Uncertain times and the insider perspective

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\textbf{A R T I C L E   I N F O}

\textbf{A B S T R A C T}

This paper examines insiders’ informational privilege by studying the nexus between aggregated self-reported insider trades and Economic Policy Uncertainty (EPU). We demonstrate that firm insiders act in response to the first signs of uncertainty as it appears in the media, and high-ranked managers, such as CEOs and CFOs, react more promptly than other insiders. Our findings further support the idea that insiders’ indirect informational advantages allow them to interpret the significance of public information for cash flows more accurately in their own companies. Our study is the first to examine insiders’ behavior using pure public information; it is also the first to exclude the influence of private information completely. We also consider various measures of EPU, including global and categorical indices representing economic, political uncertainty, while taking the financial crisis period into account.

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1. Introduction

The astute investor pays a great deal of attention to the informational landscape and the context it provides for her trading decisions. Alongside pertinent news relating to firms, the market, or the economy, an equity investor may also pay attention to broader generalized information sets thought to influence an asset’s risk premia. When that investor is also an insider in a firm, one might suppose that she ought to marry her expertise and innate knowledge of the firm to publicly available data to discern whether it could drive stock returns. That insiders make transactions based on their capacity to recognize external signals is not a new idea. It underpins Seyhun’s (1992) Cash Flow Hypothesis, a theory proffering the view that series aggregating insider transactions displayed a general sensitivity to business conditions, inviting the possibility that these could forecast stock returns. The profitability present within an insider trade is widely documented (See Finnerty, 1976; Jaffe, 1974; Jeng, Metrick, & Zeckhauser, 2003; Lin & Howe, 1990; Seyhun, 1986; Wszolek & Bohl, 2005 among others).

Consequently, the purveyors of data frequently feature Director trading datasets among their wares, citing it to be a source that generates trading signals. They make this claim even though directors quite sensibly would not declare trades based on privately held material information relevant to the stock price. If not for liquidity reasons, their ability to read in firm’s the impact of changing conditions may motivate their transactions, whether these are external or internal, or so Seyhun’s argument goes. The trading, rather than being underhand and misuse of private information, results from their expertise and sense of the more intangible markers of resilience within their firms. When there is uncertainty over government policy’s future direction over any issue affecting business conditions and ultimately cash flows, it becomes more difficult for financial market actors to price in the risk (Pasquariello & Zafeiridou, 2014). Might the insiders’ actions provide the clues needed to discern whether their firms could hold strong against the tumult in business conditions that uncertainty inevitably creates?

There is ample empirical evidence showing insiders hold such an informational advantage and frequently profit from it, and these times are not necessarily characterized by uncertainty.\textsuperscript{1} The extent of which is often tempered by the company’s size and the effect of the price to earnings ratio (Rozell & Zaman, 1996). The interest over the market effects of uncertainty is growing alongside a burgeoning literature and

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\textsuperscript{1} Early studies on company insider trading reveal that insiders frequently profit from their portfolio rebalancing activities, these include Jaffé (1974), Finnerty (1976), Givoly and Palmon (1985), Seyhun (1986), Lin and Howe (1990), Jeng, Metrick, & Zeckhauser, 2003, broadly these studies support the conclusion that insider purchases outperform selling transactions in terms of yielding abnormal returns.


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collection of measures purporting to capture the phenomena. Uncertainty is a condition created by a lack of clear, unambiguous information. Those subjected to it often scramble to mitigate against its worst effects on their investments by reaching for any piece of information that may offer clarification. For investors interested in insiders’ activity, the question then becomes whether the latter, through their actions, can signal their firms’ position in light of the context of uncertainty. This study investigates the nature of the relationship between different iterations of self-reported insider trades and economic policy uncertainty in the US. Ours is the first study to map this relationship and uncover how economic policy indecision drives insider behavior.

If utilizing an innate and intangible sense of a firm’s capacity to withstand change is an insider’s motivation to trade, it is often difficult to distinguish whether that impetus comes from public or private information in a typical insiders’ information set. The cash flow hypothesis confounds studies that attempt to attribute the advantage solely to privately held information. Although using personal expertise to interpret publicly available signals may seem ostensibly unfair, it remains quite a legitimate way for an insider to trade.

Aldridge and Cicero (2015), for example, try to demonstrate that insiders flout market abuse legislation but fail to find evidence to suggest that they might use the private information they hold on clients to initiate trades. Such instances are, in any case, difficult to detect. Where the literature highlights illegal activity, it is in reference to cases of notoriety such as Ivan Boesky’s documented history of illicit trades (See Chakravarty & McConnell, 1999; Meulbroek, 1992 and Meulbroek & Hart, 1997) or through inference based on stock price unusual stock price movement ahead of recognized price affecting events (Lambe, 2016). Instead, Aldridge and Cicero formulate the attentive trading hypothesis that suggests that insiders are particularly keen to interpret and act upon publicly available information before others. Their success in trading comes from their sales rather than purchases. The profitability studies mentioned earlier note that the insider realizes an advantage through purchases rather than sales.

To test insiders’ attentiveness, we study the relationship between insider trading and economic policy uncertainty (EPU). In doing this, we isolate the impact of public information from private. After all, it is somewhat unlikely that insiders, on aggregate, possess privately held price-sensitive information about government policies. Therefore, in times of economic uncertainty, an insider’s only informational advantage may be their familiarity with their companies’ ability to cope with prevailing business conditions. This vantage point allows them; as a result, to be better able than outsiders to interpret what the data means for their firms.

Our data sample consists of 4,813,191 insider transactions across 24,144 firms listed across all US markets over 32 years. We adopt the EPU (economic policy uncertainty) index proposed by Baker, Bloom, and Davis (2016) to measure policy uncertainty. What distinguishes our research from previous studies that use the EPU index is that we use its future value as our variable of interest. We assume that private access to unreleased government economic policy documents is unlikely for a firm insider to attain, much less a collection of insiders. We also consider that the ability to accurately and consistently predict policy direction is, as yet, beyond the reach of all. Consequently, we can rule out the possibility that insider trading is motivated by privately held information about policy direction.

We model insider transaction measures alongside the future EPU variation using Vector Autoregression (VAR) and panel data models. We observe that insiders react to the uncertainty index’s future values. We also find that higher-ranked managers, such as CEOs and CFOs, appear to respond more promptly to this than their lower-ranked counterparts. This view is consistent with the market perception that these actors hold better information than less centrally positioned directors (Goergen, Renneboog, & Zhao, 2019).

Our analysis reveals that the coverage documenting uncertainty peaks gradually. However, insiders are alive to the influence of policy uncertainty, maintaining vigilance and quickly interpreting newly arrived public information relating to economic policy uncertainty. We notice that insiders (particularly the higher-ranked executives) appear to be among the first to react to growing economic policy uncertainty when it begins to emerge in the press. This reaction happens before more intensive reportage heightens the Economic policy uncertainty index later on. Therefore, we offer evidence supporting Aldridge and Cicero (2015) attentive trading hypothesis by isolating the impact of purely public information. To understand this phenomenon’s reach, we repeat the analysis using country-specific, categorical, and global EPU indices alongside various measures of aggregate insider transactions. We also make further distinctions between insiders’ role identity and their behavior during regular and crisis periods.

Our results raise a timing issue of research in adopting EPU and other keywords-based measures. We find that some insiders move ahead of the EPU index, suggesting that a future based measure for EPU might be a better reflection of people’s opinions on uncertainty. This opinion coincides with that of Hopkins, Kim, and Kim (2017), who found that economic events covered in the media do not necessarily drive economic perceptions. Researchers should be cautious in matching the periods between EPU and other variables when estimating time series or dynamic relations.

We organize the rest of the paper as follows. In the next section, we review studies related to economic political uncertainty and its impact. We also discuss the research on insiders’ informational privileges. We present the data used in the study in Section 3. In the section following that, we then conduct our empirical analysis and discuss our findings. To confirm the robustness of our results, we change the EPU measures and other empirical analysis settings. The final part offers some conclusions.

2. Literature review

2.1. Economic policy uncertainty and its relation to the markets

In recent years there has been widespread recognition among researchers that administrative hesitancy in choosing the direction of economic policy can affect firm prices. The preoccupation for many is to arrive at a continuous index that adequately acts as a proxy for uncertainty. For instance, scholars have paid much attention to the tone of political messages, speeches, interviews, and forecast reports for signals of economic policy change (see, for instance, Romer & Romer, 2008 and Wisnievski & Moro, 2014). Furthermore, economic policy uncertainty is associated with a range of economy-wide indicators, including output, employment, investment, and productivity (Alexopoulos & Cohen, 2009; Cagigano, Castelnuovo, & Groshenny, 2014).

The idea that uncertainty can have a material impact on the economy and its explanatory metrics arises from the notion of hysteresis, a concept developed in McDonald and Siegel (1986), Dixit (1989a, 1989b), Dixit (1991), Krugman (1988), and Pindyck (1988). Following the arguments developed here, the governmental shaping of business conditions is influenced by the level of hesitancy or disagreement among legislators. The lack of clarity on how conditions may change drives up the perception of risk. From the investor perspective, the value of delaying or halting investment begins to outweigh the perceived gains from investing in the first place.

Baker et al.’s (2016) EPU index is perhaps the most influential proxy for economic policy uncertainty currently used to research the area. Using this index, numerous scholars have established the impact of economic policy uncertainty on a range of other fundamentals economic factors. When the uncertainty index heightens, it appears to be associated with adverse movements in economy-wide metrics, and many existing studies employing the EPU index appear to confirm this conclusion (e.g., Baker et al., 2016; Cagigano, Castelnuovo, & Figueres, 2017; Husted, Rogers, & Sun, 2020; Kydland & Zarraga, 2016; Leduc & Liu, 2016; Sinha, 2016).

There is a growing literature documenting the impact of economic

2.2. Insiders’ informational privilege

Many scholars agree that insiders hold both direct and indirect informational advantages over other market participants, that lead to abnormal returns. The direct advantage is that insiders can trade (albeit not legally) on their private information. For example, scholars document that insiders adjust their portfolios ahead of news releases of price-sensitive events (Karpoff & Lee, 1991; Ravina & Sapienza, 2010; Agrawal and Cooper, 2015). They act because they can predict future cash flows better than others and insiders flows (Ke, Huddart, & Petroni, 2003; Piotroski & Roulstone, 2005), and they can spot mispricing of shares and thus trade as contrarians (All, Wei, & Zhou, 2011; Ben-David & Roulstone, 2010).

Recently, indirect informational advantages have attracted more scholarly attention. Some researchers argue that insiders’ positive abnormal returns are, to some extent, obtained by analyzing public information rather than the private one. For example, Aldridge and Cicero (2015) suggest that insiders are more attentive to the public information relating to their old clients. Rozeff and Zamar (1998) and Jenter (2005) show little need for private information; one could use public information, including book-to-market ratio, to identify the mispricing. Furthermore, the insiders’ predictability of future cash flows is also questioned/weakened by Cohen, Malloy, and Pomorski (2012). Other public information, such as investor sentiment (Ha & Li, 2016) and investment horizons (Fu, Kong, Tang, & Yan, 2019), can also influence insider trading and abnormal returns.

3. Data

We collect monthly data for variables representing US EPU, insider trading, and a range of macroeconomic and market-based controls over a period beginning in January 1985 and ending in April 2018.

3.1. Uncertainty variables

We adopt our measure of uncertainty from the news-based EPU index for the US, the construction of which is outlined in Baker et al. (2016). This index is a standardized composition based on a count of newspaper articles containing specific references to an array of keywords related to policy uncertainty. The measure uses ten national broadsheets and counts the number of newspaper articles that refer to core keywords: ‘Economy,’ ‘Policy,’ and ‘Uncertainty’. The EPU index also includes other specific terms such as ‘congress, ’legislation’, ‘white house’, ‘regulation’, ‘federal reserve’, or ‘deficit’. The raw count of articles relating to the keywords is divided by the total number for a given interval to control for changes in the overall number of pieces published in each newspaper. For each newspaper, the series is normalized so that a one-unit standard deviation is given for the entire sample period. Each newspaper’s values are then summed across all ten outlets creating a representative index. The next step is to normalize this aggregated index with an average value of one hundred.

Based on ‘aging theory’ which is widely used for modelling news events (See Cataldi, Di Caro, & Schifanella, 2010), we assume that news reportage about a particular issue creating uncertainty has a discernible media lifespan. It follows a pattern redolent of the natural world’s stages of birth, growth, peak and death. Thus, the intensity of reportage on an issue generating uncertainty follows a hill shaped pattern accompanied by thin tails (See Fig. 1). Early on, there are relatively few reports, coverage then builds to a point where it reaches a crescendo, this is then followed by a dissipation brought on by waning interest or the conclusion of the matter. Eventually the issue disappears from the news agenda. We argue that insiders react to this uncertainty at the early stage because their focus on their own companies allows them to understand the implications of the uncertainty for their firms better than outsiders. An insiders’ vigilance allows her to be among the first to react before uncertainty deepens over an issue. In order to identify and evaluate uncertainty’s early-stage impact, we use the future value of EPU as the proxy for the first sign of economic policy uncertainty (PSEPU). We take this to mean the monthly average EPU where the forecasting horizon is assumed to be 30 days ahead of the current time point. Our result shows that insiders move earlier than others. For example, insiders may start to consider/react to the uncertainty of the next Federal Open Market Committee (FOMC) meeting agenda a month later, right after the outcome of the most recent one is released. However, the media coverage of the uncertainty must appear within a newsworthy timeframe, that point may only be days ahead of the next meeting, the EPU index would reflect this. Outsiders would react to the EPU index rather than the actual occurrence of the events which created it.

3.2. Insider trading variables

Data on US insiders is available through the Thomson Reuters database. The transactions of a firm’s officers, directors, and beneficial owners of more than 10% of a company’s shareholdings are held here. We use information relating to transaction date, size, and direction of trade for a sample period beginning in January 1985 and ending in April 2018. In total, our sample consists of 4,813,191 transactions from 24,144 firms listed across all major US stock exchanges. We are interested in the aggregations of insider trades instead of individual ones. The rationale for aggregation is that insider activities, when considered en masse, may indicate economy-wide shifts. While these may be detectable at the firm level, they may not yet appear in economic reports. Aggregating transactions cause idiosyncratic trading reasons to cancel out, thus reducing the inherent noise. Therefore, we construct indices that allow for this in the spirit of those created in Iqbal and Shetty (2002). We use two aggregated measures that employ the frequency of transactions and the proportional volumes. Our first measure is the net number of insider transactions (NNI). This measure is the difference between the aggregated number of purchase and sale trades in each period, standardized according to the total number of transactions over the same interval. To arrive at this measure, we estimate the following equation:

\[\text{NNI} = \frac{\text{NBR} - \text{NSL}}{\text{Total Transactions}}\]

\[\text{where} \quad \text{NBR} = \text{Number of Buy Trades} \quad \text{NSL} = \text{Number of Sell Trades}\]

\[\text{Total Transactions} = \text{NBR} + \text{NSL}\]

\[\text{NNI is then normalized by the total number of transactions over the same interval.}\]

\[\text{To arrive at this measure, we estimate the following equation:}\]

\[\text{Fig. 1. Life cycle of an uncertainty in newspaper.}\]
NPI, $\frac{ANB - ANS}{ANB + ANS}$ \hspace{1cm} (1)

where ANB and ANS represent the respective aggregate number of buy and sell transactions in each month $t$. We then employ an aggregate measure of insider trades that consider the volume of deals as a proportion of the insider’s direct holdings for each transaction. We define the net proportion index (NPI) as the net part of direct holdings traded relative to the total transacted. We express this as follows:

$$NPI_t = \frac{APB - APS}{APB + APS}$$ \hspace{1cm} (2)

where APB and APS represent the respective aggregate buy and sell transactions in terms of the proportion of direct holdings in each month $t$. Both NNI and NPI represent the imbalance of insider trades and range from 1 to –1. They are 1 when all the insider trades in the month are orders to buy and are –1 when all the trades are orders to sell. NNI and NPI are zero when the buy and sell orders are balanced.

Table 1 shows the summary statistics of the main variables: log-arithmic EPU, NNI, and NPI. We also consider three insider subgroups: CEOs, CFOs, and Others. Because the average of FSEPU is 100, it is predictable that the mean of the log (FSEPU) is close to 4.6. Every insider trading variable’s mean values are negative, suggesting that the average monthly sell orders are generally more extensive than that of monthly buy orders regardless of trading times or the proportions these occupy of insiders’ holdings. US insiders tend to sell their firms shares rather than buy them in a trend which has been followed since the 1980s. Insiders sell shares for reasons such as to realise the profits after equity incentives come into effect or to diversify their portfolios. As more compensatory awards take the form of stock or options an insider would have to divest, their holdings to release this compensation. (Seyhun, 1998). In terms of the NNI variable, the CEO and CFO groups have much lower mean NNI than the ‘others’ group. This observation implies that high-ranked insiders tend to place more sell orders relative to buy orders than the group we label as ‘others.’ Among our three subgroups, the CEO’s NPI index is the closest to zero, which means that the CEO’s trades are more balanced in terms of the proportions of their holdings than those of the other two subgroups.

### 3.3. Other variables

To control for the possible effects of market turbulence upon insider trading, we employ the measure of realised volatility in each of the VAR systems. For monthly data, we construct this variable by estimating the square root of the sum of daily returns squared ($r_i^2$) on the S&P 500 index over the sample period, which we express as $\sqrt{\sum_{i=1}^{T} r_i^2}$. Stock market returns could be a factor influencing insiders’ decision, which is considered in our VAR models. Other macroeconomic variables are also introduced to the analysis, including unemployment, Consumer Price Index, Fed Funds Rate, Industrial Production Index (See Table 2 for more details).

### 4. Empirical analysis

#### 4.1. Quick reactions of insiders to EPU

Two-lagged VAR models (suggested by information criteria) are applied to study the impact of economic policy uncertainty on insider trading behavior. The variables mentioned in the previous section are involved in the regressions. We use a Cholesky decomposition approach to identify the model. We order the variables as follows; log EPU measures, CPI, unemployment, Federal Funds rate, Industrial Production Index, S&P500 returns, S&P500 realised volatility, and the insider trading measures. We are interested in testing the supposition that as insiders are more attentive to their own companies, they could interpret the impact of uncertainty on those firms earlier than other market participants (e.g., Aldridge & Cicero, 2015).

Fig. 2 shows the orthogonalized impulse response functions (OIRF) of insider trading to FSEPU innovation. From this, shocks of log FSEPU have significant and positive impacts on both the net number of insider transactions (NNI) and the net proportion of shares held, which are traded (NPI). NNI and NPI increase by about 3%, which is initially the response of the one-standard-deviation shock to FSEPU. One month later, the FSEPU shock’s impact reaches its peak: NNI and NPI increase by about 6% as a response. The effect lasts for three months and disappears eventually. Thus, we confirm that insiders react to the future

### Table 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPU</td>
<td>Average daily US EPU in the current month</td>
<td>Economic Policy Uncertainty website&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>FSEPU</td>
<td>The first sign of EPU (Average daily US EPU in the next month)</td>
<td>Economic Policy Uncertainty website</td>
</tr>
<tr>
<td>FSFEPU</td>
<td>The first sign of Global EPU (Average daily Global EPU in the next month)</td>
<td>Economic Policy Uncertainty website</td>
</tr>
<tr>
<td>NNI</td>
<td>The difference between the aggregated number of purchase and sale trades according to the total number of transactions over the same interval</td>
<td>Thomson Reuters</td>
</tr>
<tr>
<td>NPI</td>
<td>The net proportion of direct holdings traded relative to the total proportion traded</td>
<td>Thomson Reuters</td>
</tr>
<tr>
<td>RV</td>
<td>Realised volatility, which is the square root of the sum of S&amp;P 500 daily returns in a given certain month</td>
<td>DataStream</td>
</tr>
<tr>
<td>SPR</td>
<td>Log returns of S&amp;P 500 monthly return index</td>
<td>DataStream</td>
</tr>
<tr>
<td>Unemployment</td>
<td>The number of people actively seeking work as a proportion of the total labour force</td>
<td>St Louis Fed website&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>CPI</td>
<td>Consumer Price Index, which is a time series of change in household purchases of goods and services</td>
<td>St Louis Fed website</td>
</tr>
<tr>
<td>Federal Funds Rate</td>
<td>The overnight interest rate of lending</td>
<td>St Louis Fed website</td>
</tr>
<tr>
<td>INDPROM</td>
<td>The Industrial Production Index, measuring real output for industrial establishments such as manufacturing, mining, and electric, and gas utilities</td>
<td>St Louis Fed website</td>
</tr>
</tbody>
</table>

<sup>a</sup> [https://www.policyuncertainty.com/](https://www.policyuncertainty.com/)

<sup>b</sup> [https://www.stlouisfed.org/](https://www.stlouisfed.org/)
economic uncertainty level, supporting the argument that insiders react to uncertainty at its very early stages. Furthermore, when uncertainty in the future increases, insiders tend to buy more shares. This finding demonstrates that an insider’s ‘typical modus operandi’ is to act in a contrarian fashion when uncertainty arises. This point coincides with past studies that have shown that insiders, on aggregate, tend to trade contrary to broadly held opinion (Jiang & Zaman, 2016; Piotroski & Roulstone, 2005). The tendency of insiders to act in a contrarian fashion to vestiges of uncertainty is perhaps due in large part to their confidence in the future cash flows of their companies. Insiders do not tend to increase their shareholding when they believe that uncertainty would significantly influence the future cash flows of their firm (Anginer, Donmez, Seyhun, and Zhang, 2020). Their buying behavior could also be because of the mispricing of the shares under uncertainty (Reusch, 2014). A further explanation behind the purchasing behavior of insiders is noted in Ha and Li (2016) who observe that insiders could also be motivated to purchase their shares to boost flagging investor sentiment caused by uncertainty.

4.1.2. Panel data analysis

Further to the VAR model, we investigate our data following a panel data approach controlling for time and firm fixed effects. The Hausman test supports this choice, confirming that the random-effects model residuals can correlate to the regressors in our specifications.

We assume that when insiders make a trading decision, they consider both the first signs and contemporary influences of economic policy uncertainty concurrently. Our panel data approach also allows us to examine these impacts of EPU on insider trading simultaneously. The following equation model specification is as follows:

\[ IT_{it} = \text{constant} + \Phi \cdot \log(FSEPU_t) + \delta \cdot \log(EPU_t) + \gamma \]

- Controls, + \tau_i + \varphi_i + \epsilon_{it}

\[ Controls = \begin{bmatrix} CPI, Unemployment, Federal Funds rate, \text{INDPRO}, RV, SPR, \end{bmatrix} \]

\[ IT \text{ represents an insider trading measure iterated in terms of insider transactions (NNI) or the proportion of a firm’s total shares held by the insider (NPI). The variables used are the same as in VAR, allowing the results to be roughly comparable. To control for possible industrial differences exhibited by insiders, we break the aggregated measures down. \tau_i and \varphi_i, time, and firm fixed effects, respectively, are used to control for the unobserved time and firm effects. The coefficient \Phi is the impact of the first signs of economic policy uncertainty (FSEPU) on insiders’ behavior, and \delta is the impact of the contemporary one (EPU). They are positive if insiders tend to buy more shares when the uncertainty is high and vice versa. If |\Phi| > |\delta|, insiders put more weight on the first signs of economic policy uncertainty than contemporary influences. If insiders already react to the early signs of uncertainty to a great extent, the reaction to the same uncertainty peaked in the next period will not be substantial. On the other side, if insiders do not pay much attention to the uncertainty at the early stage, the reaction will be strong when the same uncertainty episode peaks. Therefore (|\Phi| > |\delta|) measures an insiders’ sensitivity to the first signs of EPU. Suppose \Phi and \delta have the same sign, small or negative values of (\Phi > |\delta|). This observation suggests that an insiders’ focus on current uncertainties is close to or stronger than their noticing its first signs. Thus, there is a relatively high degree of negligence in seeing the early signs. On the other side, the signs of \delta and \varphi are different, which means that insiders change their minds on the same spike of uncertainty one month later and adjust the position in the opposite direction, in the case of where their initial response turned out to be an over-reaction.

The results of the panel data regressions are outlined in the columns labelled as “Pooled” in Panel A of Table 3. \Phi is positive and significant. When the log (FSEPU) is one unit higher, the net number and proportions of buy orders (NNI and NPI) are 8% and 7.5% higher, respectively. It suggests that one standard deviation increase in log (FSEPU) will increase NNI by 3.1% or cause an increase of 4.5% in buy orders. Thus, our investigation confirms the findings revealed through the VAR model, showing that insiders significantly react to the first signs of uncertainty in policy direction and then trade in a contrarian pattern to these. \delta are significant and around 1.5% less than the values for \Phi. This observation implies that insiders still react to contemporaneous uncertainty, but that reaction is much weaker than the first signs produced related to uncertainty. Due to the inherent lag present in media reportage, traders take their actions on trading once the media report those stories indicating uncertainty. These actions are consistent with our earlier observation that insiders are attentive and tend to react sharply to signs of uncertainty.

4.2. Informational privileges of high-ranked insiders

The previous section shows evidence that insiders react quickly to uncertainty. However, we have yet to establish the depth of their informational privileges. Ordinarily, research can answer this question by contrasting insiders’ behavior with that of a group not classed as an insider but are yet knowledgeable of the firm. In this case, no such comparison is feasible. Instead, we compare the reactions to uncertainty across different classifications of insiders. We make the distinction according to the individuals’ position in their firms. The role of insiders represents various accessibility to closely-held information. It is reasonable to believe that an insider in a top executive role can better interpret data related to the company than one at a lower position. For example, the CEO may know much more about the company than a beneficial owner or a voting trustee. We could also question if a distinction arises between the CEO and the CFO. It is difficult to predict the level of attentiveness that a CEO might have over a CFO, seeing as the latter is charged with creating or at least safeguarding the firms’ financial policies. However, there is some evidence to suggest that CFO’s use “better information” than their CEOs counterparts when they conduct insider trading (Wang, Shin, & Francis, 2012). As insiders in our dataset occupy more than 50 different types of positions, we simplify by dividing these into three groups: CEOs, CFOs, and Others. Creating these
while the Others' response to uncertainty decreases, eventually disappearing after the third month. The CEOs' NNI increases by more than 4% initially in response to an FSEPU shock reaching about 6% one month later. The concavity exhibited in the Others' subgroup’s reaction is sharper than that for CEOs and CFOs in both NNI and NPI cases. The difference in shape suggests that the initial reactions in this subgrouping to the first observable time and firm effects. For brevity, the coefficients of control variables are not reported. **, * denote statistical significance at 1% and 5% respectively.

Since high-ranked insiders usually possess higher shareholdings than other insider groups, a possible explanation for the previous result could be that people who hold more shares react to the uncertainty more quickly because their potential gain/loss is greater than other less invested individuals. To test whether the results are due to the shareholding rather than the role of the insider, we re-sort the insider group by the shareholding and run the vector auto-regressions again. Group one contains the people who are the top 10% in terms of shares held, group two is from 10% down to 25% and group three are the remaining insiders in the sample. Fig. 3 shows the result of the VAR analysis. Insiders’ NPI in groups one and two do not react to an FSEPU shock significantly. Furthermore, the concavity exhibited in group one’s reaction is sharper than the others in both NNI and NPI cases. Both observations suggest that insiders with higher shareholdings are less sensitive to the first signs of uncertainty than others. The results of the panel data model, reported in Penal B of Table 3, show a similar conclusion to the VAR analysis. The analysis shows that Φs are significant in cases of NNI and NPI for insiders in group one. This result suggests that unlike CEOs and CFOs, insiders in group one do not react as quickly as the other groups. Therefore, we could confirm that the sensitivity to the uncertainty is due to the role of the insiders rather than specifically to the value of the shares that they shareholdings.

### 4.3. Impact of categorical EPUs

We consider the impact of categorical EPUs introduced in Baker et al. (2016), where eight categorical EPU indices after the additional category-relevant criteria are considered. These are fiscal policy, monetary policy, health policy, national security, regulation, sovereign debt & currency crises, entitlement programs, and trade policy. The orthogonalized impact responses function (OIRF) values appear in Fig. 4 (NNI measure). From these figures, we can observe that insider trading response is positive and significant in the first three months for the shocks of most economic policy measures in each category. The
categorical EPUs’ impact on insider trading exhibit a concave pattern of behavior similar to that presented through the analysis of the general EPU. The initial response of NNI to a one standard deviation positive shock from the categorical EPUs averages around 3%. For the Insiders, NNI rises by about 4% in response to fiscal policy uncertainty; this is the strongest and is only about 2% stronger than the response to national security policy uncertainty which is the weakest. The shock of national security policy uncertainty appears to offer the weakest response. The impact of categorical EPUs becomes more potent in the second month, except in health policy and entitlement programs uncertainties, which appear weaker.

Because the categorical EPUs are components of aggregated EPUs, by considering these categorical EPUs simultaneously, we can evaluate the individual contributions to the insiders’ behavior. One of the strengths of the panel data model is that it can determine the impacts of the categorical EPUs at the same time. Furthermore, we consider the subgroups of insiders along with the pooled case. The model is shown as follows:

\[
\text{NNI}_i = \text{constant} + \Phi \cdot \log(\text{FS Categorical EPU}_i) + \delta \cdot \log(\text{Catigorical EPU}_i) + \gamma \cdot \text{Controls}_i + \tau_i + \varphi_i + \epsilon_i, \tag{5}
\]

Fig. 3. Reactions of different insiders on uncertainty — VAR model.
This figure depicts the orthogonalized responses of different insiders’ trading to one-standard-deviation FSEPU innovation. The insiders are divided into three groups in two ways: first, by their positions in firms: CEOs, CFOs, and Others, second, by their shareholding, group one is the 10% of people holding the most shares, group two is from that top 10% to 25% and group three are other insiders. The net number of insider transactions (NNI) and the net proportion of direct holdings traded relative to the total proportion traded (NPI) are two measures of insider trading. The monthly average EPU which is 30 days ahead of the current time point (FSEPU) is employed as the proxy of the first sign of EPU in the VAR model which uses a Cholesky decomposition identification with the following ordering: log (FSEPU), CPI, unemployment, Federal Funds rate, Industrial Production Index, S&P500 returns, S&P500 realised volatility and NNI (or NPI). Data are monthly and confidence bands are 95%.
The 8 categorical EPU indexes are fiscal policy, monetary policy, health care, national security, regulation, sovereign debt & currency crises, entitlement programs, trade policy. The monthly average EPU which is 30 days ahead of the current time point (FSEPU) is employed as the proxy of the first sign of EPU in the VAR model. This figure depicts the orthogonalized responses of net number of insider transactions (NNI) to one-standard-deviation the first sign of categorical EPU innovation.

4.4.1. Impact of the global financial crisis

We test the data to understand how insiders behaved during the period that captures the great financial crisis and its aftermath. Our analysis distinguishes the recent global financial crisis and its aftermath (capture in a period beginning in August 2007 and extending to June 2014) from other, relatively more tranquil periods to test whether people behaved differently in the crisis period. We use a dummy variable of the crisis period in our panel data model to examine the financial crisis’s impact. The model is given as follows. 

\[ IT_{it} = \text{constant} + \Phi \cdot \log(FSEPU_{it}) + \theta \cdot \log(FSEPU_{it}) \cdot \text{Dummy}_{crisis} + \delta \cdot \log(EPU_{it}) + \rho \cdot \log(EPU_{it}) \cdot \text{Dummy}_{crisis} + \gamma \cdot \text{Dummy}_{crisis} \]

\[ + \phi_{it} + \epsilon_{it} \]

Where \( \text{Dummy}_{crisis} \) is a dummy variable which is one during the global financial crisis (2007.08–2014.06) and is zero otherwise. \( \phi_{it} \) and \( \epsilon_{it} \) are used to control for the unobserved time and firm effects. The results are reported in Table 5. \( \theta_{s} \) are negative and significant at 10% and 5% levels in the case of NNI and NPI respectively, whereas \( \delta_{s} \) are positive and significant, which implies that insiders trade more cautiously in response to the first signs of uncertainties but more boldly in response to the contemporary uncertainties in the crisis period.

4.4.2. Impact of global EPU

The late-twentieth-century surge in globalization has led to a burgeoning transnational influence of domestic economic policy, where the cash flows of firms in one country are affected by policy change in another. Therefore, we widen our lens to examine the association between a globalized measure of policy uncertainty and insider behavior in the US. The Global EPU (GEPU) index we employ is an average of including using the global EPU index instead of the US only version. We test whether the effects are different between relatively normal periods versus a time of crisis. Just as in the previous section, we find that insiders react to various economic policy uncertainty measures at the early stage.

4.4. Further analysis

To extend the previous findings, we conduct several further tests,
The table below presents the coefficients and corresponding t-statistic values (in brackets) for fixed effects panel data regressions as follows.

\[
IT_{ij} = \text{constant} + \Phi \cdot \log(FS_{EPU}) + \theta \cdot \log(FS_{EPU}) + \text{Dummy}_{crisis} + \gamma \cdot \text{Controls} + \tau_i + \varphi_t + \epsilon_{it}
\]

The dependent variable modelled in this table is the net number of insider transactions (NNI) and net proportion of insider holdings (NPI) traded at monthly intervals. \text{Dummy}_{crisis} is a dummy variable which is one during the global financial crisis (2007.08–2014.06) and is zero otherwise. Control variables are described in Table 2, \( \tau_i \) and \( \varphi_t \) time and firm fixed effects respectively, are used to control for the unobserved time and firm effects. For brevity, the coefficients of control variables are not reported. **, * denote statistical significance at 1% and 5%, respectively.

### Table 4

**Impacts of categorical EPU on insider trading.**

<table>
<thead>
<tr>
<th></th>
<th>Pooled</th>
<th>CEOs</th>
<th>CFOs</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(FS_{FP})</td>
<td>-0.0400***</td>
<td>-0.0106</td>
<td>-0.0319</td>
<td>-0.0599***</td>
</tr>
<tr>
<td>log(FP)</td>
<td>-0.0073**</td>
<td>-0.0035**</td>
<td>-0.0299</td>
<td>-0.0352**</td>
</tr>
<tr>
<td>log(FS_{MP})</td>
<td>0.0074**</td>
<td>0.0062**</td>
<td>0.0312***</td>
<td>0.0409**</td>
</tr>
<tr>
<td>log(MP)</td>
<td>0.0109**</td>
<td>0.0299***</td>
<td>0.00535</td>
<td>0.0260**</td>
</tr>
<tr>
<td>log(FS_{HC})</td>
<td>-0.0019</td>
<td>-0.0039</td>
<td>-0.0175</td>
<td>-0.0012</td>
</tr>
<tr>
<td>log(HC)</td>
<td>-0.0126</td>
<td>0.0187</td>
<td>-0.0112</td>
<td>0.0196***</td>
</tr>
<tr>
<td>log(FS_{NS})</td>
<td>0.0058</td>
<td>-0.0122</td>
<td>-0.0149</td>
<td>-0.0000</td>
</tr>
<tr>
<td>log(NS)</td>
<td>0.0011</td>
<td>-0.0087</td>
<td>0.0050</td>
<td>0.0150**</td>
</tr>
<tr>
<td>log(FS_{RL})</td>
<td>0.0261***</td>
<td>0.0274**</td>
<td>0.0314**</td>
<td>0.0231**</td>
</tr>
<tr>
<td>log(RL)</td>
<td>-0.0074</td>
<td>-0.0109</td>
<td>-0.0174</td>
<td>-0.0151***</td>
</tr>
<tr>
<td>log(FS_{SDCC})</td>
<td>0.0169***</td>
<td>0.0107***</td>
<td>0.0083*</td>
<td>0.0141**</td>
</tr>
<tr>
<td>log(SDCC)</td>
<td>0.0119***</td>
<td>0.0097***</td>
<td>0.0050</td>
<td>0.0097***</td>
</tr>
<tr>
<td>log(FS_{EP})</td>
<td>0.0215***</td>
<td>0.0254**</td>
<td>0.0313***</td>
<td>0.0241**</td>
</tr>
<tr>
<td>log(EP)</td>
<td>0.0405***</td>
<td>0.0172*</td>
<td>0.0440***</td>
<td>0.0200***</td>
</tr>
<tr>
<td>log(FS_{TP})</td>
<td>-0.0050</td>
<td>-0.0083*</td>
<td>-0.0064</td>
<td>-0.0017</td>
</tr>
<tr>
<td>log(TP)</td>
<td>0.0036</td>
<td>-0.0063</td>
<td>0.0058</td>
<td>0.0023</td>
</tr>
<tr>
<td>Firm fixed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time fixed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adj-R²</td>
<td>0.0386</td>
<td>0.0392</td>
<td>0.0584</td>
<td>0.0340</td>
</tr>
<tr>
<td>N</td>
<td>275,864</td>
<td>105,731</td>
<td>63,928</td>
<td>534,938</td>
</tr>
</tbody>
</table>

Variable definitions are given in Table 2, \( \tau_i \) and \( \varphi_t \) time and firm fixed effects respectively, are used to control for the unobserved time and firm effects. For brevity, the coefficients of control variables are not reported. **, * denote statistical significance at 1%, 5% respectively.

### Table 5

**Impact of EPU on insider trading during different periods.**

<table>
<thead>
<tr>
<th></th>
<th>NNI</th>
<th>PNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(FSEPU)</td>
<td>0.0770**</td>
<td>0.0745**</td>
</tr>
<tr>
<td>log(FSEPU)*Dummy_{crisis}</td>
<td>-0.0239</td>
<td>-0.0311*</td>
</tr>
<tr>
<td>log(EPU)</td>
<td>0.0032</td>
<td>0.0009</td>
</tr>
<tr>
<td>log(EPU)*Dummy_{crisis}</td>
<td>0.0279*</td>
<td>0.0331*</td>
</tr>
<tr>
<td>Dummy_{crisis}</td>
<td>0.0698</td>
<td>0.0728</td>
</tr>
<tr>
<td>Firm fixed</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time fixed</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adj-R²</td>
<td>0.0345</td>
<td>0.0342</td>
</tr>
<tr>
<td>N</td>
<td>327,516</td>
<td>305,021</td>
</tr>
</tbody>
</table>

### Table 6

**Impact of Global EPU on insider trading.**

<table>
<thead>
<tr>
<th></th>
<th>Current-based Global EPU</th>
<th>PPP-based Global EPU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NNI</td>
<td>PNI</td>
</tr>
<tr>
<td>log(FS_{FEP})</td>
<td>0.0773**</td>
<td>0.0759**</td>
</tr>
<tr>
<td>log(FS_{FEP})*Dummy_{crisis}</td>
<td>-0.0212</td>
<td>-0.0297</td>
</tr>
<tr>
<td>log(GP)</td>
<td>0.0712**</td>
<td>0.0697**</td>
</tr>
<tr>
<td>log(GP)*Dummy_{crisis}</td>
<td>0.0279*</td>
<td>0.0331*</td>
</tr>
<tr>
<td>Dummy_{crisis}</td>
<td>0.0698</td>
<td>0.0728</td>
</tr>
<tr>
<td>Firm fixed</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time fixed</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adj-R²</td>
<td>0.0345</td>
<td>0.0342</td>
</tr>
<tr>
<td>N</td>
<td>492,671</td>
<td>468,208</td>
</tr>
</tbody>
</table>

The dependent variable modelled in this table is the net number of insider transactions (NNI) and net proportion of insider holdings (PNI) traded at monthly intervals. Dummy_{crisis} is a dummy variable which is one during the global financial crisis (2007.08–2014.06) and is zero otherwise. Control variables are described in Table 2, \( \tau_i \) and \( \varphi_t \) time and firm fixed effects respectively, are used to control for the unobserved time and firm effects. For brevity, the coefficients of control variables are not reported. **, * denote statistical significance at 1% and 5%, respectively.

### Table 7

The table below presents the coefficients and corresponding t-statistic values (in brackets) for fixed effects panel data regressions as follows.

\[
IT_{ij} = \text{constant} + \Phi \cdot \log(FS_{EPU}) + \theta \cdot \log(FS_{EPU}) + \text{Dummy}_{crisis} + \gamma \cdot \text{Controls} + \tau_i + \varphi_t + \epsilon_{it}
\]

The dependent variable modelled in this table is the net number of insider transactions (NNI) and net proportion of insider holdings (PNI) traded at monthly intervals. Dummy_{crisis} is a dummy variable which is one during the global financial crisis (2007.08–2014.06) and is zero otherwise. Control variables are described in Table 2, \( \tau_i \) and \( \varphi_t \) time and firm fixed effects respectively, are used to control for the unobserved time and firm effects. For brevity, the coefficients of control variables are not reported. **, * denote statistical significance at 1% and 5%, respectively.

### 5. Conclusions

In this paper, we study the capacity for insiders’ to take advantage of their informational privilege. We find that insider activity occurs just as the early vestiges of economic policy uncertainty begin to appear. High-ranked insiders (CEOs and CFOs) are more sensitive to the first signs of uncertainty than other individuals holding different roles within a firm.

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3 Sources: www.policyuncertainty.com: Global EPU is calculated to create two measures, one using current price GDP measures and using purchasing power parity adjusted GDP figures.
and classed as an insider. The implication is that high-ranked insiders act when other market investors are relatively inattentive. The reason for this inattention is that they are less able to synthesize the information regarding the policy. The assumed rationale is that the attentiveness of (high-ranked) insiders is motivated by a coupling of personal economic stakes in their companies with expert knowledge of their firm’s resilience or lack thereof to macroeconomic influences.

One of this paper’s contributions is that, unlike previous literature, it eliminated the influence of direct informational privilege (private information) on insiders’ behavior and thus correctly evaluates the indirect informational privileges. We make this distinction by examining the relationship between insider trades and media published economic policy uncertainty and then analyzing the informational hierarchy within the insiders’ groups. Using a large sample of transactions, we demonstrate that, in general, insiders, especially the high-ranked ones, immediately act when faced with early indications of economic policy uncertainty and well ahead of the more intense periods of coverage. We add more detail to the picture by examining the relationship between insider trades and economic policy uncertainty, in the categorical sense, that isolates the reason for uncertainty and in the globalized sense, which accounts for the possible influence of external trading partner countries. Our findings offer one clear message: insiders’ privileges are not necessarily coming from a better information set than the public. Insiders are more sensitive and better able to read what uncertainty over economic policy might mean for the firms which they are involved with.

CRediT authorship contribution statement

Brendan Lambe: Writing – review & editing. Zhiyong Li: Methodology, Formal analysis, Writing – original draft. Weiping Qin: Methodology, Formal analysis, Writing – original draft, Project administration.

References