank of Analyst Forecast Errors in the Year Following Director Sales

Based on:		All Announcements in year t-1		Announcements with ≥ 5 Analysts		Announcements with ≥ 10 Analysts	
Trade Category		*Rank(AFE)*	t-ratio	*Rank(AFE)*	t-ratio	*Rank(AFE)*	t-ratio
Insider	β_1	-.033	-1.0	-.017	-0.5	.045	0.9
Interlock	β_2	.019	0.6	.040	1.2	**.066**	1.6
Unconnected_High	β_3	-.006	-0.3	-.002	-0.1	.029	0.9
Unconnected_Moderate	β_4	-.018	-0.7	.003	0.1	.029	0.6
Unconnected_No Status	β_5	-.024	-1.4	.005	0.3	.035	1.1
n = # of firm obs in panel		1,055		749		439	

Panel B. Mean Rank of Analyst Forecast Errors in the Year Following Director Purchases

Based on:		All Announcements in year t-1		Announcements with ≥ 5 Analysts		Announcements with ≥ 10 Analysts	
Trade Category		*Rank(AFE)*	t-ratio	*Rank(AFE)*	t-ratio	*Rank(AFE)*	t-ratio
Insider	β_1	.011	0.6	.026	1.3	**.055**	2.4
Interlock	β_2	**.036**	1.6	**.056**	2.7	**.073**	3.5
Unconnected_High	β_3	**.043**	2.4	**.057**	3.6	**.054**	2.4
Unconnected_Moderate	β_4	**.029**	2.0	**.024**	1.7	**.042**	2.3
Unconnected_No Status	β_5	.012	0.6	.015	0.7	.033	1.2
n = # of firm obs in panel		1,549		1,187		841	

Appendix A. Institutional Features of Insider Trading in Finland

A.1. Insider Trading Regulation in Finland

The first regulation of insider trading in Finland was introduced in the 1989 Securities Market Act (SMA). It was designed to deter corporate insiders, security issuers and other parties from using insider information they might possess. According to the SMA, inside information refers any "information of a precise nature relating to a security subject to public trading or to multilateral trading which has not been made public or which otherwise has not been available in the markets and which is likely to have a material effect on the value of the security."

The sanctions against the abuse of insider information in Finland are regulated in the SMA and the Penal Code. According to the Penal Code, abuse of inside information is prohibited and possible sanctions vary from a fine to an imprisonment of four years. The sanctions in the SMA are lower than those in the Penal Code, but according to the SMA not only intentional but also unintentional use of insider information is prohibited.

In addition to the formal laws against insider trading, insiders are restricted in their trading by the publication, "Guidelines for Insiders," published by Nasdaq OMX Helsinki and guidelines issued by the Finnish Association of Securities Dealers (FASD). In addition, most publicly listed companies in Finland have adopted internal guidelines regarding insider trading, which are often more strict than the guidelines of Nasdaq OMX Helsinki and the FASD.

A.2. Insiders of Finnish Listed Companies

According to the SMA, the ownership of publicly traded securities in Finnish listed companies and information concerning trade executions must be made public if the owner is:

1) a member or deputy member of the board of directors or supervisory board of the company, managing director or deputy managing director, or deputy director, or an employee of an audit organization with main responsibility for the audit of the accounts of the company;

2) any other person belonging to the senior management of the company, who regularly obtains inside information and who has the right to make decisions on the future development and the arrangement of business operations of the company;

3) the spouse of a person referred in paragraphs 1 and 2 above, or a minor whose guardian is the person referred to in paragraph 1 or 2, or another family member of the person referred to in paragraph 1 or 2 who has lived for at least one year in the same household with the person subject to the duty to declare;

4) an organization or foundation in which a person referred to in the paragraphs above, either alone or together with the members of his family, or with another person referred to in the above paragraphs, exercises control directly or indirectly.

A.3. Registration of Trades

According to the SMA (Chapter 5, Section 7), the issuers of securities that are traded on a Finnish stock exchange must maintain a public insider register that presents the holdings and trades of persons subject to the disclosure requirements. These companies may choose where to keep the public register, but this site must be approved by the Finnish Financial Supervisory Authority (FSA), be open for public inspection, and be maintained in its entirety at a single place (FIN-FSA Standard 5.3). Most firms employ Euroclear Finland to maintain their register. Euroclear publishes these registers through its EFI SIRE system.[29] The SIRE system is directly

[29] The Finnish companies that currently do not subscribe to the EFI SIRE system include: Interavanti Oyj, Pohjois-Karjalan Kirjapaino Oyj, Julius Tallberg-Kiinteistöt Oyj, Outokumpu Oyj, QPR Software Oyj, SSK Suomen Säästäjien Kiinteistöt Oyj, Tekla Oyj, Telia Sonera Oyj and Vaahto Group Plc Oyj. If a company does not use the SIRE system, the location of its public register is typically its head office.

linked to a book entry system, so that changes in insider holdings are updated automatically without any delay. In general, information about insider trades is available to the public between four and seven days after the transaction.[30]

The public register of insider holdings includes personal information (including the insider's name) about the insider subject to the disclosure requirement, and information on their holdings of the issuer's securities, as well as all transactions in these securities. Similar information (excluding names) is disclosed for selected other people and organizations related to these company insiders, as discussed above (see section A2). According to FSA Standard 5.3, the public information about insider trades must be available to the public for at least 5 years after the trade has taken place.

Since July 2006, all Finnish listed companies are also obligated to publish their insider registers on the internet (see SMA 5:7 (13.5.2005/297)). However, these trades must be available online for only 12 months. These online registers contain the same information as the public register, and they are available on companies' own web site or on Euroclear's NetSire webpage.

A.4. Supervision of Insider Trading: The Roles of the FSA, Exchange, and the Company

In Finland the supervision of insider trading is executed by three different parties: the FSA, the Nasdaq OMX Helsinki Stock Exchange and the listed companies themselves. The FSA is responsible for regulating and monitoring the Finnish financial and insurance sector, as well as the parties operating in this sector. The FSA seeks to prevent the abuse of insider information, first by regulation, and then by ex-post monitoring and supervision of insider trading activities.

[30] The most settlement period is 3 days. In all cases, changes in ownership by insiders must be made public within seven days following the trade.

Similar to most other national markets, the supervision of insider trading in Finland focuses on suspected cases of abuse of inside information. Information about potential market abuse is obtained from the automated monitoring system or from other market participants.[31] The Nasdaq OMX Helsinki Stock Exchange Insider Guidelines set minimum requirements for the insider trading restrictions. According to the guidelines, permanent insiders shall schedule their trading of securities issued by the company so that their trading will not undermine the public confidence in the securities market. It is recommended that insiders should only trade when the market has all the relevant information about the company, for example, after the publication of interim reports. Insiders are also subject to binding trading restrictions with regard to their own company's stock, during the period from at least 14 days prior to an interim report until publication of such a report. Each listed company has the discretion to define a longer window for such trading by its insiders.

Appendix B. Identification of Insiders

We identify directors in the Euroclear database by first collecting data on "public insider" trades in shares of companies listed on the Nasdaq OMX Helsinki Exchange over the period, July 2005 through February 2010. The data were hand collected from the EFI Sire register, which is available at the customer service point of Euroclear Finland's head office in Helsinki. The EFI Sire register reports insider holdings and transaction data for almost all listed Finnish companies and, at any point in time, has historical data for the past 5 years. The insider register is directly linked to the Euroclear book entry system. The Euroclear database should thus include all transactions made by insiders.

[31] Other market participants could be, for example, a stock broker, a corporate lawyer, or other employee, who are responsible for reporting all suspicious activity to the FSA.

The collected data include the insider's name and position in the company, the transaction date and settlement date, and the number of shares bought or sold. These data also specify whether the trade is done by the insider, a company where the insider exercises controlling power, or by the insider's spouse or underaged children. Multiple trades made by an insider on the same day are netted. For example, if an insider buys 1000 shares and sells 2000 shares on the same day, this day's activity is recorded as a single sale of 1000 shares.

The database makes a distinction between several types of changes in ownership: *exchange transaction or other transaction*, *account transfer*, and *other*. We include only the entries marked as *exchange transaction or other transaction*, since these trades reflect on-market trades that are instigated by the insider. In contrast, an *account transfer* is not a trade and the *other* category includes transfers resulting from gifts or inheritance, and therefore includes transfers that are not instigated by the insider. The register also distinguishes between different types of assets, and includes stock and derivative instruments. We only include trades in common and preferred stocks, because these trades can be matched with trades from the Euroclear database.

We restrict our selection of insider trades to those made by members of the Board of Directors and by the managing directors for all Finnish listed companies. For these insiders, we have detailed records from the Virre database of the National Board of Patents and Registration of Finland. These data include the name, birth date, and the start date and end date for each person's tenure as director. After applying these criteria, we have a total of 2,616 trades made by 510 different insiders. For each trade, we have the date, the stock name, and the net daily number of shares traded.[32] In addition, we know the identity of the insider and the insider's year of birth.

[32] Several companies have more than one class of stock listed on the OMX Helsinki exchange where each class has a unique stock identifier, ISIN. In these cases, we search each of the stock classes for the matching transaction.

We match insider trades from the public register to similar trades made by an account from the Euroclear database, based on the stock, the trade date, and the net number of shares traded. We also have the year of birth for each accountholder in the Euroclear database, which enables an additional screen to match trades made by insiders.

We are able to match 2,337 (89%) of the total of 2,616 insider transactions in our dataset, based on net daily volume, trade date, stock code, and year of birth of the accountholder.[33] These trades originate from 475 different insider accounts. We drop 9 of these matched insider accounts for which the proportion of matched trades is less than 50%. This final screen results in 466 unique insider accountholders that held a position as board member or managing director in a company listed on the Finnish stock exchange sometime during the period, 2005 to 2010. For each insider, and for every year in the sample, we know from the Virre database: (i) whether the accountholder was a member of the board of directors for a given company, (ii) the companies for which the insider had interlocking directorships, and (iii) the insider's position in the network of directors, based on the social network measures discussed in section 2.

Appendix C. Attributes of the Firms Traded by Directors

C.1. Measurement of Firm Characteristics

For each day in the sample period, we obtain each stock's adjusted rank values for several relevant firm characteristics using a two-step procedure. First we compute each variable. More specifically, we compute the Dimson beta (*BETA*) for each stock by regressing the daily return on the value-weighted market return, along with three leads and lags of the market return, over the 250-day period ending one day before the trade date. Market capitalization (*Size*) is the number of shares outstanding multiplied by the daily closing price. For trade date *t*, we use the

[33] Our inability to match 11% of the trades could be due to data entry errors on our side (e.g. spelling of name, volume data, or dates). In addition, some insider trades appear to have an irregular settlement period of 1 or 2 trading days, rather than the typical 3-day settlement period.

median market capitalization over the 21-day period ending 20 trading days earlier. The market-to-book ratio (*M/B*) is the market value of equity divided by the book value of equity at the end of the prior calendar year. Finally, we measure the past return for each stock over the four different windows several time frames, including the last year excluding the most recent month (*Ryear*), the last month excluding the most recent week (*Rmonth*), the last week excluding the most recent day (*Rweek*), and the last day (*Rday*).

Second, we transform each control variable into decile ranks by first sorting the cross section of stocks each day into 10 groups. Next, we assign a value to the stocks in each decile, where the values are adjusted to range from -0.5 (for the lowest decile) to +0.5 (for the highest decile). This adjustment serves to attenuate the influence of outliers.[34] The mean adjusted rank values in Panels A and B of Table C.1 are then obtained by averaging these adjusted ranks across all stock trading days within every trade category.

C.2. Average Firm Characteristics for Each Category of Director Trades

Panels A and B of Table C.1 report descriptive statistics for the characteristics of the firms sold and bought, respectively, for each category of trades by directors. [35] We report the mean adjusted decile ranks of the firm's characteristics. First consider the attributes of firms sold and bought for all categories of trades other than insider trades. Panels A and B of Table C.1 reveal that directors trade outside stocks with relatively high betas, high market-to-book ratios, and large size. They also tend to be contrarian, selling after stocks have increased in value and buying after they have decreased. For each firm attribute, however, the difference in the mean scaled ranks between every category of director trades and all other retail trades (reported in the last row of each panel) is small in magnitude. For example, the maximum difference in the average ranks

[34] See Grinblatt, Keloharju and Linnainma (2012) and Berkman, Koch and Westerholm (2014) for similar analysis.
[35] We find similar results for trades made by the family members of directors (not reported here for brevity).

across these trade categories is only 0.07 (i.e., the difference in the mean rank for the firm's beta between retail sales and interlock sales in Panel B). This difference is relatively small, given that the change in scaled ranks between any pair of adjacent deciles is 0.1.

Next consider insider trades. As expected, the characteristics of the insider's own company are generally closer to the median firm. Similar to other retail investors, and consistent with US evidence, insiders tend to be contrarian when they trade their own company's stock (for example, see Ravina and Sapienza, 2010). In general, Table C.1 reveals no evidence to indicate that the average stock traded by directors is substantially different from the average stock traded by retail investors.

Table C.1. Sample Characteristics for Different Types of Firms Traded by Directors

This table summarizes the characteristics of different types of firms traded by directors. Panel A reports the mean adjusted ranks of the control variables for the subset of sales in every caterogy of trades by directors. Panel B gives the analogous results for director purchases in every trade category. Control variables include the firm's beta, market-to-book ratio, size, and previous returns taken over four time frames including the past year excluding the last month, the past month excluding the last week, the past week excluding the last day, and the most recent day. Construction of these variables is described in Appendix C. The mean adjusted ranks for each variable are computed by first transforming each variable into decile ranks every day in the sample, and then adjusting these daily ranks to range from -0.5 (for the lowest decile) to +0.5 (for the highest decile). The adjusted daily ranks for each category of trades are then averaged across all days in the sample period.

Panel A. Average Attributes of Firms Sold in Every Category of Trades by Directors, versus All Retail Trades

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
trade category (i)	Rank(β)	Rank(M/B)	Rank(Size)	Rank(Ryear)	Rank(Rmonth)	Rank(Rweek)	Rank(Rday)
Insider	-0.07	0.07	-0.06	0.04	0.03	0.04	0.02
Interlock	0.15	0.07	0.26	0.04	0.04	0.03	0.04
Unconnected High	0.19	0.06	0.31	0.00	0.03	0.02	0.03
Unconnected Moderate	0.20	0.05	0.30	0.00	0.03	0.02	0.05
Unconnected No Status	0.17	0.08	0.26	0.01	0.04	0.03	0.04
All Retail Trades	0.22	0.09	0.29	0.01	0.02	0.02	0.04

Panel B . Average Attributes of Firms Purchased in Every Category of Trades by Directors, versus All Retail Trades

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
trade category (i)	Rank(β)	Rank(M/B)	Rank(Size)	Rank(Ryear)	Rank(Rmonth)	Rank(Rweek)	Rank(Rday)
Insider	0.04	-0.01	0.06	-0.02	-0.03	-0.01	-0.01
Interlock	0.21	0.07	0.33	0.00	-0.03	-0.01	-0.02
Unconnected High	0.20	0.07	0.33	-0.02	-0.02	-0.02	-0.02
Unconnected Moderate	0.21	0.05	0.31	-0.03	-0.03	-0.03	-0.04
Unconnected No Status	0.20	0.08	0.29	-0.03	-0.04	-0.02	-0.02
All Retail Trades	0.24	0.11	0.31	-0.03	-0.03	-0.02	-0.03