Uncertain times and the insider perspective

Brendan Lambe **Zhiyong Li** **Weiping Qin**[1]

Abstract

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.

JEL Codes: G10, G14, G15, G38

Keywords: Informational privilege, Insider trading, Economic policy uncertainty, Public information

[1] Corresponding author. Email: WQin@soton.ac.uk, Department of Banking and Finance, Southampton Business School, University of Southampton.

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 assets' 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 Jaffe, 1974; Finnerty, 1976; Seyhun, 1986; Lin and Howe, 1990; Jeng et al., 2003; Wisniewski and 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 their firm 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 and 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[2]. The extent of which is often tempered by the company's size and the effect of the price to earnings ratio (Rozeff and Zaman, 1988). The interest over the market effects of uncertainty is growing alongside a burgeoning literature and 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

[2] Early studies on company insider trading reveal that insiders frequently profit from their portfolio rebalancing activities, these include Jaffe (1974a, 1974b), Finnerty (1976a, 1976b), Givoly and Palmon (1985), Seyhun (1986a, 1986b), Lin and Howe (1990), Jeng et al. (2003), broadly these studies support the conclusion that insider purchases outperform selling transactions in terms of yielding abnormal returns.

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.

Alderidge 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 and McConnell, 1999; Meulbroek, 1992; and Meulbroek and 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 insiders' 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 et al. (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 variables 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 et al., 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 Alderidge and Cicero's (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 et al. (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 and Romer, 2008 and Wisniewski and Moro, 2014). Furthermore, economic policy uncertainty is associated with a range of economy-wide indicators, including output, employment, investment, and productivity (Alexopolous and Cohen, 2009; Caggiano et al., 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; Leduc and Liu, 2016; Kydland and Zarazaga, 2016; Sinha, 2016; Caggiano et al., 2017; Husted et al., 2020).

There is a growing literature documenting the impact of economic uncertainty on financial markets. Pastor and Veronisi (2012) provide the theoretical justification for how a conflict-ridden governmental decision-making process may negatively influence market returns. A further model hypothesizing this influence on stock option prices appears in Kelly et al. (2016). The empirical grounding underpinning these developments in understanding appears in Pastor and Veronisi (2013). They document how the nature of the response is conditioned by the magnitude of political uncertainty and underlying economic conditions. Kang, Perez de Gracia and Ratti (2017) note the directional impact of uncertainty on US stock prices and Christou et al. (2017) observe a spillover effect of US uncertainty levels to connected economies. Stock price volatility is also increased by heightened uncertainty, as documented in Liu and Zhang (2015), Brogaard and Detzel (2015), Arouri et al. (2016).

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 and Lee, 1991; Ravina and Sapienza, 2010; Agrawal and Cooper, 2015). They act because they can predict future cash flows better than others and insiders flows (Ke et al., 2003; Piotroski and Roulstone, 2005), and they can spot mispricing of shares and thus trade as contrarians (Ben-David and Roulstone, 2010, Ali et al., 2011).

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, Alldredge and Cicero (2015) suggest that insiders are more attentive to the public information relating to their old clients. Rozeff and Zaman (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 et al. (2012). Other public information, such as investor sentiment (Ha and Li, 2016) and investment horizons (Fu et al., 2018), 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 and 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 Figure 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 (FSEPU). 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.

<Insert Figure 1 here>

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:

$$NNI_t = \frac{ANB_t - ANS_t}{ANB_t + ANS_t} \quad [1]$$

where $\mathrm{ANB_t}$ and $\mathrm{ANS_t}$ represent the respective aggregated number of buy and sell transactions in each month t. We then employ an aggregative 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:

$$NPI_t = \frac{APB_t - APS_t}{APB_t + APS_t} \quad [2]$$

where APB_t and APS_t 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: logarithmic 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.

<Insert Table 1 here>

3.3 Other Variables

To control for the possible effects of market turbulence upon insider trading, we employ the measure of realized 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 $\sqrt{\sum_{i=1} r_i^2}$. 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).

<Insert Table 2 here>

4 Empirical Analysis

4.1 Quick Reactions of Insiders to EPU

4.1.1 VAR Analysis

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 realized 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., Alldredge and Cicero, 2015).

Figure 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 economic uncertainty level, supporting the argument that insiders react to uncertainty at its very early stages[3].

<Insert Figure 2 here>

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 (Piotroski and Roulstone, 2005; Jiang and Zaman, 2010). 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 et.al 2020). Their buying behaviour could also be because of the mispricing of the shares under uncertainty (Keusch 2014). A further explanation behind the purchasing behaviour of insiders is noted in Ha and Li (2016) who observe

[3] In addition, we run the VAR model within each sector. The results are similar and are available upon request.

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:

$$IT_{i,t} = constant + \Phi \cdot \log(FSEPU_t) + \delta \cdot \log(EPU_t) + \gamma \cdot Controls_t + \tau_t + \varphi_i + \varepsilon_{i,t} \quad [3]$$

$$Controls_t = \begin{bmatrix} CPI_t \\ Unemployment_t \\ Federal\ Funds\ rate_t \\ INDPRO_t \\ RV_t \\ SPR_t \end{bmatrix} \quad [4]$$

IT 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. τ_t and φ_i, time, and firm fixed effects, respectively, are used to control for the unobserved time and firm effects. The coefficient Φ is the impact of the first signs of economic policy uncertainty (FSEPU) on insiders' behavior, and δ 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 Φ and δ 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 Φ and δ 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. Φs are 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. δs are significant and around 1.5% less than the values for Φs. 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.

<Insert Table 3 here>

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 executory 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 et al. 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 subgroupings allows us to test the sensitivity of different insiders' roles to public information that might influence their companies listed value.

We test for differences between the two groups by running VAR models that separately include those three groups of insiders. The results appear in Figure 3. The patterns across the insiders'

types are concave, indicating an instant significant and positive reaction by all insiders to an FSEPU shock; after one month, the effects reach their peak. The Insiders' 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 signs of uncertainty are not as strong as those one month later. This observation indicates that those in this category are not as capable as CEOs and CFO's of appreciating the unfolding events' price relevance.

<Insert Figure 3 here>

Panel data analysis tests the issue of sub-groups. The model setting is Equation [3]. The results are shown in Panel A of Table 3. We can see that all coefficients for log(FSEPU) (Φ) are significant and positive across the different sup groupings of insiders, which further confirms that insiders react quickly in a trade contrary to burgeoning levels of uncertainty. It is meaningless to compare coefficients of log(FSEPU) (Φ) across different groups for insiders who might have different attitudes toward uncertainty. While it is of interest to compare Φ with δ in the same sub-groups, both CEOs' and CFOs' δs are not significant and are much lower than Φs while the Others' δs (around 0.05) are significant are very similar to Φs (0.056). This result implies that CEOs and CFOs react to early signs of uncertainty (FSEPU), i.e., when it first appears in the media. Simultaneously, the Others' reactions to the same uncertainties last for at least two months, and ($|\Phi|-|\delta|$) is very small (0.0063), which suggests that they are, to some extent, not very sensitive to the first signals of uncertainty.

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. Figure 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 Figure 4 (NNI measure). From these figures, we can observe that insider trading responses are 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.

<Insert Figure 4 here>

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 sub-groups of insiders along with the pooled case. The model is shown as follows:

$$NNI_{i,t} = constant + \Phi \cdot V_log\ (FS\ Catigorical\ EPU_t) + \delta \cdot V_log\ (Catigorical\ EPU_t) + \gamma \cdot Controls_t + \tau_t + \varphi_i + \varepsilon_{i,t} \quad [5]$$

Where $V_log\ (FS\ Catigorical\ EPU_t)$ and $V_log\ (Catigorical\ EPU_t)$ are the vectors of log categorical FSEPUs and categorical EPUs. τ_t and φ_i, indicate the time and firm fixed effects, respectively, and these are used to control for the unobserved time and firm effects. The results are reported in Table 4. In the pooled case, we find that insiders are influenced by most of the categorical EPUs. The uncertainty surrounding national security, trade policy, and health care policy are the least influential factors. Both Φ and δ of fiscal policy uncertainty are negative, which suggests that insiders reduce their holding facing this kind of uncertainty. Unlike monetary policy, the impact of fiscal policy on both the economy and share price is theoretically and empirically controversial (see Chatziantoniou et. al. 2013 for a review). The mechanism could be complicated,

and the impact on firms' cash flow might be ambiguous. Therefore, it is possible that even insiders may not be very certain about the nature of the impact and would not be confident in behaving in a contrarian fashion. It is of interest that fiscal policy uncertainty is the only factor which makes insiders reduce their holdings, however as it is not the focus of our paper, we recommend it for further study. We note that insiders in each sub-group behave differently in reacting to each of these. CEOs are not influenced by categories of health care, national security (both Φ and δ are not significant). Still, all the others only show some degree of negligence toward the emergence of the first sign of fiscal policy, sovereign debt & currency crises (both Φs and δs are significant). CFOs are not influenced by fiscal policy, health care, national security, and trade policy (both Φ and δ are not significant). They are also more or less ignorant to the first signs of entitlement programs (both Φ and δ are significant). The 'Others' pay less attention to the early signs of most categorical EPUs (both Φs and δs are significant) except for the regulation index where the 'Others' subgroup appears to over-react (Φ and δ have the opposite signs and are significant). For trade policy, the 'Others 'do not react (both Φ and δ are not significant). In general, therefore, CEOs and CFOs have similar levels of sensitivity to the first signs of categorical EPUs as they do to the general EPU index. In contrast, the 'Others' subgrouping displays less sensitivity.

<Insert Table 4 here>

4.4 Further Analysis

To extend the previous findings, we conduct several further tests, 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.

4.4.1 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.

$$IT_{i,t} = constant + \Phi \cdot \log(FSEPU_t) + \theta \cdot \log(FSEPU_t) \cdot Dummy_{crisis} + \vartheta \cdot \log(EPU_t) + \rho \cdot \log(EPU_t) \cdot Dummy_{crisis} + \delta \cdot Dummy_{crisis} + \gamma \cdot Controls_t + \tau_t + \varphi_i + \varepsilon_{i,t} \quad [6]$$

Where $Dummy_{crisis}$ is a dummy variable which is one during the global financial crisis (2007.08-2014.06) and is zero otherwise. τ_t and φ_i, time and firm fixed effects respectively, are used to

control for the unobserved time and firm effects. The results are reported in Table 5. θs are negative and significant at 10% and 5% levels in the case of NNI and NPI respectively, whereas ρs 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.

<Insert Table 5 here>

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 national EPU indices across 20 countries weighted according to each nation's GDP[4].

It is of interest to examine the impact of global EPU on insiders' behavior. Like the US EPU, global EPU is also public information for insiders. GEPU is "a GDP-weighted average of national EPU indices for 20 countries". We also evaluate the impact using the panel data model of Equation [3] results are reported in Table 6. Φs are positive and significant, which is the same as in section 4.1.2. On the other side, δs are positive and most significant as well. ($|\Phi|-|\delta|$)s are much smaller than those in Table 3, suggesting that insiders are less sensitive to the first sign of GEPU than the one of US EPU because US insiders are less concerned with global economic policy uncertainty.

<Insert Table 6 here>

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 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

[4] 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.

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.

References

Agrawal, A. and Cooper, T., 2015. Insider trading before accounting scandals. *Journal of Corporate Finance* 34, 169-190.

Aldridge, D.M. and Cicero, D.C., 2015. Attentive insider trading. *Journal of Financial Economics* 115, 84-101.

Alexopoulos, M. and Cohen, J., 2009. Uncertain times, uncertain measures. Working paper, University of Toronto, Department of Economics.

Ali, A., K. Wei, and Y. Zhou, 2011, Insider Trading and Option Grant Timing in Response to Fire Sales (and Purchases) of Stocks by Mutual Funds. *Journal of Accounting Research* 49, 595-632.

Anginer, Deniz and Donmez, Anil and Seyhun, H. Nejat and Zhang, Ray, Global Economic Impact of COVID-19: Evidence from Insider Trades (May 20, 2020). Available at SSRN: https://ssrn.com/abstract=3624403 or http://dx.doi.org/10.2139/ssrn.3624403

Arouri, M., Estay, C., Rault, C. and Roubaud, D., 2016. Economic policy uncertainty and stock markets: Long-run evidence from the US. *Finance Research Letters* 18, 136-141.

Baker, S.R., Bloom, N. and Davis, S.J., 2016. Measuring economic policy uncertainty. *The Quarterly Journal of Economics* 131, 1593-1636.

Ben-David, I. and Roulstone, D.T., 2010. Idiosyncratic risk and corporate transactions. Working paper, Ohio State University.

Brogaard, J. and Detzel, A., 2015. The asset-pricing implications of government economic policy uncertainty. *Management Science* 61, 3-18.

Caggiano, G., Castelnuovo, E., and Figueres, J. M., 2017. Economic policy uncertainty and unemployment in the united states: A nonlinear approach. *Economics Letters* 151, 31–34.

Caggiano, G., Castelnuovo, E., and Groshenny, N., 2014. Uncertainty shocks and unemployment dynamics in us recessions. *Journal of Monetary Economics* 67, 78–92.

Cataldi, M., Di Caro, L. and Schifanella, C., 2010. Emerging topic detection on twitter based on temporal and social terms evaluation. *Proceedings of the tenth international workshop on multimedia data mining* (pp. 1-10).

Chakravarty, S. and McConnell, J.J., 1999. Does insider trading really move stock prices? *Journal of Financial and Quantitative Analysis* 34, 191-209.

Chatziantoniou, I., Duffy, D. and Filis, G., 2013. Stock market response to monetary and fiscal policy shocks: Multi-country evidence. *Economic Modelling*, 30, pp.754-769.

Christou, C., Cunado, J., Gupta, R. and Hassapis, C., 2017. Economic policy uncertainty and stock market returns in PacificRim countries: Evidence-based on a Bayesian panel VAR model. *Journal of Multinational Financial Management* 40, 92-102.

Cohen, L., Malloy, C. and Pomorski, L., 2012. Decoding inside information. *Journal of Finance* 67, 1009-1043.

Dixit, A., 1989. Entry and exit decisions under uncertainty. *Journal of Political Economy* 97, 620-638.

Dixit, A., 1989. Intersectoral capital reallocation under price uncertainty. *Journal of International Economics* 26, 309-325.

Dixit, A., 1991. Analytical approximations in models of hysteresis. *The Review of Economic Studies* 58, 141-151.

Finnerty, J.E., 1976. In siders and market efficiency. *Journal of Finance* 31, 1141-1148.

Fu, X., Kong, L., Tang, T. and Yan, X., 2019. Insider trading and shareholder investment horizons. *Journal of Corporate Finance* 62, 101508.

Givoly, Dan, & Palmon, Dan (1985). Insider Trading and the Exploitation of Inside Information: Some Empirical Evidence. *The Journal of Business*, 58, 69–87.

Goergen, M., Renneboog, L. and Zhao, Y., 2019. Insider trading and networked directors. *Journal of Corporate Finance* 56, 152-175.

Ha, CY. and Li, T., 2016. Insider Trading and Investor Sentiment. Working paper, Peking University.

Hopkins, D.J., Kim, E. and Kim, S., 2017. Does newspaper coverage influence or reflect public perceptions of the economy? *Research & Politics* 4, 1-7.

Husted, L., Rogers, J. and Sun, B., 2020. Monetary policy uncertainty. *Journal of Monetary Economics* 115, 20-36.

Iqbal, Z. and Shetty, S., 2002. An investigation of causality between insider transactions and stock returns. *The Quarterly Review of Economics and Finance* 42, 41-57.

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

Jeng, L.A., Metrick, A. and Zeckhauser, R., 2003. Estimating the returns to insider trading: A performance-evaluation perspective. *Review of Economics and Statistics* 85, 453-471.

Jenter, D., 2005. Market timing and managerial portfolio decisions. *Journal of Finance* 60, 1903-1949.

Jiang, X. and Zaman, M.A., 2010. Aggregate insider trading: Contrarian beliefs or superior information? *Journal of Banking and Finance* 34, 1225-1236.

Karpoff, J.M. and Lee, D., 1991. Insider trading before new issue announcements. *Financial Management* 20, 18-26.

Ke, B., Huddart, S. and Petroni, K., 2003. What insiders know about future earnings and how they use it: Evidence from insider trades. *Journal of Accounting and Economics* 35, 315-346.

Kelly, B., Pastor, L. and Veronesi, P., 2016. The price of political uncertainty: Theory and evidence from the option market. *Journal of Finance* 71, 2417 – 2480.

Keusch, T 2014, Essays on insider trading, PhD Thesis, Maastricht University, Maastricht

Kang, W., Perez de Gracia, F.P. and Ratti, R.A., 2017. Oil price shocks, policy uncertainty, and stock returns of oil and gas corporations. *Journal of International Money and Finance* 70, 344 – 359.

Krugman, P., 1988. Deindustrialization, reindustrialization, and the real exchange rate. Working paper (No. w2586), National Bureau of Economic Research.

Kydland, F.E. and Zarazaga, C.E., 2016. Fiscal sentiment and the weak recovery from the Great Recession: A quantitative exploration. *Journal of Monetary Economics* 79, 109-125.

Lambe, B.J., 2016. An unreliable canary: Insider trading, the cash flow hypothesis and the financial crisis. *International Review of Financial Analysis* 46, 151-158.

Leduc, S. and Liu, Z., 2016. Uncertainty shocks are aggregate demand shocks. *Journal of Monetary Economics* 82, 20-35.

Lin, J.C. and Howe, J.S., 1990. Insider trading in the OTC market. *Journal of Finance* 45, 1273-1284.

Liu, L. and Zhang, T., 2015. Economic policy uncertainty and stock market volatility. *Finance Research Letters* 15 99-105.

McDonald, R. and Siegel, D., 1986. The value of waiting to invest. *The Quarterly Journal of Economics* 101, 707-727.

Meulbroek, L.K., 1992. An empirical analysis of illegal insider trading. *Journal of Finance* 47, 1661-1699.

Meulbroek, L.K. and Hart, C., 1997. The effect of illegal insider trading on takeover premia. *Review of Finance* 1, 51-80.

Pasquariello, P. and Zafeiridou, C., 2014. Political uncertainty and financial market quality. Working paper, University of Michigan.

Pastor, L. and Veronesi, P., 2012. Uncertainty about government policy and stock prices. *Journal of Finance* 67, 1219-1264.

Pástor, Ľ. and Veronesi, P., 2013. Political uncertainty and risk premia. *Journal of Financial Economics* 110, 520-545.

Pindyck, R.S., 1988. Capital risk and models of investment behaviour. In: *Economic modelling in the OECD countries* (pp. 103-117). Springer, Dordrecht

Piotroski, J.D. and Roulstone, D.T., 2005. Do insider trades reflect both contrarian beliefs and superior knowledge about future cash flow realizations? *Journal of Accounting and Economics* 39, 55-81.

Ravina, E. and Sapienza, P., 2010. What do independent directors know? Evidence from their trading. *Review of Financial Studies* 23, 962-1003.

Romer, C.D. and Romer, D.H., 2008. The FOMC versus the staff: where can monetary policymakers add value? *American Economic Review* 98, 230-35

Rozeff, M.S. and Zaman, M.A., 1998. Overreaction and insider trading: Evidence from growth and value portfolios. *Journal of Finance* 53, 701-716.

Seyhun, H.N., 1986. Insiders' profits, costs of trading, and market efficiency. *Journal of financial Economics* 16, 189-212.

Seyhun, H.N., 1992. The effectiveness of the insider-trading sanctions. *The Journal of Law and Economics* 35, 149-182.

Seyhun, H.N., 1998. Investment Intelligence From Insider Trading. Mass MIT Press, Cambridge.

Sinha, A., 2016. Monetary policy uncertainty and investor expectations. *Journal of Macroeconomics* 47, 188-199.

Wang, Weimin, Shin, Yong-Chul, & Francis, Bill (2012). Are CFOs' Trades More Informative Than CEOs' Trades? *Journal of Financial and Quantitative Analysis*, 47, 743–762.

Wisniewski, T.P. and Bohl, M.T., 2005. The information content of registered insider trading under lax law enforcement. *International Review of Law and Economics* 25, 169-185.

Wisniewski, T.P. and Moro, A., 2014. When EU leaders speak, the markets listen. *European Accounting Review* 23, 519-551.

Table 1

Table 1: Summary Statistics

This table summarises the statistics of uncertainty and insider trading variables. More specifically, the logarithm of FSEPU (log(FSEPU)), pooled NNI and pooled NPI are reported. Meanwhile, total insiders are categorised into three subgroups including CEO, CFO and others. Monthly data is from 01/1985 to 04/2018.

Variables	N	Mean	Std. Dev.	Min	Max
log(FSEPU)	396	4.536	0.389	3.643	5.537
NNI (Pooled)	396	-0.310	0.316	-1	1
NPI (Pooled)	396	-0.278	0.311	-1	1
NNI (CEO)	356	-0.380	0.425	-1	1
NPI (CEO)	347	-0.209	0.465	-1	1
NNI (CFO)	326	-0.448	0.380	-1	1
NPI (CFO)	325	-0.276	0.388	-1	1
NNI (Others)	396	-0.297	0.305	-1	1
NPI (Others)	396	-0.277	0.307	-1	1

Table 2

Table 2: Definitions of variables

Variables	Definition	Source
EPU	Average daily US EPU in the current month	Economic Policy Uncertainty website[5]
FSEPU	The first sign of EPU (Average daily US EPU in the next month)	Economic Policy Uncertainty website
FSGEPU	The first sign of Global EPU (Average daily Global EPU in the next month)	Economic Policy Uncertainty website
NNI	The difference between the aggregated number of purchase and sale trades according to the total number of transactions over the same interval	Thomson Reuters
NPI	The net proportion of direct holdings traded relative to the total proportion traded	Thomson Reuters
RV	Realised volatility, which is the square root of the sum of S&P 500 daily returns in a given certain month	DataStream
SPR	Log returns of S&P 500 monthly return index	DataStream
Unemployment	The number of people actively seeking work as a proportion of the total labour force	St Louis Fed website[6]
CPI	Consumer Price Index, which is a time series of change in household purchases of goods and services	St Louis Fed website
Federal Funds Rate	The overnight interest rate of lending Federal Reserve funds	St Louis Fed website
INDPRO	The Industrial Production Index, measuring real output for industrial establishments such as manufacturing, mining, and electric, and gas utilities	St Louis Fed website

5 https://www.policyuncertainty.com/

6 https://www.stlouisfed.org/

Table 3

Table 3: Impacts of EPU on insider trading

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

$$IT_{i,t} = constant + \Phi \cdot log\ (\mathrm{FS}EPU_t) + \delta \cdot log\ (EPU_t) + \gamma \cdot Controls_t + \tau_t + \varphi_i + \varepsilon_{i,t}$$

The dependent variable modelled in this table is the net number of insider transactions (NNI) and the net proportion of direct holdings traded relative to the total proportion traded (NPI) at monthly intervals calculated from insider transaction data of pooled and sub-groups of insiders (in Panel A, sub-groups are CEOs, CFOs and Others, in Panel B, The first group are the 10% of people whose holding the most shares the second group is are from the top 10% to 25% and the third group are the remaining insiders.). The first sign of EPU (FSEPU) and current EPU are included in the regression. Control variables are CPI, unemployment, Federal Funds rate, INDPRO, RV, SPR. More details about control variables are described in Table 2. τ_t and φ_i , 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.

Panel A	NNI				NPI			
	Pooled	CEOs	CFOs	Others	Pooled	CEOs	CFOs	Others
log(FSEPU)	0.0800**	0.0728**	0.0479**	0.0569**	0.0753**	0.0742**	0.0504**	0.0564**
	(13.43)	(8.28)	(4.07)	(12.25)	(11.88)	(8.30)	(4.10)	(11.49)
log(EPU)	0.0160**	0.0162	0.0197	0.0506**	0.0149*	0.0154	0.0144	0.0436**
	(2.66)	(1.80)	(1.65)	(10.66)	(2.33)	(1.68)	(1.16)	(8.66)
Firm fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj-R^2	0.0339	0.0356	0.0555	0.0302	0.0337	0.0364	0.0604	0.0311
N	327516	120737	72754	638320	305021	116374	66783	579069

Panel B	NNI			NPI		
	Group One	Group Two	Group Three	Group One	Group Two	Group Three
log(FSEPU)	0.0224	0.0445***	0.0632***	0.0240	0.0441***	0.0629***
	(1.37)	(3.86)	(13.48)	(1.46)	(3.80)	(12.77)
log(EPU)	0.0531***	0.0240*	0.0498***	0.0539***	0.0242*	0.0414***
	(3.33)	(2.11)	(10.50)	(3.36)	(2.12)	(8.25)
Firm fixed	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes	Yes	Yes
Adj-R^2	0.00995	0.0146	0.0343	0.00986	0.0143	0.0360
N	40143	86969	631672	40143	86969	567663

Table 4

Table 4: Impacts of categorical EPU on insider trading

The table below presents the coefficients and corresponding t-statistic values (in brackets) for fixed effects panel data regressions. The dependent variable modelled in this table is the net number of insider transactions (NNI) at monthly intervals. log fiscal policy (FP), log monetary policy (MP), log health care (HC), log national security (NS), log regulation (RL), log sovereign debt & currency crises (SDCC), log entitlement programs (EP), log trade policy (TP). "FS" is short for "first sign".

$$NNI_{i,t} = constant + \Phi \cdot V_log\ (FS\ Catigorical\ EPU_t) + \delta \cdot V_log\ (Catigorical\ EPU_t) + \gamma \cdot Controls_t + \tau_t + \varphi_i + \varepsilon_{i,t}$$

Variable definitions are given in Table 2. τ_t and φ_i , 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.

	Pooled	CEOs	CFOs	Others
log(FS_FP)	-0.0400***	-0.0106	-0.0319	-0.0599***
	(-4.62)	(-0.76)	(-1.69)	(-8.83)
log(FP)	-0.0372***	-0.0385**	-0.0299	-0.0352***
	(-4.23)	(-2.89)	(-1.67)	(-5.22)
log(FS_MP)	0.0374***	0.0282***	0.0312***	0.0429***
	(9.47)	(4.64)	(4.01)	(13.70)
log(MP)	0.0109**	0.0269***	0.00535	0.0260***
	(2.71)	(4.50)	(0.64)	(8.20)
log(FS_HC)	-0.0019	-0.0039	-0.0175	-0.0012
	(-0.29)	(-0.37)	(-1.24)	(-0.24)
log(HC)	-0.0126	0.0187	-0.0112	0.0196***
	(-1.94)	(1.82)	(-0.78)	(3.94)
log(FS_NS)	0.0058	-0.0122	-0.0149	-0.0000
	(1.20)	(-1.69)	(-1.49)	(-0.01)
log(NS)	0.0011	-0.0087	0.0050	0.0150***
	(0.22)	(-1.17)	(0.50)	(3.82)
log(FS_RL)	0.0261***	0.0274**	0.0314**	0.0231***
	(4.49)	(2.99)	(2.63)	(5.08)
log(RL)	-0.0074	-0.0109	-0.0174	-0.0151***
	(-1.35)	(-1.22)	(-1.44)	(-3.48)
log(FS_SDCC)	0.0169***	0.0107***	0.0083*	0.0141***
	(9.67)	(4.12)	(2.36)	(10.05)
log(SDCC)	0.0119***	0.0097***	0.0050	0.0097***
	(6.77)	(3.75)	(1.46)	(6.95)
log(FS_EP)	0.0215***	0.0254**	0.0313**	0.0214***
	(4.22)	(3.22)	(2.92)	(5.26)
log(EP)	0.0405***	0.0172*	0.0440***	0.0200***
	(7.53)	(2.07)	(4.02)	(4.72)
log(FS_TP)	-0.0050	-0.0083*	-0.0064	-0.0017
	(-1.95)	(-2.09)	(-1.22)	(-0.79)
log(TP)	0.0036	-0.0063	0.0058	0.0023
	(1.44)	(-1.65)	(1.19)	(1.06)
Firm fixed	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes
Adj-R^2	0.0386	0.0392	0.0584	0.0340
N	275864	105731	63928	534938

Table 5

Table 5: Impact of EPU on insider trading during different periods

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

$$IT_{i,t} = constant + \Phi \cdot \log(FSEPU_t) + \theta \cdot \log(FSEPU_t) \cdot Dummy_{crisis} + \vartheta \cdot \log(EPU_t) + \rho \cdot \log(EPU_t) \cdot Dummy_{crisis} + \delta \cdot Dummy_{crisis} + \gamma \cdot Controls_t + \tau_t + \varphi_i + \varepsilon_{i,t}$$

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. $Dummy_{crisis}$ 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. τ_t and φ_i , 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.

	NNI	NPI
log(FSEPU)	0.0770**	0.0745**
	(11.18)	(10.10)
log(FSEPU)*$Dummy_{crisis}$	-0.0239	-0.0311*
	(-1.91)	(-2.38)
log(EPU)	0.0032	0.0009
	(0.46)	(0.12)
log(EPU)*$Dummy_{crisis}$	0.0279*	0.0331*
	(2.25)	(2.51)
$Dummy_{crisis}$	0.0698	0.0728
	(1.27)	(1.30)
Firm fixed	Yes	Yes
Time fixed	Yes	Yes
Adj-R^2	0.0345	0.0342
N	327516	305021

Table 6

Table 6: Impact of Global EPU on insider trading

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

$$IT_{i,t} = constant + \Phi \cdot \log(FSGEPU_t) + \delta \cdot \log(GEPU_t) + \gamma \cdot Controls_t + \tau_t + \varphi_i + \varepsilon_{i,t}$$

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. Control variables are described in Table 2. τ_t and φ_i , 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.

	Current-based Global EPU		PPP-based Global EPU	
	NNI	NPI	NNI	NPI
log(FSGEPU)	0.0773**	0.0759**	0.0817**	0.0795**
	(10.89)	(10.35)	(11.82)	(11.15)
log(GEPU)	0.0712**	0.0697**	0.0731**	0.0712**
	(9.68)	(9.12)	(10.32)	(9.67)
Firm fixed	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes
Adj-R^2	0.0329	0.0343	0.0330	0.0344
N	492671	468208	492671	468208

Figure 1

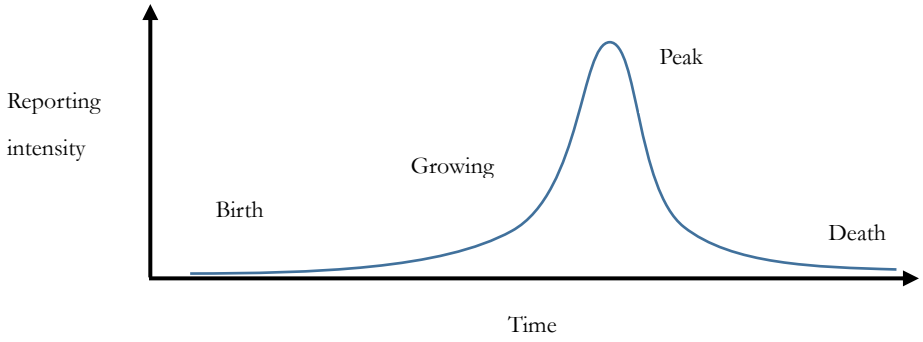


Figure 1: Life cycle of an uncertainty in newspaper

Figure 2

Figure 2: Responses of Insider Trading to FSEPU Innovation, Monthly data

This figure depicts the orthogonalized responses of insider trading to one-standard-deviation FSEPU innovation. 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%.

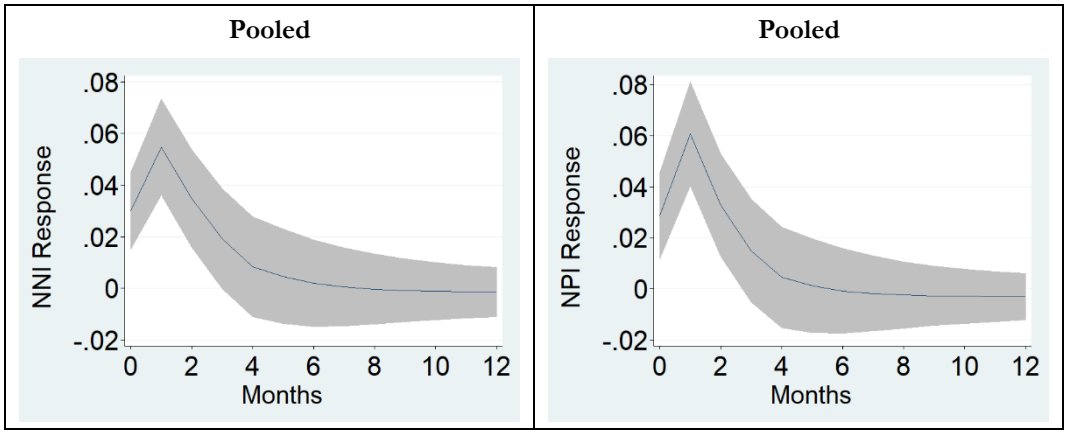
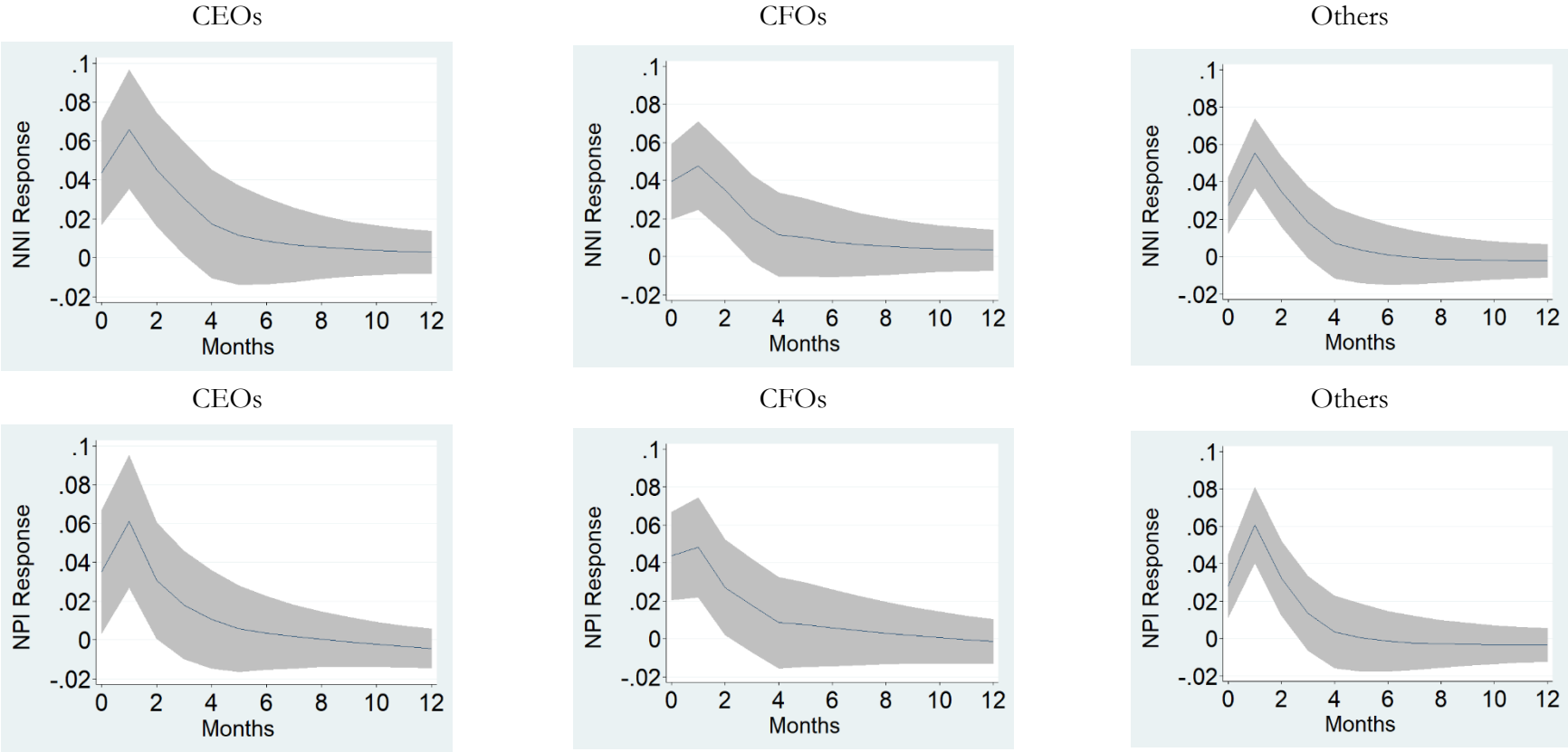


Figure 3

Figure 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%.



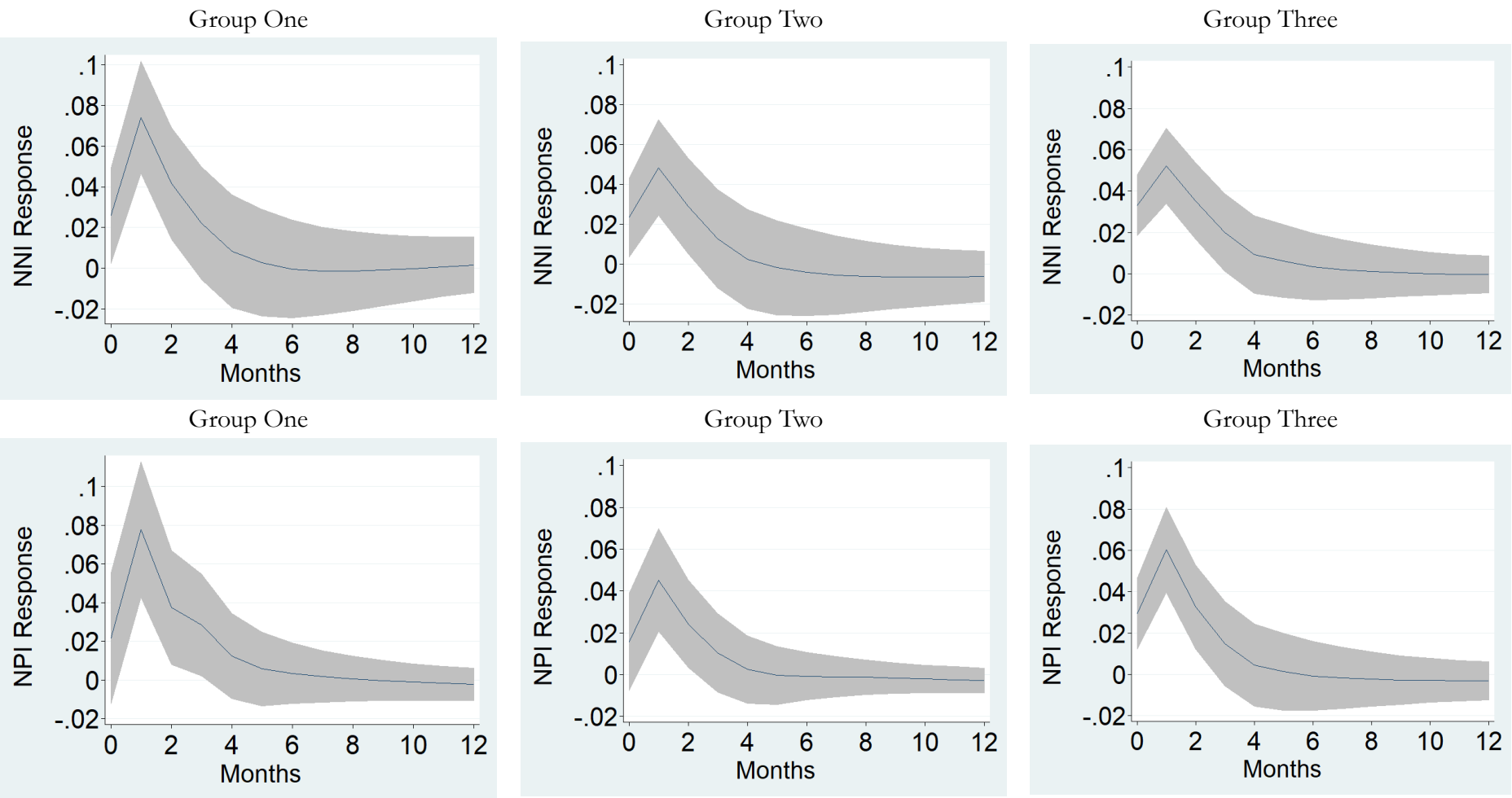
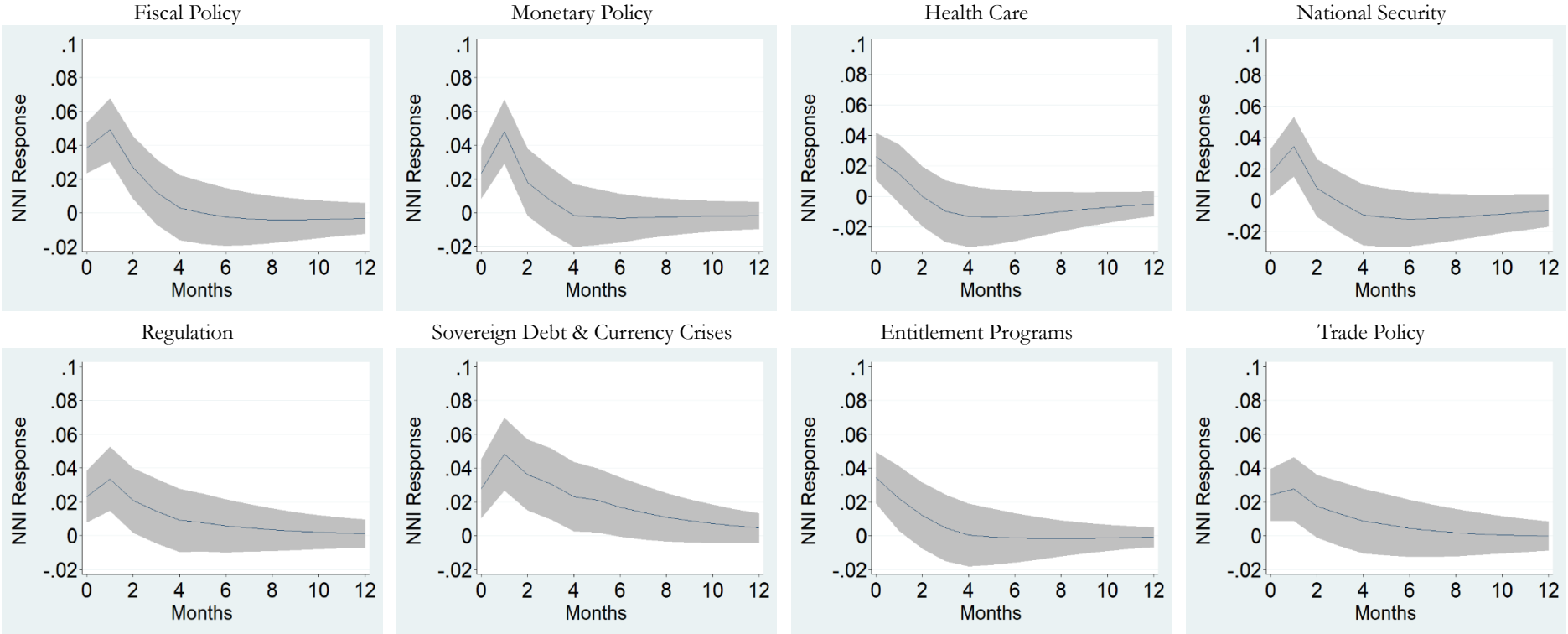

Group One
Group Two
Group Three
NNI Response
NPI Response
.1
.08
.06
.04
.02
0
-.02
0
2
4
6
8
10
12
Months

Figure 4

Figure 4: Responses of NNI to the First Sign of Categorical EPU Innovation, Monthly data

This figure depicts the orthogonalized responses of net number of insider transactions (NNI) to one-standard-deviation the first sign of categorical EPU innovation. 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 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. Data are monthly and confidence bands are 95%.