Precautionary vs Signaling Motive of Share Repurchases: Evidence from Policy Uncertainty and the COVID-19 Crisis

Abstract

Using policy-related uncertainty as a shock to firms' internal and external financing frictions, we find significantly lower repurchase likelihood, short-term market reactions, and post-announcement completion rate of open market share repurchases during periods of high policy uncertainty. Firms are more likely to switch from a high- to low-commitment repurchase technique when policy uncertainty is high. In contrast, for firms that are significantly undervalued ex-ante, higher policy uncertainty leads to more repurchase activities. In addition, we show that the COVID-19 crisis is associated with lower repurchase likelihood for financially constrained firms or those with high cash flow volatility, while undervalued firms repurchase more shares during the pandemic period. Our results are robust after controlling for potential sources of endogeneity and conducting a battery of robustness tests. Collectively, our evidence suggests that the relationship between uncertainty and share repurchases are conditional on institutional contexts. Firms' level of financial flexibility, their demand for signaling, the creditability and magnitude of repurchase signals, all significantly affect their precautionary and signaling motives.

JEL classification: G32; G35; G38.

Key words: Policy uncertainty; share repurchases; precautionary motive; signaling motive; COVID-19.

1. Introduction

In the contemporary economy, regulatory institutions and policymakers make policy-related decisions that frequently change the business environment in which firms operate. Such changes can significantly alter corporate behaviors. However, few studies to date have examined how economy-wide factors affect an important corporate decision: share repurchases (e.g., Walkup, 2016).[1] More importantly, it is unclear how firms react to elevated policy uncertainty when their needs for signaling and hoarding cash reserves are both amplified. This paper attempts to fill this gap by empirically investigating the impact of policy-related uncertainty on share repurchases in the United States.

The predicted effects of policy uncertainty on share repurchases are unclear ex-ante. On the one hand, policy uncertainty increases external financing costs and provides a shock to the supply of credit (Pastor and Veronesi, 2013; Brogaard and Detzel, 2015). In addition, cash flow volatility is also intensified when policy is uncertain (Nguyen and Phan, 2017). Such elevated internal and external financing frictions lead to significant deteriorations in cash flows and firms might have stronger precautionary motives to hold more cash for operating activities, which are essential for firms' long-term prospects (Duong *et al.*, 2020; Jens and Page, 2021). Because share repurchases exhibit a more flexible way than dividends to distribute excess cash to shareholders and managers are not obliged to undertake share repurchases (Jagannathan, Stephens and Weisbach, 2000), this *precautionary motive hypothesis* implies that firms may decide to retain a larger portion of their earnings by reducing share repurchases amid uncertainty.

On the other hand, policy uncertainty amplifies information asymmetry about firm values, making it more difficult for investors to collect corporate information (Nagar, Schoenfeld and Wellman, 2019). Therefore, firms are more likely to be misvalued during periods of high policy uncertainty and they could react to such a deteriorated information environment by sending positive signals about their underlying profitability and financial strength to the market through share repurchases (Ikenberry, Lakonishok and Vermaelen, 1995; Dittmar, 2000; Anolick *et al.*, 2021). The credibility of the positive signals could be enhanced in the event of uncertainty and firms could use share repurchases as a tool to reduce information asymmetry in response to increased policy uncertainty. Therefore, this *signaling motive hypothesis* predicts that firms increase share repurchases during periods of high policy uncertainty.

While policy uncertainty is unobservable and could be difficult to quantify, we use Baker, Bloom and Davis's (2016) (henceforth, BBD) index to measure policy uncertainty. The BBD index is constructed as a weighted average of four components: the frequency of newspaper articles containing keywords related to policy uncertainty, the level of uncertainty related to future changes in the federal tax code, and the dispersion in economic forecasts of both government spending and the Consumer Price Index. The BBD index is statistically significantly correlated with events that are expected to generate policy-related uncertainty.[2]

Policy uncertainty provides an ideal setting to study the relationship between uncertainty and share repurchases. Unlike firm-specific uncertainty, policy uncertainty acts as a shock to all firms in the economy and is difficult for firms and investors to hedge or diversify away (Duong *et al.*, 2020). The policy uncertainty index designed by Baker, Bloom and Davis (2016) is broader, captures the long-run time-variant policy uncertainty and reflects a wider range of policy-relevant environments than event-driven uncertainty which ignores the uncertainty outside the timeframe recorded by the specific events (Brogaard and Detzel, 2015; Attig *et al.*, 2021). It includes different types of uncertainty that are directly tied to policies, such as uncertainty related to tax, government spending, and both fiscal and monetary policies. Overall, the policy uncertainty index provides a comprehensive picture of the magnitude of the first-order effect of uncertainty on share repurchases.

Specifically, we focus on the universe of non-financial, non-utility firms covered by the Compustat database from 1985 to 2021. Consistent with the *precautionary motive hypothesis*, we first find evidence of a negative effect of policy uncertainty on share repurchases that is economically sizable and statistically significant. In particular, a one standard deviation increase in policy uncertainty is associated with a 5.0% lower repurchase ratio, and a 1.3% decrease in repurchase likelihood. These results are economically sizable because the decrease is 25.0% of the average repurchase ratio (18.6% of the unconditional probability) in our sample. We further find that the overall index's explanatory power mainly arises from its news-based component, while the other three components are not significantly related to share repurchase activities. The baseline results remain unaltered after conducting a battery of robustness tests. In addition, through a series of cross-sectional heterogeneity analyses, we further demonstrate that policy uncertainty affects firms' repurchase decisions through its impact on internal and external financing frictions.

Our results are also robust to controlling for potential sources of endogeneity. Policy uncertainty and share repurchases can be jointly correlated with unobservable factors, such as investment opportunities, which raises an endogeneity concern and potentially biases the coefficient estimates. Following the prior literature (e.g., Gulen and Ion, 2016; Nguyen and Phan, 2017), we use the partisan polarization measure (*POLAR*), which tracks legislators' ideological positions over time as an instrument for policy uncertainty. Using the fitted value of policy uncertainty, we still find that higher policy uncertainty is associated with lower repurchase ratio and likelihood. Another potential issue is that the policy uncertainty index might capture the effects of non-policy-related factors, such as economic uncertainty and these factors may affect share repurchases. We attempt to alleviate the measurement error bias by extracting the component of the United States policy uncertainty index orthogonal to the Canadian policy uncertainty index. The results remain robust.

In the next set of tests, we gauge the effect of policy uncertainty on share repurchase announcement returns. Consistent with the *precautionary motive hypothesis*, we find a negative relation between policy uncertainty and the average three-day abnormal returns around open market share repurchase (henceforth, OMSR) announcements. Consistent with our documented channels through which policy uncertainty affects share repurchases, this negative effect is more evident for firms that are financially constrained and that have higher cash flow volatility.

Unlike repurchases via Dutch auction, tender offers, or private negotiations, OMSR programs do not commit the firm to completing a prespecified buyback program and managers are not obligated to complete the repurchase program following the OMSR announcement (Babenko, Tserlukevich and Vedrashko, 2012). Consistent with the *precautionary motive hypothesis*, we find that the buyback ratio is lower after OMSR announcements during periods of high policy uncertainty. The decline of the completion rate is significantly greater for firms that are financially constrained and that have higher cash flow volatility. Furthermore, we explore the relation between policy uncertainty and repurchase techniques and find that firms are more likely to switch from a high- to low-commitment repurchase vehicle during periods of high policy uncertainty, supporting the *precautionary motive hypothesis*.

Our results so far support the *precautionary motive hypothesis* that firms react to intensified policy uncertainty by cutting share repurchases to preserve cash. However, we cannot rule out the possibility that the signaling motive also exists in certain circumstances. Using three different measures of misvaluation to explore the cross-sectional heterogeneity, we find compelling evidence that the signaling motive of firms' repurchase decisions exists when policy uncertainty is amplified. In particular, the subsample analysis reveals that the signaling motive becomes substantial when firms are significantly undervalued ex-ante.

In the last set of tests, we use the COVID-19 crisis as an exogenous and unparalleled shock to firms' internal and external financing frictions and explore the impact of this crisis on corporate repurchase activities. We find that the market reacts more positively to OMSR announcements during the pandemic period, which supports the signaling motive. By conducting multivariate tests, we draw casual inferences that the COVID-19 crisis is associated with lower repurchase likelihood for firms with intensified internal and external financing frictions. Furthermore, we consistently find that undervalued firms repurchase more shares during the pandemic period.

Our study contributes to the existing literature in several important ways. First, Pirgaip and Dinçergök (2019) find weak evidence for the precautionary motive in the United States while Anolick *et al.* (2021) provide empirical support for the signaling motive in the European Union. We provide direct and robust evidence that firms in the United States, on average, cut share repurchases when facing a shock to the supply of credit. However, for firms that are significantly undervalued ex-ante, policy uncertainty leads to higher repurchase ratio as these firms are motivated to enhance the credibility of the undervaluation signal in the event of uncertainty. We shed light on the literature by highlighting that different motives drive the repurchase decisions of firms with distinct characteristics when facing elevated policy uncertainty.

Second, our paper contributes to the existing literature by highlighting the institutional dimensions that determine firms' repurchase motives amid uncertainty. To our best knowledge, we are the first to explore what explains these observed different motives of repurchase activities under policy uncertainty between the US and the European market. Comparing with European firms, we find that US firms, on average, are less financially flexible, have lower level of information asymmetry, and are less prone to be undervalued. As a result, the signaling motive is less demanded for US firms while their motive for hoarding more cash reserves is much stronger than their European peers.[3] Such difference is further reinforced by the much tighter rules over the repurchase approval and authorization window in Europe. This is also consistent with prior studies that document declining signaling effects of share repurchases in the United States but persistent signaling motive in the Europe (Fu and Huang, 2016; Manconi, Peyer and Vermaelen, 2019).

Third, this paper is among the first to examine firms' share repurchase activities during the COVID-19 crisis and contributes to a nascent stream of literature on how the COVID-19 crisis systematically affects the corporate payout policy. Cejnek, Randl and Zechner (2021) examine dividend futures and find that the value of near-term dividend futures dropped more than the overall market during the first quarter of 2020. Krieger, Mauck and Pruitt (2021) investigate the impact of the COVID-19 crisis on dividend policy and find that the percentage of dividend cuts and omissions is three to five times higher than that in the pre-COVID-19 period. Complementing this fast-growing literature, we find that market reacts more positively to share repurchase announcements during the pandemic period than the pre-COVID-19 period. In addition, the COVID-19 crisis is associated with lower repurchase likelihood for financially constrained firms or those with high cash flow volatility while undervalued firms repurchase more shares during the pandemic period.

Fourth, we highlight that firms adopt a different attitude towards share repurchases than towards dividend payouts when financial resources are constrained. Attig *et al.* (2021) explore the effect of policy uncertainty on dividend policy and document that policy uncertainty has a consistently positive and significant effect on dividends. Dividends appear to be a more credible monitoring device in addressing agency problems and limiting management opportunism during periods of high policy uncertainty. On the contrary, our study yields important corporate policy implications by highlighting the statistically significant reduction in share repurchases, on average, for the precautionary motive when facing elevated policy uncertainty. This is not surprising as share repurchases represent a much more flexible form of payout, which strengthens the precautionary motive of share repurchases (Guay and Harford, 2000; Jagannathan, Stephens and Weisbach, 2000). Our findings further support the evidence that neither firms nor investors perceive dividends and repurchases as perfect substitutes (Lee and Rui, 2007; Herdhayinta, Lau and Shen, 2021).

The remainder of the paper is organized as follows: Section 2 describes the data and our policy uncertainty measure. Section 3 presents our main empirical analyses. Section 4 presents further tests and discussion. Section 5 concludes.

2. Data and methodology

2.1 Measuring policy uncertainty

We measure policy-related uncertainty using an aggregate index developed by Baker, Bloom and Davis (2016). The policy uncertainty index is constructed as a weighted average of four components that are related to uncertainties in news, tax code changes, and dispersion in forecasts of monetary and fiscal policies, respectively. The news component measures policy uncertainty identified by an automated search of ten large newspapers every month from January 1985. The tax component of the policy uncertainty index uses data from the Congressional Budget Office on the tax provisions set to expire in the near future and captures the level of uncertainty related to future changes in the tax code. The last two components of the policy uncertainty index capture forecaster disagreement about future monetary and fiscal policies.

The overall measure of policy uncertainty is calculated by normalizing each of the four above components and taking a weighted average based on a weight allocation of 1/2 for the news-based component, 1/6 for the tax component, 1/6 for the CPI forecast disagreement, and 1/6 for the government spending forecast disagreement. We construct our annual policy uncertainty variable as the average policy uncertainty index values for the last 3-month period of each year. Panel A of Table 1 shows the summary statistics of the overall policy uncertainty index and its components for our sample period from 1985 to 2021. The mean value of the overall policy uncertainty index is 113.84 during our sample period, which is very similar to the values documented by Nguyen and Phan (2017) and Bonaimé, Gulen and Ion (2018). Panel B of Table 1 illustrates that the overall index positively correlates with each of its components and the components correlate imperfectly with one another. The correlation coefficients between the four components range from -0.01 to 0.48. To facilitate interpretation of the economic significance of our results, we normalize the policy uncertainty index to unit standard deviation in our regression analysis.

2.2 Share repurchase data

Our initial sample includes all Compustat firms from 1985 to 2021. We first exclude utilities and financial firms (SIC codes 4900–4949 and 6000–6999) because their payout decisions are influenced by regulations (Fama and French, 2001). We also exclude firms with missing data for total assets (item 6, AT), income before extraordinary items (item 18, IB), common shares outstanding (item 25, CSHO), and closing share price (item 24, PRCC_F). We compute share repurchases as the purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV). The repurchase amount is set to zero if it is less than one percent of the market capitalization at the end of the previous year. Panel C of Table 1 shows the summary statistics of the key dependent variables for our sample period from 1985 to 2021.

3. Results

3.1 Policy uncertainty and share repurchases

In this section, we begin our empirical analysis by examining the impact of policy uncertainty on share repurchases. To get a better insight into the impact, we first visually observe the time-series of the policy uncertainty index and share repurchases from 1985 to 2021 in Figure 1. The three-month moving averages of the number of share repurchases by US public firms are reported, together with the policy uncertainty index.

Figure 1 shows that periods of high policy uncertainty are generally accompanied by lower number of share repurchases. The policy uncertainty index has a correlation of −28% with the number of repurchase deals, and this is significant at the 1% level. This negative relation appears to be pervasive throughout our entire sample and is not restricted to periods of poor economic conditions. For instance, after the financial crisis period, policy uncertainty remains high and share repurchase activities remain low, even though the general economic conditions improved substantially after 2009.

Next, we formally examine the effect of policy uncertainty on share repurchases. We implement the following pooled regression model in our main analysis:

$$SR_{i,t+1} = \alpha + \beta\, PU_t + \mu F_{i,t} + \gamma_k + \delta_t + \varepsilon_{i,k,t+1} \qquad (1)$$

where i indexes firms, k indexes industries, and t indexes time. All non-binary independent variables are lagged by one year. γ and δ denote industry and month fixed effects. ε is the error term.

The dependent variable, *SR*, is the share repurchase variables in year *t*+1. The main independent variable, *PU*, is the average policy uncertainty index values for the last 3-month period of year *t*. *F* are vectors of firm variables that have been found to affect share repurchases in the prior literature (e.g., Farre-Mensa, Michaely and Schmalz, 2014). To control for time invariant industry-related variables that might affect share repurchase activities, we use the Fama-French (1997) industry classifications to define industry.[4] We also include month fixed effects to control for a seasonal variation of share repurchase activities. Across all models, we use heteroscedasticity–robust standard errors double–clustered at the firm and year level to correct for potential cross-sectional and serial correlation in the error term (Petersen, 2009). All continuous variables are winsorized at the 1st and 99th percentiles. Detailed definitions of all the variables can be found in the appendix.

We perform OLS regressions, with the dependent variable *Repurchase Ratio*, and probit regression, with the dependent variable *Repurchase Dummy*. *Repurchase Ratio* is defined as the purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV), divided by income before extraordinary items (item 18, IB). *Repurchase Dummy* is a dummy variable that is equal to one if a firm makes an OMSR announcement in a particular year, and zero otherwise. To facilitate interpretation of the economic significance of our results, we report marginal effects for coefficients in probit regressions.

The results are reported in Table 2. In column (1), we find that policy uncertainty is negatively associated with the repurchase ratio in the following year. This suggests that policy uncertainty strongly predicts the next year's share repurchase ratio. The regression coefficient of –0.050 indicates that a one standard deviation increase in policy uncertainty is associated with a 5.0%

lower repurchase ratio in the next year. These results are economically significant because the decrease is 25.0% of the average repurchase ratio in our sample (=20.0%).

In column (2), we show that higher policy uncertainty is associated with lower repurchase likelihood in the following year. The marginal effect indicates that a one standard deviation increase in the policy uncertainty index is associated with a 1.3% decrease in the repurchase likelihood. A 1.3% decrease is economically sizable, representing 18.6% of the unconditional probability (=7.0%). Consistent with the *precautionary motive hypothesis*, firms significantly reduce share repurchase activities in the following year when policy uncertainty is high.

We replace the overall policy uncertainty index with the news-based component in columns (3) and (4) and find that the negative effect of policy uncertainty on share repurchases remains. In the online appendix, we provide detailed steps for exploring which source of the policy uncertainty index drives our findings and find that the overall index's explanatory power mainly arises from its news-based component, while the other three components are not significantly related to share repurchase activities.[5] This is not surprising because the news-based component itself is in principle designed to encompass any policy uncertainty pertaining to the other three components, and it also makes up the majority of the overall policy uncertainty index (50%). Consequently, we follow Gulen and Ion (2016) and present empirical results using only the news-based component for the remainder of our tests. In this way, we mitigate the concerns over measurement errors and the confusion about which elements of the policy uncertainty index are responsible for our findings. Nevertheless, our results remain unchanged if the overall policy uncertainty index is adopted instead.

In the online appendix, we also show that our baseline results remain unaltered after conducting a battery of robustness tests. First, our results are qualitatively similar after controlling for the election indicator and macro-level variables. Second, we control for time invariant unobservable firm-specific variation that may be related to a specific firm's share repurchase decision and our results remain unchanged. Third, we use a dummy variable as an alternative measure of policy uncertainty and our results remain unaltered. Fourth, we distinguish the effects of policy uncertainty from those of economic uncertainty and find that our results are not driven by recession periods or confounded by the effect of economic uncertainty.

A cross-sectional heterogeneity analysis of possible external channels in the online appendix reveals that the negative impact of policy uncertainty on share repurchases is stronger for financially constrained firms (we use four measures: credit rating dummy, KZ index, WW index, and SA index). With regards to internal channels, we find that higher policy uncertainty is associated with lower repurchase likelihood in the following year, and the magnitude is significantly larger for firms with lower amounts of free cash flows and firms with higher cash flow volatility. This further supports the *precautionary motive hypothesis*.

3.2 Robustness checks: dealing with endogeneity

3.2.1 Two-stage instrumental variable (IV) analysis

Policy uncertainty is likely to be countercyclical (Gulen and Ion, 2016) and both policy uncertainty and share repurchases could be jointly correlated with unobservable factors, for example investment opportunities, which raises an endogeneity concern and potentially biases the coefficient estimates in our baseline regressions. In this section, we adopt instrumental variable estimations to mitigate such concerns. In our context, a suitable instrumental variable should be significantly correlated with policy uncertainty (the relevance condition) but should only affect share repurchases via its relationship with policy uncertainty (the exclusion condition).

Following Gulen and Ion (2016) and Nguyen and Phan (2017), we use the degree of political polarization in the United States Senate (*POLAR*) as an instrument for policy uncertainty. The partisan polarization measure is based on the DW-NOMINATE scores developed by McCarty, Poole and Rosenthal (1997), which track legislators' ideological positions over time. Legislators with similar votes are scored similarly to each other, whereas legislators with different preferred outcomes have greater distance between each other's scores. The distance between two ideological points (i.e., the difference between two *DW-NOMINATE* scores) indicates the level of disagreement between two legislators.

McCarty (2012) argues that partisan polarization makes it more difficult to build legislative coalitions, which leads to policy gridlock and produces greater variation in policy. In our context, we expect that higher political polarization leads to greater uncertainty in policy decisions. Therefore, our partisan polarization measure satisfies the relevance condition. On the other hand, political polarization is unlikely to have a direct impact on a firm's share repurchases, other than its indirect impact through policy uncertainty. This satisfies the exclusion condition. Supporting this conjecture, we find an insignificant relation between the instrumental variable and our measures of share repurchase activities in untabulated results.

In Table 3, we use the above political polarization measure as an instrument for policy uncertainty and reexamine the effect of policy uncertainty on repurchase ratio and likelihood. We employ the standard two-stage least-squares (2SLS) regression when the dependent variable is continuous and the two-stage instrumental variables probit (ivprobit) model when the dependent variable is binary. We report the first-stage results in columns (1) and (3), where the dependent variable is the news-based component of the policy uncertainty index (*News PU*). The results show that the coefficient on the instrumental variable (*POLAR*) is positive and significant at the 1% level.

Importantly, we find that the Cragg-Donald Wald F statistic for the weak identification test is substantially higher than the critical value suggested by Stock and Yogo (2002), allowing us to reject the possibility of weak identification in our instrumental variable estimations. In column (2), we replace the independent variable *News PU* with its fitted value from the first stage (*Instrumented News PU*). The coefficient on *Instrumented News PU* is negative and significant at the 5% level, which indicates that higher policy uncertainty is associated with lower repurchase ratio in the following year. In column (4), the coefficient on *Instrumented News PU* is negative and significant at the 1% level, which indicates a negative relation between policy uncertainty and repurchase likelihood. Overall, the results in Table 3 help alleviate endogeneity concerns and confirm the robustness of our findings that policy uncertainty is negatively related to repurchase ratio and likelihood.

3.2.2 Canadian policy uncertainty

Another potential issue when we use the BBD index to proxy for policy uncertainty is that it might capture the effects of non-policy-related factors, such as economic uncertainty, and these factors may also affect share repurchases. If this is the case, our tests will suffer from a measurement error bias. We attempt to alleviate the measurement error bias by considering the similarity between the US and Canadian economies. The US and Canadian economies are closely linked to each other due to the extensive international trade activities between the two countries (Romalis, 2007). Hence, we expect shocks that affect general economic uncertainty in the United States to also affect general economic uncertainty in Canada, although possibly to a lesser extent. If the policy uncertainty index captures non-policy-related economic uncertainty, we can eliminate this confounding aspect by extracting the component of the United States policy uncertainty index orthogonal to the Canadian policy uncertainty index.

Following Gulen and Ion (2016) and Nguyen and Phan (2017), we address the measurement error concern using a two-step regression approach. In the first step, we run a quarterly regression, regressing the news-based component of the US policy uncertainty index on the Canadian news-based policy uncertainty measure. We also control for the country-level average sales growth, average Tobin's Q, and cash flows. We indeed find that the news-based component of the US policy uncertainty index is positively correlated with the Canadian news-based policy uncertainty measure, and the coefficient is significant at the 1% level (results are untabulated and available upon request). We then extract the regression residual (labelled *News RPU*) from the first-stage regression. Given that the United States and Canadian economies are closely related, the residual from a regression of the US news-based policy uncertainty measure on the Canadian measure should be free from potential contaminating effects of the economic uncertainty for both countries.

In the second step, we replace the news-based policy uncertainty index with *News RPU*. In column (1) of Table 4, we reperform OLS regressions with the dependent variable *Repurchase Ratio*. We find that the coefficient on *News RPU* is negative and significant at the 5% level, implying that higher policy uncertainty is associated with lower repurchase ratio in the following year. Furthermore, we reexamine the effect of policy uncertainty on the repurchase likelihood in column (2) and find that *News RPU* carries a negative coefficient that is significant at the 5% level. This evidence further corroborates our finding of a negative relation between policy uncertainty and the probability of share repurchase. As our results are qualitatively similar using each measure of share repurchase activity, we next focus on *Repurchase Dummy* for further analysis.

3.3 Policy uncertainty and share repurchases: market reactions

OMSR announcements in the United States generate average positive excess returns of around 3% (Oyon, Markides and Ittner, 1994; Grullon and Michaely, 2004). In this section, we further validate our evidence by investigating the market reactions of repurchase announcements during heightened policy uncertainty. If the *signaling motive hypothesis* explains our story, undervalued firms could use buyback announcements as a tool to reduce information asymmetry between managers and shareholders built upon uncertainty (Anolick *et al.*, 2021). Hence, we expect repurchase announcement returns to be more positively related to policy uncertainty because the credibility of the undervaluation signal is further enhanced in the event of uncertainty.

On the other hand, policy uncertainty poses an external risk to firm operations and leads to a higher cost of external financing. If firms announce OMSRs when policy uncertainty is high, they could possibly deteriorate firms' financial stability because firms utilize part of their internal funds to repurchase shares and it is more difficult for firms to raise capital externally, leaving less funds for other key corporate activities. Therefore, if the precautionary motive prevails, we expect investors to react less positively to OMSR announcements during periods of high policy uncertainty than during other periods.

In Table 5, we run cross-sectional regressions and gauge the effect of policy uncertainty on market reactions to share repurchases after controlling for firm characteristics, an election indicator, and macro-level variables. We measure the market reaction using the three-day CAR from day −1 to day 1 where day 0 is the OMSR announcement date. We use the market model to measure expected returns and the CRSP value-weighted market index as the benchmark. The estimation period ends 46 days before the announcements of share repurchases and we require the minimum (maximum) estimation length to be 3 (255) days.[6] Industry and month fixed effects are included, and standard errors are clustered by firm.

In column (1), the coefficient on the news-based component of the policy uncertainty index is negative and significant at the 5% level, which indicates a negative relation between policy uncertainty and average three-day abnormal returns. The effect of policy uncertainty is also economically sizable; the point estimate suggests that a one standard deviation increase in policy uncertainty above its sample mean is associated with a decrease of 0.19% in average three-day abnormal returns centered on the OMSR announcement date. The decrease represents 8.8% of the average three-day CAR in our sample (= 2.17%). In column (2) of Table 5, we find that for firms that are financially constrained ex-ante, higher policy uncertainty is associated with lower three-day abnormal returns. Lastly, we interact the policy uncertainty index with cash flow volatility in column (3) and find that for firms with high cash flow volatility, higher policy uncertainty is associated with lower three-day abnormal returns.

Overall, our findings indicate that the higher the level of policy uncertainty, the lower the three-day abnormal return. This effect is more evident for firms that have financial constraints and those with higher cash flow volatility. This further supports the *precautionary motive hypothesis* – investors appear to be concerned about the financial sustainability of firms and react less positively to their OMSR announcements.

3.4 Policy uncertainty and the completion rate of share repurchases

Unlike repurchases via Dutch auction, tender offers, or private negotiations, open market repurchase programs do not commit a firm to completing a prespecified buyback program and the managers are not obligated to complete the repurchase program following an OMSR announcement (Babenko, Tserlukevich and Vedrashko, 2012). In this section, we empirically gauge the effect of policy uncertainty on the completion rate of share repurchases. If the signaling motive dominates, we expect to observe a higher completion rate during heightened policy uncertainty because firms have stronger incentive to complete the repurchase deal to enhance the credibility of the undervaluation signal in the event of uncertainty. In contrast, under the *precautionary motive hypothesis*, we expect a lower completion rate when policy uncertainty is high because higher external financing cost might motivate firms to prioritize internal funds to key corporate activities.

Banyi, Dyl and Kahle (2008) use various proxies of actual share repurchases taken from the previous literature and find that although no measurements are free from measurement error, the least problematic estimate of actual repurchases is the purchases of common and preferred stock minus any decrease in redeemable preferred stock, using data from the Compustat database.[7] Therefore, we follow previous literature (Grullon and Michaely, 2004; Gong, Louis and Sun, 2008; Lei and Zhang, 2016) and calculate the buyback ratio of share repurchases as the purchases of common and preferred stock (item 115, PRSTKC) minus any decrease in redeemable preferred stock (item 175, PSTKR), scaled by the market value of equity (item 25, CSHO)*(item 24, PRCC_F).

Table 6 reports the effect of policy uncertainty on the completion rate of share repurchases. We employ Tobit regressions where the dependent variable is the buyback ratio of share repurchases one year after the OMSR announcement. In column (1), the coefficient on the news-based component of the policy uncertainty index is negative and significant at the 1% level, which indicates that the buyback ratio is lower after OMSR announcements during periods of high policy uncertainty. In economic terms, a one standard deviation increase in policy uncertainty above its sample mean is associated with a decrease of 0.31% in the buyback ratio after the OMSR announcement. The decrease is economically sizable because it represents 8.2% of the average buyback ratio in our sample (= 3.76%).

Consistent with the *precautionary motive hypothesis*, in columns (2) and (3) of Table 6, we find that higher policy uncertainty is associated with lower buyback ratio after OMSR announcements, especially for financially constrained firms or those with higher cash flow volatility.

3.5 Policy uncertainty and repurchase techniques

Firms repurchase their shares through four main vehicles: (1) fixed-price tender offer, (2) Dutch auction tender offer, (3) privately negotiated stock repurchase, and (4) open market share repurchase. Share repurchases conducted through the first three techniques represent a firm's commitment to buy back shares because firms are obliged to fulfill their obligations after the repurchase announcements. In contrast, OMSRs act as a weaker commitment device because the company has an option to repurchase shares, but not an obligation (Vermaelen, 2005).

In this section, we examine the effect of policy uncertainty on repurchase techniques. If the precautionary motive prevails, we expect that firms switch from high- to low-commitment repurchase vehicles during periods of high policy uncertainty because OMSRs exhibit a more flexible way to buy back stocks and managers are not obliged to undertake share repurchases amid uncertainty. In contrast, under the *signaling motive hypothesis*, we expect to observe a switch from low- to high-commitment repurchase device during heightened policy uncertainty because firms have stronger incentives to select a high-commitment repurchase technique to enhance the credibility of the undervaluation signal when policy uncertainty is high.

In Table 7, we run cross-sectional regressions and investigate the effect of policy uncertainty on repurchase techniques. The dependent variable in column 1 (2) is a binary variable that equals one if a firm switches from a low- to high-commitment (high- to low-commitment) repurchase technique in a particular year, and zero otherwise. We define OMSRs as a low-commitment repurchase technique and the other three as high-commitment repurchase vehicles.

In column (1), the coefficient on the news-based component of the policy uncertainty index is negative and significant at the 1% level, which indicates that firms are less likely to switch from a low- to high-commitment repurchase technique in the event of high policy uncertainty. Similarly, in column (2), the coefficient on the news-based component of the policy uncertainty index is positive and significant at the 1% level, suggesting that firms are more prone to change from a high- to low-commitment repurchase vehicle during periods of high policy uncertainty. Overall, our results further validate the *precautionary motive hypothesis* as we document a lower likelihood of switching to high-commitment repurchase techniques when policy uncertainty propagates.

3.6 Policy uncertainty and share repurchases: misvaluation

The empirical results in the previous sections are consistent with the *precautionary motive hypothesis*. However, we cannot rule out the possibility that the signaling motive also affects firms' repurchase decisions in certain circumstances. In this section, we test the existence of the signaling motive and explore potential scenarios for it to become significant amid uncertainty. The main idea behind the *signaling motive hypothesis* is that corporate undervaluation is more prevalent in the event of uncertainty, and it is particularly effective to signal undervaluation by repurchasing stocks when uncertain market conditions prevail. Therefore, we expect firms to repurchase more shares amid uncertainty if they are significantly undervalued ex-ante.

We use three different measures of misvaluation. First, we define a firm as undervalued if its market-to-book ratio is in the bottom 5th percentile among all sample firms each year. Second, we follow Rhodes-Kropf, Robinson and Viswanathan (2005) to decompose the market-to-book ratio into three components:

$$m_{it}\text{-}b_{it} = \underbrace{m_{it}\text{-}v_{it}(\alpha_{jt})}_{\text{firm-specific error}} + \underbrace{v_{it}(\alpha_{jt})\text{-}v_{it}(\alpha_{j})}_{\text{time-series sector error}} + \underbrace{v_{it}(\alpha_{j})\text{-}b_{it}}_{\text{long-run value to book}} \qquad (2)$$

The first term in equation (2) is the difference between the market value and the estimated fundamental value. It captures firm-specific error in market valuation. A firm is defined as undervalued if the first term in this market-to-book ratio decomposition is in the bottom 5^{th} percentile among all sample firms each year. Third, we follow Bonaimé and Ryngaert (2013) and define firm undervaluation based on insider transactions reported in SEC form 4 from the Thomson Reuters (Refinitiv) Insiders database. For each OMSR announcement, we look at the trading behavior of the CEO one quarter before the announcement date. We label firms as "undervalued" if total insider purchases exceed total insider sales by at least $200,000 and/or 0.01% of the firm's market capitalization at the end of the prior quarter.

Since we examine insider trading behavior before OMSR announcements, we are unable to conduct the repurchase likelihood analysis. Instead, we perform OLS regressions with the dependent variable *Repurchase Ratio*. The results are reported in Table 8. In Panel A, we implement full sample analysis and interact the news-based component of the policy uncertainty index with the undervaluation dummy variable using our three measures of misvaluation. Across all specifications, the interaction variable carries a positive coefficient that is statistically significant at conventional levels. This evidence implies that undervalued firms signal the perceived undervaluation to market participants via buyback activities when facing higher levels of policy uncertainty.

In Panel B, we conduct subsample analyses. In columns (1), (3) and (5), we focus on firms that are undervalued before the OMSR announcement and find that the coefficient on the news-based component of the policy uncertainty index is positive and significant across all specifications, which indicates that undervalued firms repurchase more shares during periods of high policy uncertainty, supporting the *signaling motive hypothesis*. In columns (2), (4) and (6), we show that other firms repurchase fewer shares when policy uncertainty is high, consistent with the *precautionary motive hypothesis*.

Taken together, our results show that the precautionary motive dominates the average effect of policy uncertainty on share repurchases in the United States. However, for a subset of firms that are significantly undervalued ex-ante, the signaling motive becomes substantial when firms make repurchase decisions amid uncertainty.

3.7 The COVID-19 crisis and share repurchases

With the COVID-19 shock, the global economic activity is abruptly and severely constricted by this worldwide pandemic (e.g., Albuquerque *et al.*, 2021). Ding *et al.* (2021) show that the COVID-19 crisis is significantly different from past crises in terms of its cause, scope and severity. Since the COVID-19 pandemic brought about an exogenous and unparalleled shock to the global economy and financial markets, we use the COVID-19 crisis as an exogenous shock to firms' internal and external financing frictions and explore the impact of this crisis on corporate repurchase activities. We define the COVID-19 period from January 2020 to December 2021 and the pre-COVID-19 period from January 2018 to December 2019.

In Panel A of Table 9, we first report short-term market reactions to OMSRs during the COVID-19 crisis. We measure the market reaction using the three-day CAR from day −1 to day 1 where day 0 is the OMSR announcement date. We find that the average three-day abnormal return during the COVID-19 crisis is 3.71% while the three-day abnormal return is 2.25% in the pre-COVID-19 period, and the difference is statistically significant at the 5% level. This indicates that investors react more positively to OMSR announcements during the COVID-19 crisis, which is consistent with the signaling motive. We also investigate the effect for year 2020 and 2021 separately and find that the effect mainly comes from OMSR announcements in 2020. This is consistent with the conjecture that the signaling effect is stronger at the beginning of the pandemic when the information asymmetry about firm values is amplified. The level of information asymmetry gradually declines as time passes when various information has been conveyed to outside investors.

In Panel B of Table 9, we perform probit regression, with the dependent variable *Repurchase Dummy*. *COVID* is a dummy variable that equals one from 2020 to 2021, and zero from 2018 to 2019. In column (1), we find that the *COVID* variable itself is statistically insignificant at conventional levels, suggesting that, in general, the COVID-19 crisis does not significantly affect corporate repurchase propensities.

In column (2), we evaluate the incremental effect of financial constraints on the relation between the COVID-19 crisis and share repurchases. Specifically, we interact the COVID dummy variable with the WW index and the coefficient on the interaction variable is negative and significant at the 1% level, which suggests that financially constrained firms have lower repurchase likelihood during the COVID-19 crisis period. In column (3), we examine how the effect of the COVID-19 crisis on the repurchase likelihood varies in a cross-section of firms based on measures of cash flow volatility. We find that the interaction variable carries a negative coefficient that is significant at the 1% level. Supporting the *precautionary motive hypothesis*, the COVID-19 crisis is associated with lower repurchase likelihood for firms that have higher cash flow volatility.

In Panel C of Table 9, we investigate whether undervalued firms repurchase more shares during the COVID-19 crisis. Using three different measures of misvaluation, we consistently find that undervalued firms repurchase more shares during the COVID-19 period across all specifications, consistent with the *signaling motive hypothesis*.

While COVID-19 serves as a truly exogenous and unparalleled shock with the unique feature of large-scale policy response to limit the spread of disease and support the local economy (Reinhart, 2020), the scope of its resulting uncertainty may go far beyond its impact on policy uncertainty. Thus, although it acts as an interesting and important setting for us to explore how firms react to such extreme situations with full-scale uncertainties in many dimensions, we note that our results should be interpreted with caution as we cannot conclude how much of its overall effects on corporate repurchase activities actually manifest themselves via the policy uncertainty channel.

4. Further tests and discussion: US market vs European market

Our results so far show that the precautionary motive dominates the relationship between policy uncertainty and firms' repurchase activities in the United States. However, Anolick *et al.* (2021) examine the short-term market reactions of repurchase announcements in the European market and find that the signaling motive prevails. In this section, we further delve into this question and investigate potential reasons behind such difference.

We follow Anolick *et al.* (2021) and select 9 European countries for our European sample: Austria, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden and the United Kingdom. We download financial data from Compustat Global and information about analysts from I/B/E/S. Then we compare the key characteristics of these European firms with those of the US firms in our sample.

Table 10 reports the mean value of key characteristics for US and European firms, respectively. As shown in the table, US firms, on average, have higher debt ratio (*Leverage*), invest more (*Capital expenditure and R&D expenses*), and are more financially constrained (*WW index*) than European firms. Furthermore, they receive higher valuation (*market-to-book ratio*) and have lower level of information asymmetry (*larger firm size, more tangible assets, more analysts following the firm, lower dispersion/error of analysts' forecasts*). As a result, the signaling motive is less demanded for US firms while their motive for hoarding more cash is much stronger than their European peers.

Furthermore, the share repurchase regulations in the United States and the Europe differ significantly. US firms only need approval from their boards and there is no time restriction for buyback activities. In contrast, there are significant restrictions on share buybacks in the European Union. An explicit approval at the shareholder meeting is required for open market share repurchases, and this authorization is only valid for 18 months.[8] Therefore, the credibility of the repurchase's signaling effect is much stronger in Europe because of these regulatory restrictions.

In addition, the number of repurchase announcements in the United States is larger than the total number of repurchases announced in the rest of the world (Manconi, Peyer and Vermaelen, 2019). This can be seen from the size difference between our sample and the sample from Anolick *et al.* (2021) (10,962 in the United States vs 882 in nine European countries). Since many firms in the United States made multiple open market repurchase programs (Jagannathan and Stephens, 2003), the repeated repurchase activities in the US market may undermine the marginal signaling effect of each announcement.

Finally, Manconi, Peyer and Vermaelen (2019) find that the long-term excess returns outside the United States have not declined in recent years while Fu and Huang (2016) document that the long-term excess returns in the United States have disappeared in recent years. One reason is that recent share repurchases in the United States are not primarily motivated by mispricing and market timing. Therefore, the signaling effect in the United States is weaker because repurchase activities are conducted not mainly for reasons of signaling mispricing.

Taken together, our study suggests that the relationship between policy uncertainty and share repurchases is conditional on institutional contexts. Firms' level of financial flexibility, their demand for signaling, the creditability and magnitude of repurchase signals, all significantly affect their precautionary and signaling motives, which may result in different motives prevailing among various countries, industries, or periods.

5. Conclusion

Using policy uncertainty as a shock to the supply of credit, we find that the repurchase likelihood, short-term market reactions, post-announcement completion rate of OMSRs, and the propensity of switching from low- to high-commitment repurchase techniques are all significantly lower during periods of high policy uncertainty. Our baseline results are unaltered when we control for potential unobservable factors and measurement error bias. Taken together, the aforementioned results support the *precautionary motive hypothesis* that firms in the United States, on average, cut share repurchases when facing a shock to the supply of credit.

Meanwhile, we also find compelling evidence that the signaling motive of firms' repurchase decisions exists when policy uncertainty is high. Specifically, for firms that are significantly undervalued ex-ante, policy uncertainty leads to higher repurchase ratio as firms are motivated to enhance the credibility of the undervaluation signal in the event of uncertainty. Importantly, through detailed examinations and discussions, we contribute to the existing literature by highlighting the institutional dimensions that determine firms' repurchase motives amid uncertainty. Our research findings have timely implications for policymakers and corporate executives, given the large recent changes in policy uncertainty and their adverse effects on the real economy. Our findings also shed light on how other situations or extreme events (e.g., the COVID-19 crisis) that intensify financing frictions can affect firms' repurchase policies.

Footnotes

1. Share repurchases are the dominant form of corporate payout (Skinner, 2008) and industrial public US firms spend more than $550 billion on share repurchases prior to the credit crisis of 2007-2008 (Farre-Mensa, Michaely and Schmalz, 2014).

2. The index spikes during events that are associated with high policy uncertainty, such as the two Gulf Wars, the 9/11 attack, the 2011 debt-ceiling dispute, and political battles over fiscal policy.

3. In fact, the US firms' heightened precautionary motive of cash reserve has been documented by Bates, Kahle and Stulz (2009). In their paper, they attribute this motive to changes in US firms' fundamental characteristics: less working capital, fewer inventories and accounts receivable, intensified cash flow volatility, and increased R&D expenditures. In addition, Floyd, Li and Skinner (2015) also suggest that different types of firms (industrial vs banks) exhibit fundamental differences in their payout policies during the credit crisis of 2007-2008.

4. Our results hold when we use the two–digit Standard Industrial Classification (SIC) codes to define industry.

5. We also document consistent results across different subgroups of firms based on their internal and external financing frictions. The detailed demonstration is provided in the online appendix.

6. To check whether our results remain robust if a multifactor model is applied, we use the Fama and French (1993) three factor model plus the momentum factor (Carhart, 1997) as the benchmark to control for market return, size, market-to-book ratio and momentum. Our results remain unaltered. Our results are also quantitatively similar using alternative event windows.

7. Several measurements are used in the previous literature to measure the buyback ratio. Fama and French (2001) select changes in treasury stock from Compustat to proxy for the actual repurchase rate. Stephens and Weisbach (1998) and Guay and Harford (2000) use decreases in shares outstanding from CRSP to measure the buyback ratio.

8. Please refer to Kim, Schremper and Varaiya (2005) for a complete review of the open market repurchase regulations in major stock markets.

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Figure 1. Policy uncertainty and share repurchases

This figure depicts the time-series of the policy uncertainty index and share repurchases from 1985 to 2021. The three-month moving averages of the number of share repurchases (red dashed line) by US public firms are reported, together with the policy uncertainty index (blue solid line). We measure policy-related uncertainty using an aggregate index developed by Baker, Bloom and Davis (2016). The BBD index is constructed as a weighted average of four components: the frequency of newspaper articles containing keywords related to policy uncertainty (*News Component*), the level of uncertainty related to future changes in the federal tax code (*Tax Component*), and the dispersion in both economic forecasts of the government spending (*Government Spending Component*) and the Consumer Price Index (*CPI Component*) to proxy for forecaster disagreement about future monetary and fiscal policies. The left axis represents the value of the policy uncertainty index, and the right axis represents the number of share repurchases deals.

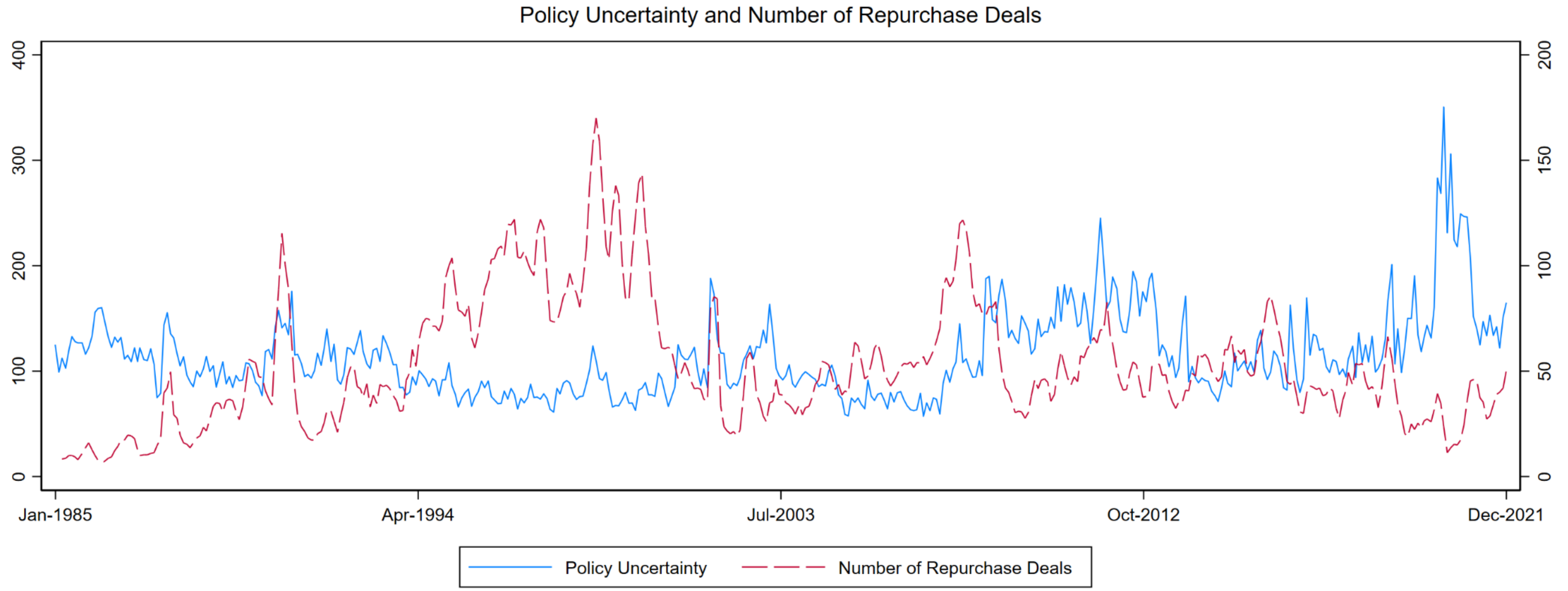

Table 1. Summary statistics and correlation matrix

The table summarizes the Baker, Bloom and Davis (2016) monthly policy uncertainty index, its four components, and our key independent variables during our sample period from 1985 to 2021. The BBD index is constructed as a weighted average of four components: the frequency of newspaper articles containing keywords related to policy uncertainty (*News Component*), the level of uncertainty related to future changes in the federal tax code (*Tax Component*), and the dispersion in both economic forecasts of the government spending (*Government Spending Component*) and the Consumer Price Index (*CPI Component*) to proxy for forecaster disagreement about future monetary and fiscal policies. Panel A presents summary statistics for the policy uncertainty index and Panel B presents correlation coefficients with their associated *p*-values in parentheses. Panel C presents summary statistics for the key dependent variables. Detailed definitions of all variables can be found in the appendix. All continuous variables are winsorized at the 1st and 99th percentiles. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Summary statistics of policy uncertainty index

Variables	N	Mean	10th Perc.	Median	90th Perc.	Std. Dev
Overall PU	444	113.84	74.57	105.86	162.63	39.51
News Component	444	121.15	71.94	106.43	183.10	57.20
Tax Component	444	234.45	13.49	73.65	771.24	392.15
Gov. Spending Component	444	98.36	52.86	85.99	160.62	48.33
CPI Component	444	95.52	68.01	86.84	136.02	29.52

Panel B. Correlation matrix of policy uncertainty index

	Overall PU	News Component	Tax Component	Gov. Spending Component
News Component	0.919***			
	(0.000)			
Tax Component	0.453***	0.236***		
	(0.000)	(0.000)		
Gov. Spending Component	0.402***	0.136***	0.085*	
	(0.000)	(0.004)	(0.075)	
CPI Component	0.298***	-0.009	0.162***	0.484***
	(0.000)	(0.859)	(0.001)	(0.000)

Panel C. Summary statistics of key dependent variables

Variables	N	Mean	10th Perc.	Median	90th Perc.	Std. Dev
Repurchase Ratio	144,113	0.20	0	0	0.48	9.23
Repurchase Dummy	144,169	0.07	0	0	0	0.26
CAR (-1,+1)	11,557	2.17%	-4.95%	1.51%	10.47%	7.40
Completion Rate	11,887	3.76%	0	1.99%	9.92%	5.26
Low-to-High Commitment Dummy	12,555	0.18	0	0	1	0.39

Table 2. Policy uncertainty and share repurchases

This table reports the effect of policy uncertainty on share repurchases after controlling for firm characteristics. The dependent variable for each regression is indicated at the top of each column. We perform OLS regressions in columns (1) and (3) using the dependent variable *Repurchase Ratio* and probit regression in columns (2) and (4) using the dependent variable *Repurchase Dummy*. *Repurchase Ratio* is defined as the purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV), divided by income before extraordinary items (item 18, IB). *Repurchase Dummy* is a dummy variable that is equal to one if a firm makes an OMSR announcement in a particular year, and zero otherwise. The independent variable of interest in columns (1) and (2) is *PU*, which represents the Baker, Bloom and Davis (2016) policy uncertainty index. *News PU* is the news-based component of the policy uncertainty index. Industry and month fixed effects are included and standard errors are clustered at the firm and year level. All continuous variables are winsorized at the 1st and 99th percentiles. Detailed definitions of all variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	Repurchase Ratio	*Repurchase Dummy*	*Repurchase Ratio*	*Repurchase Dummy*
PU	-0.050***	-0.013***		
	(0.005)	(0.006)		
News PU			-0.055***	-0.014***
			(0.005)	(0.000)
Total Assets	0.039***	0.019***	0.039***	0.020***
	(0.000)	(0.000)	(0.000)	(0.000)
ROA	-0.000	0.000***	-0.000	0.000***
	(0.515)	(0.005)	(0.525)	(0.004)
Sales Growth	-0.037***	-0.002	-0.037***	-0.002
	(0.001)	(0.173)	(0.001)	(0.229)
Leverage	-0.003	-0.105***	-0.002	-0.104***
	(0.877)	(0.000)	(0.940)	(0.000)
Cash	0.083	0.002	0.084	0.003
	(0.453)	(0.792)	(0.447)	(0.755)
MB	0.000	0.000*	0.000	0.000
	(0.614)	(0.090)	(0.597)	(0.061)
Return	0.034	-0.004	0.035	-0.004
	(0.194)	(0.165)	(0.190)	(0.178)
Volatility	-0.740	-0.011	-0.694	0.006
	(0.353)	(0.859)	(0.383)	(0.921)
Industry FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
N	144,113	144,169	144,113	144,169

Table 3. Addressing the endogeneity concern: instrumental variable approach

In this table, we employ the standard two-stage least-squares (2SLS) regression when the dependent variable is *Repurchase Ratio* and two-stage instrumental variables probit (ivprobit) model when the dependent variable is *Repurchase Dummy*. The dependent variable of each regression is indicated at the top of each column. We use the partisan polarization measure (*POLAR*) as the instrument for the news-based component of policy uncertainty index (*News PU*), which tracks legislators' ideological positions over time. The results of the first-stage regressions are reported in columns (1) and (3), where the dependent variable is the news-based component of policy uncertainty index (*News PU*). The results of the second-stage regressions are reported in columns (2) and (4), where the dependent variables are *Repurchase Ratio* and *Repurchase Dummy*, respectively. *Repurchase Ratio* is defined as the purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV), divided by income before extraordinary items (item 18, IB). *Repurchase Dummy is* a binary variable that is equal to one if a firm makes an OMSR announcement in a particular year, and zero otherwise. Industry and month fixed effects are included and standard errors are clustered at the firm and year level. All continuous variables are winsorized at the 1st and 99th percentiles. Detailed definitions of all variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

	(1) *first-stage* *News PU*	(2) *second-stage* *Repurchase Ratio*	(3) *first-stage* *News PU*	(4) *second-stage* *Repurchase Dummy*
POLAR	7.179***		6.201***	
	(0.000)		(0.000)	
Instrumented News PU		-0.122**		-0.014***
		(0.028)		(0.000)
Financial Variables	Yes	Yes	Yes	Yes
Election Indicator	Yes	Yes	Yes	Yes
Macro Variables	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
N	122,810	122,810	122,860	122,860

Table 4. Addressing the measurement error bias: Canadian policy uncertainty

In this table, we address the measurement error concern. The dependent variable of each regression is indicated at the top of each column. In the first step, we run the quarterly regression and regress the news-based component of the US policy uncertainty index on the Canadian news-based policy uncertainty measure. We also control for the country-level average sales growth, average Tobin's Q, and cash flows. We then extract the regression residual (labelled *News RPU*) from the first-stage regression, which is the difference between the actual and the predicted US news-based policy uncertainty measure. In the second step, we replace the news-based policy uncertainty index with *News RPU* and reperform the OLS regression in column (1) with the dependent variable being the repurchase ratio that is defined as the purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV), divided by income before extraordinary items (item 18, IB). In column (2), we perform a probit regression where the dependent variable is the repurchase dummy that is equal to one if a firm makes an OMSR announcement in a particular year, and zero otherwise. Industry and month fixed effects are included and standard errors are clustered at the firm and year level. All continuous variables are winsorized at the 1st and 99th percentiles. The detailed definitions of all the variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

	(1) *Repurchase Ratio*	(2) *Repurchase Dummy*
News RPU	-0.050**	-0.011**
	(0.013)	(0.016)
Financial Variables	Yes	Yes
Election Indicator	Yes	Yes
Macro Variables	Yes	Yes
Industry FE	Yes	Yes
Month FE	Yes	Yes
N	144,113	144,151

Table 5. Policy uncertainty and share repurchase: market reactions

This table reports the effect of policy uncertainty on market reactions to share repurchases after controlling for firm characteristics, an election indicator, and macro-level variables. We measure the market reaction using the three-day cumulative abnormal return (CAR) from day −1 to day 1, where day 0 is the OMSR announcement date. We use the market model to measure expected returns and the CRSP value-weighted market index as the benchmark. The estimation period ends 46 days before the announcements of share repurchases and we require the minimum (maximum) estimation length to be 3 (255) days. The independent variable of interest is *News PU*, which represents the news-based component of the Baker, Bloom and Davis (2016) policy uncertainty index. *Credit Rating* is a dummy variable that is equal to one if the firm has a credit rating from S&P, Moody's, Fitch, or Duff & Phelps, and zero otherwise. *Cash Flow Volatility* is calculated as the standard deviation of operating rate of return [i.e., operating income (item 13, OIBDP) divided by total assets (item 6, AT)] over the most recent four years including the current fiscal year. Industry and month fixed effects are included and standard errors are clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. Detailed definitions of all variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

	(1) *CAR (-1,+1)*	(2) *CAR (-1,+1)*	(3) *CAR (-1,+1)*
News PU	-0.193**	-0.532***	-0.061
	(0.016)	(0.000)	(0.488)
Credit Rating		-1.185**	
		(0.048)	
*News PU*Credit Rating*		0.338**	
		(0.048)	
Cash Flow Volatility			15.847***
			(0.005)
*News PU*Cash Flow Volatility*			-4.519***
			(0.001)
Financial Variables	Yes	Yes	Yes
Election Indicator	Yes	Yes	Yes
Marco Variables	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Observations	10,962	9,750	10,399

Table 6. Policy uncertainty and the completion rate of share repurchases

This table reports the effect of policy uncertainty on the completion rate of share repurchases. We employ Tobit regressions where the dependent variable *Completion Rate* is the buyback ratio of share repurchases one year after the OMSR announcement. The ratio is calculated as the purchases of common and preferred stock (item 115, PRSTKC) minus any decrease in redeemable preferred stock (item 175, PSTKR), scaled by the market value of equity (item 25, CSHO)*(item 24, PRCC_F). The independent variable of interest is *News PU*, which represents the news-based component of the Baker, Bloom and Davis (2016) policy uncertainty index. *Credit Rating* is a dummy variable that is equal to one if the firm has a credit rating from S&P, Moody's, Fitch, or Duff & Phelps, and zero otherwise. *Cash Flow Volatility* is calculated as the standard deviation of operating rate of return [i.e., operating income (item 13, OIBDP) divided by total assets (item 6, AT)] over the most recent four years including the current fiscal year. Industry and month fixed effects are included and standard errors are clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. The detailed definitions of all the variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

	(1) *Completion Rate*	(2) *Completion Rate*	(3) *Completion Rate*
News PU	-0.311***	-0.425***	-0.248***
	(0.000)	(0.000)	(0.005)
Credit Rating		-0.629	
		(0.209)	
*News PU*Credit Rating*		0.394***	
		(0.005)	
Cash Flow Volatility			8.401**
			(0.049)
*News PU*Cash Flow Volatility*			-2.727**
			(0.043)
Financial Variables	Yes	Yes	Yes
Election Indicator	Yes	Yes	Yes
Marco Variables	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Observations	11,446	10,024	10,498

Table 7. Policy uncertainty and repurchase techniques

This table reports the effect of policy uncertainty on repurchase techniques. We employ probit regressions where the dependent variable in column 1 (2) is a dummy variable that is equal to one if a firm switches from a low- to high-commitment (high- to low-commitment) repurchase technique in a particular year, and zero otherwise. We define OMSRs as a low-commitment repurchase technique and the other three as high-commitment repurchase vehicles. The independent variable of interest is *News PU*, which represents the news-based component of the Baker, Bloom and Davis (2016) policy uncertainty index. Industry and month fixed effects are included and standard errors are clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. The detailed definitions of all the variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Low-to-High Commitment Dummy	*High-to-Low Commitment Dummy*
News PU	-0.054***	0.085***
	(0.000)	(0.000)
Financial Variables	Yes	Yes
Election Indicator	Yes	Yes
Marco Variables	Yes	Yes
Industry FE	Yes	Yes
Month FE	Yes	Yes
Observations	12,555	12,555

Table 8. Policy uncertainty and share repurchases: misvaluation

This table reports how the effect of policy uncertainty on share repurchases varies in a cross-section of firms based on measures of misvaluation. Full sample analysis and subsample analysis are adopted in Panel A and Panel B, respectively. We perform OLS regressions using the dependent variable *Repurchase Ratio*. *Repurchase Ratio* is defined as the purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV), divided by income before extraordinary items (item 18, IB). We use three different measures of undervaluation as indicated at the top each column. First, we define a firm as undervalued if its market-to-book ratio is in the bottom 5th percentile among all sample firms each year. Second, we follow Rhodes-Kropf, Robinson and Viswanathan (2005) to decompose the market-to-book ratio into three components. A firm is defined as undervalued if the first term in this market-to-book ratio decomposition is in the bottom 5th percentile among all sample firms each year. Third, we follow Bonaimé and Ryngaert (2013) and label firms as "undervalued" if total insider purchases exceed total insider sales by at least $200,000 and/or 0.01% of the firm's market capitalization at the end of the prior quarter. The independent variable of interest is *News PU*, which represents the news-based component of the Baker, Bloom and Davis (2016) policy uncertainty index. Industry and month fixed effects are included and standard errors are clustered at the firm and year level. All continuous variables are winsorized at the 1st and 99th percentiles. Detailed definitions of all variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Full sample analysis

	(1) *Market-to-book Ratio*	(2) *MTB Decomposition*	(3) *Insider Trading*
News PU	-0.010	-0.068***	-0.013***
	(0.156)	(0.002)	(0.000)
Undervaluation	-0.102***	-0.440***	0.081
	(0.000)	(0.001)	(0.395)
*News PU*Undervaluation*	0.032***	0.089**	0.053*
	(0.000)	(0.017)	(0.084)
Financial Variables	Yes	Yes	Yes
Election Indicator	Yes	Yes	Yes
Marco Variables	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Observations	144,118	144,113	145,039

Panel B. Subsample analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	Market-to-book Ratio		*MTB Decomposition*		*Insider Trading*	
	Undervalued Firm	Other Firms	Undervalued Firm	Other Firms	Undervalued Firm	Other Firms
News PU	0.029**	-0.069***	0.010**	-0.064***	0.124***	-0.059***
	(0.012)	(0.002)	(0.037)	(0.002)	(0.000)	(0.000)
Financial Variables	Yes	Yes	Yes	Yes	Yes	Yes
Election Indicator	Yes	Yes	Yes	Yes	Yes	Yes
Marco Variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,889	138,229	7,114	136,999	289	144,814

Table 9. The COVID-19 crisis and share repurchases

This table reports the effect of the COVID-19 crisis on share repurchases. Panel A reports the mean values of short-term market reaction to OMSR announcements for the COVID-19 and the pre-COVID-19 periods and compares the differences in means between the two periods. We measure the short-term market reaction using the three-day cumulative abnormal return (CAR) from day −1 to day 1, where day 0 is the announcement date of an OMSR. We test for differences in means using the t-test allowing for unequal variances. In Panel B, We perform probit regression from 2018 to 2021 using the dependent variable *Repurchase Dummy*. *Repurchase Dummy* is a dummy variable that is equal to one if a firm makes an OMSR announcement in a particular year, and zero otherwise. *COVID* is a dummy variable that equals one from 2020 to 2021, and zero from 2018 to 2019. *WW index* is a measure of financial constraints. *Cash Flow Volatility* is calculated as the standard deviation of operating rate of return [i.e., operating income (item 13, OIBDP) divided by total assets (item 6, AT)] over the most recent four years including the current fiscal year. In Panel C, we perform OLS regressions using the dependent variable *Repurchase Ratio*. *Repurchase Ratio* is defined as the purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV), divided by income before extraordinary items (item 18, IB). We use three different measures of undervaluation as indicated at the top of each column. First, we define a firm as undervalued if its market-to-book ratio is in the bottom 5th percentile among all sample firms each year. Second, we follow Rhodes-Kropf, Robinson and Viswanathan (2005) to decompose the market-to-book ratio into three components. A firm is defined as undervalued if the first term in this market-to-book ratio decomposition is in the bottom 5th percentile among all sample firms each year. Third, we follow Bonaimé and Ryngaert (2013) and label firms as "undervalued" if total insider purchases exceed total insider sales by at least $200,000 and/or 0.01% of the firm's market capitalization at the end of the prior quarter. In Panels B and C, industry and month fixed effects are included and standard errors are clustered at the firm and year level. All continuous variables are winsorized at the 1st and 99th percentiles. The detailed definitions of all the variables can be found in the appendix. *p*-values are reported in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

Panel A. OMSR announcements

	COVID-19 Period		Pre-COVID-19 Period		Difference
	N	*CAR (-1,+1)*	N	*CAR (-1,+1)*	Event – Non-Event
COVID 2020-2021	184	3.71%***	10,778	2.25%***	1.46%**
COVID 2020	132	4.19%***	10,778	2.25%***	1.94%***
COVID 2021	52	2.51%***	10,778	2.25%***	0.26%

Panel B. Financial constraints and cash flow volatility

	(1)	(2)	(3)
	Repurchase Dummy	*Repurchase Dummy*	*Repurchase Dummy*
COVID	2.962	1.935	2.280
	(0.703)	(0.623)	(0.567)
WW Index		0.048***	
		(0.002)	
*COVID*WW Index*		-0.098***	
		(0.000)	
Cash Flow Volatility			-0.141
			(0.118)
*COVID*Cash Flow Volatility*			-0.609***
			(0.000)
Financial Variables	Yes	Yes	Yes
Election Indicator	Yes	Yes	Yes
Marco Variables	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Observations	10,523	10,493	9,631

Panel C. Undervaluation

	(1) *Market-to-book Ratio*	(2) *MTB Decomposition*	(3) *Insider Trading*
COVID	0.714	0.159	0.544
	(0.215)	(0.772)	(0.621)
Undervaluation	0.053***	-0.089***	-0.278***
	(0.003)	(0.004)	(0.000)
*COVID*Undervaluation*	0.021*	0.080***	0.195**
	(0.054)	(0.001)	(0.033)
Financial Variables	Yes	Yes	Yes
Election Indicator	Yes	Yes	Yes
Marco Variables	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes
Observations	10,663	10,663	10,702

Table 10. Comparison of Key Characteristics: USA vs Europe

This table shows the mean values and number of observations of key characteristics for US and European firms. We follow Anolick *et al.* (2021) and select 9 European countries for our Europe sample: Austria, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden, and the United Kingdom. We obtain financial information for US firms from Compustat and analysts information from I/B/E/S. We download financial data from Compustat Global and information about analysts from I/B/E/S for the European sample. The detailed definitions of all the variables can be found in the appendix. We test for differences in means using the t-test allowing for unequal variances. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

	USA		Europe		Difference
	N	Mean	N	Mean	USA - Europe
Leverage	179,781	0.344	110,169	0.215	0.129***
Capital expenditure	178,616	0.058	91,616	0.049	0.009***
R&D expense	180,359	0.072	110,580	0.022	0.050***
WW index	159,069	-0.096	97,205	-0.214	0.118***
MB	181,033	2.884	91,610	2.760	0.124***
Firm size	181,076	4.883	92,034	4.812	0.071***
Tangible assets	180,058	0.264	110,492	0.233	0.031***
Number of analysts	191,817	6.087	90,042	5.911	0.176***
Dispersion of analysts' forecasts	155,990	0.166	67,119	0.225	-0.059***
Error in analysts' forecasts	182,480	0.351	84,542	0.425	-0.074***

Appendix. Variable definitions

Panel A. Dependent variable of interest	
Variable	Definition
Repurchase Ratio	The purchases of common and preferred stock (item 115, PRSTKC) minus any reduction in the value of the net number of preferred stocks outstanding (item 56, PSTKRV), all divided by income before extraordinary items (item 18, IB).
Repurchase Dummy	A dummy variable that is equal to one if a firm makes an OMSR announcement in a particular year, and zero otherwise.
CAR (-1,+1)	We measure the market reaction using the three-day cumulative abnormal return (CAR) from day −1 to day 1 where day 0 is the announcement date of an open market share repurchase. We use the market model to measure expected returns and the CRSP value-weighted market index as the benchmark. The estimation period ends 46 days before the announcements of share repurchases and we require the minimum (maximum) estimation length to be 3 (255) days.
Completion Rate	The buyback ratio of share repurchases one year after the OMSR announcement. The ratio is calculated as the purchases of common and preferred stock (item 115, PRSTKC) minus any decrease in redeemable preferred stock (item 175, PSTKR), scaled by market value of equity (item 25, CSHO) × (item 24, PRCC_F).
Low-to-High Commitment Dummy	A dummy variable that is equal to one if a firm switches from a low- to high-commitment repurchase technique in a particular year, and zero otherwise. We define OMSRs as a low-commitment repurchase technique and the other three as high-commitment repurchase vehicles.
High-to-Low Commitment Dummy	A dummy variable that is equal to one if a firm switches from a high- to low-commitment repurchase vehicle in a particular year, and zero otherwise.

Panel B. Independent variable of interest	
Variable	Definition
PU	Represents the Baker, Bloom and Davis (2016) policy uncertainty index. We construct our annual policy uncertainty variable as the average BBD index values of the last 3-month period of a fiscal year. The BBD index is constructed as a weighted average of four components: the frequency of newspaper articles containing keywords related to policy uncertainty (*News Component*), the level of uncertainty related to future changes in the federal tax code (*Tax Component*), and the dispersion in economic forecasts of the government spending (*Government Spending Component*) and the Consumer Price Index (*CPI Component*) to proxy for forecaster disagreement about future monetary and fiscal policies.
News PU	The news-based component of the Baker, Bloom and Davis (2016) policy uncertainty index.
PU Dummy	A dummy variable that is equal to one if the news-based component of the Baker, Bloom, and Davis (2016) policy uncertainty index is higher than the sample median, and zero otherwise.
POLAR	The DW-NOMINATE scores developed by McCarty, Poole and Rosenthal (1997), which track legislators' ideological positions over time. Legislators with similar votes are scored similarly to each other, whereas legislators with different preferred outcomes have greater distance between each other's scores. The distance between two ideological points (i.e., the difference between two *DW-NOMINATE* scores) indicates the level of disagreement between two legislators.
COVID	A dummy variable that is equal to one from 2020 to 2021, and zero from 2018 to 2019.
Recession	We follow National Bureau of Economic Research (NBER) business-cycle data and define *Recession* as a dummy variable that is equal to one for the recession period (the year 1990-1991, 2001, 2007-2009, 2020) and zero otherwise.

Panel C. Macroeconomic uncertainty and valuation waves	
Variable	Definition
CFNAI	The Chicago Fed National Activity Index (*CFNAI*) is based on 85 monthly economic indicators designed to measure current economic activity and inflationary pressure (data are available at https://www.chicagofed.org/research/data/cfnai/historical-data).
GDP	The average one-year-ahead GDP growth forecast from the Livingstone Survey of Professional Forecasters. Expected GDP growth is the average one-year-ahead GDP forecast from the biannual Livingstone Survey of Professional Forecasters (data are available from the Philadelphia FED).
CAPE	Shiller's Cyclically Adjusted Price-Earnings (CAPE) ratio, which is developed by Robert Shiller, proxies for the relative valuation of the market, with high values indicating overvaluation (data are available at http://www.econ.yale.edu/~shiller/data.htm).
VOX	The VXO implied volatility index is the daily index of implied volatility released by the Chicago Board Options Exchange, calculated based on the trading of S&P 100 options.
MacU3	The Jurado, Ludvigson and Ng (2015) monthly index of macroeconomic uncertainty, which is constructed from the volatility in the unforecastable component in a system of 279 macroeconomic variables (data are available at https://www.sydneyludvigson.com/data-and-appendixes).
Election	A dummy variable that is equal to one if a presidential election is scheduled in the current calendar year, and zero otherwise.
Panel D. Financial constraints	
Credit Rating	A dummy variable that equals one if the firm has a credit rating from S&P, Moody's, Fitch, or Duff & Phelps and zero otherwise, using data obtained from Compustat (variable *splticrm*).

Kaplan-Zingales (1997) Index	KZ Index=–1.001909 [(IB + DP)/lagged PPENT] + 0.2826389 [(AT + PRCC_F×CSHO – CEQ – TXDB)/AT] + 3.139193 [(DLTT + DLC)/(DLTT + DLC + SEQ)] – 39.3678 [(DVC + DVP)/lagged PPENT] – 1.314759 [CHE/lagged PPENT] Where IB is income before extraordinary items; DP is depreciation and amortization; PPENT is property, plant, and equipment; AT is total assets; PRCC_F is share price; CSHO is common shares outstanding; CEQ is common equity; TXDB is deferred taxes; DLTT is long-term debt while DLC is debt in current liabilities; SEQ is shareholders' equity; DVC is common dividends and DVP is preferred dividends; CHE is cash and short-term investments.
Whited-Wu (2006) Index	WW Index = (–0.091×CF) – (0.062×DIVPOS) + (0.021×TLTD) – (0.044×LNTA) + (0.102×ISG) – (0.035×SG) Where CF is the ratio of cash flow to total assets; DIVPOS is an indicator that takes the value of one if the firm pays cash dividends; TLTD is the ratio of the long-term debt to total assets; LNTA is the natural log of total assets, ISG is the firm's 3-digit industry sales growth; SG is firm sales growth.
SA Index	The size–age index of Hadlock and Pierce (2010) computed using the following equation: $-0.737 \times \text{Size} + 0.043 \times \text{Size}^2 - 0.040 \times \text{Age}$, where Size is the log of inflation adjusted total assets deflated using the 1983 consumer price index, and Age is the number of years the firm has been on Compustat with a non-missing stock price.
Panel E. Misvaluation	
Undervaluation: Market-to-book Ratio	A dummy variable that is equal to one if a firm is undervalued ex-ante, and zero otherwise. A firm is defined as undervalued if its market-to-book ratio is in the bottom 5th percentile among all sample firms each year.
Undervaluation: MTB Decomposition	A dummy variable that is equal to one if a firm is undervalued ex-ante, and zero otherwise. A firm is defined as undervalued if the first term in the market-to-book ratio decomposition is in the bottom 5th percentile

	among all sample firms each year.
Undervaluation: Insider Trading	A dummy variable that is equal to one if a firm is undervalued ex-ante, and zero otherwise. We label firms as "undervalued" if total insider purchases exceed total insider sales by at least $200,000 and/or 0.01% of the firm's market capitalization at the end of the prior quarter before the OMSR announcement date.
Panel F. Firm characteristics	
Total Assets	Natural logarithm of total assets (item 6, AT), measured in 1983 US dollars.
ROA	Income before extraordinary items (item18, IB) plus interest expense (item 15, XINT) plus income taxes (item 16, TXT), all divided by total assets (item 6, AT).
Sales Growth	The difference between current sales (item 12, SALE) and lagged sales, all divided by lagged sales.
Leverage	Long-term debt (item 9, DLTT) plus debt in current liabilities (item 34, DLC), all divided by total assets (item 6, AT).
Capital Expenditure	Capital expenditures (item 128, CAPX) over total assets (item 6, AT).
R&D Expense	Research and development expense (item 46, XRD) divided by total assets (item 6, AT).
Firm Size	Natural logarithm of the market value of equity. The market value of equity is share price (item 24, PRCC_F) times common shares outstanding (item 25, CSHO).
Tangible Assets	Property, plant and equipment (item 8, PPENT) divided by total assets (item 6, AT).
Cash	Cash and cash equivalents (item 1, CHE) over total assets (item 6, AT).
MB	The market value of equity divided by the book value of equity. The market value of equity is share price (item 24, PRCC_F) times common shares outstanding (item 25, CSHO). Book value of equity is shareholders' equity (item 216, SEQ) minus preferred stock plus

	deferred taxes (item 35, TXDITC). We measure preferred stock using liquidation value (item PSTKL), redemption value (item 175, PSTKR) or carrying value (item 130, PSTK) in this order, depending on availability. If SEQ is missing, we measure the book value of equity as common equity (item 60, CEQ) plus carrying value of preferred stock (item 130, PSTK). Finally, if CEQ is missing, we measure the book value of equity as total assets (item 6, AT) minus total liabilities (item 181, LT).
Return	Cumulative returns during the 12-month period ending at the end of the firm's fiscal year.
Volatility	The standard deviation of the firm's daily returns from month *t-12* to *t-1*.
Cash Flow	Cash flow amount is calculated as net cash flow from operating activities (item 308, OANCF) divided by total assets (item 6, AT).
Cash Flow Volatility	Cash flow volatility is computed as the standard deviation of operating rate of return [i.e., operating income (item 13, OIBDP) divided by total assets (item 6, AT)] over the most recent four years including the current fiscal year (Chay and Suh, 2009).
Panel G. Analysts variables	
Number of Analysts	Number of analysts following the firm in a particular year from I/B/E/S. The more analysts follow a firm, the more information is discovered and revealed to the public, and hence asymmetric information is lower.
Dispersion of Analysts' Forecasts	Natural logarithm of one plus standard deviation of analysts' forecasts divided by the absolute value of median forecast from I/B/E/S. Higher dispersion of analysts' forecasts indicates higher level of information asymmetry.
Error in Analysts' Forecasts	Natural logarithm of one plus the difference between actual and forecasted earnings per share, scaled by the absolute value of median earnings per share forecast from I/B/E/S. Higher error of analysts' forecasts indicates higher level of information asymmetry.