Policy Uncertainty and Household Stock Market Participation

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Using a unique micro-level panel dataset, we relate households' stock market participation to policy uncertainty. We show that households significantly reduce their equity participation during periods of high policy uncertainty, identified by gubernatorial elections. The decline in participation varies with risk aversion, employment risk, and cost of processing information. In certain situations, election-triggered drop in participation is followed by a partial increase in post-election years as the uncertainty over policy outcomes subsides, reflecting a real distortion. Our findings suggest that policy uncertainty is an important channel through which the political process creates a negative externality in financial markets.

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1. Introduction

Low level of household stock market participation is one of the major challenges of household finance, and has potentially large economic and welfare effects (Campbell, 2006). Despite the diversification gains and significant risk premium involved in investing in the stock market, the estimates of participation rates — either directly or indirectly — by U.S. households only range from forty to fifty percent.[1] Traditional explanations for limited stock market participation include fixed participation costs and non-standard preferences (e.g., Dow and Werlang, 1992; Haliassos and Bertaut, 1995; Vissing-Jorgensen, 2003; Ang, Bekaert, and Liu, 2005). Since limited stock market participation rate has a direct impact on the level of the equity premium (e.g., Mankiw and Zeldes, 1991; Campbell, 1993; Constantinides and Duffie, 1996; Vissing-Jorgensen, 1999; Heaton and Lucas, 2000), on the volatility of asset prices (Allen and Gale, 1994), and on wealth inequality (Favilukis, 2013), proper identification of the determinants of stock market participation decisions is important.

In this study we identify an important channel, namely policy uncertainty, to explain the variation in households' stock market participation. We relate policy uncertainty to the range, likelihood, and impact of future government policy outcomes. Politicians and regulatory institutions frequently make decisions that can influence employment, minimum wage, taxation, government spending, business environment, and economic prospects (e.g., Peltzman, 1987; Alesina and Roubini, 1992; Besley and Case, 1995), which are all important sources of risks faced by households. The magnitude of uncertainty regarding who will make policy decisions, what policy actions will be undertaken, and to what extent the policies will be implemented has a large impact on households' exposure to risk, which, in turn, can influence their demand for risky assets

[1] Survey of Consumer Finances (https://www.federalreserve.gov/econres/scfindex.htm), Hong, Kubik, and Stein, 2004, Giannetti and Wang, 2016.

such as stocks (Giavazzi and McMahon, 2012; Boutchkova et al., 2012; Pástor and Veronesi, 2012, 2013).

The topic of policy-related uncertainty has drawn increased attention from policy-makers, academics, and the media. Despite recent research showing that policy uncertainty has adverse real effects on corporate decision-making (Julio and Yook, 2012; Baker, Bloom, and Davis, 2016; Gulen and Ion, 2016; Jens, 2017; Colak, Durnev, and Qian, 2017), surprisingly little is known about its influence on households. We seek to fill this gap in the nascent literature by investigating —both empirically and theoretically— if and how policy uncertainty affects households' stock market decisions. Our theoretical framework predicts that an increase in policy uncertainty reduces households' participation in the stock market for two reasons. First, it causes an increase in asset risk and hence induces households to reduce their stock investment. Second, it increases the households' labor income risk and thus results in a hedging demand to sell stocks by the households. Consistent with the theoretical predictions, we find unambiguous evidence that higher levels of policy uncertainty *cause* households to exhibit a lower propensity to participate in stock market —both on the extensive margin in terms of the participation rate and on the intensive margin in terms of percentage of assets invested in stocks.

To quantify the impact of policy uncertainty on households' participation in the stock market, we use the micro-level longitudinal Survey of Income and Program Participation (SIPP) data, a panel data that tracks households (about 30,233 to 44,347 in each panel) up to four years. An advantage of using panel data is that it allows us to control for household fixed effects, therefore to eliminate compositional problems caused by unobserved household characteristics that are constant over time. Utilizing the SIPP data spanning from 1996 to 2011, we construct two measures of stock market participation. The first one, the extensive margin, is an indicator variable

that equals one if a household holds any stocks in a publicly held corporation or a mutual fund at the beginning of the interview month. The second measure, the intensive margin, reflects the monetary value of equity investment as a fraction of the households' total liquid wealth (defined as the sum of stockholdings and safe assets, such as bonds, checking accounts, and savings accounts).

In our context, identification may be compromised if policy cycles are correlated with business cycles. For instance, there may be concomitant economic downturns driving the households' decision to reduce stock market participation, irrespective of policy-related uncertainty. To overcome these confounding effects, we exploit the quasi-natural experiment created by the U.S. gubernatorial elections as an exogenous source of policy uncertainty (e.g., Atanassov, Julio, and Leng, 2016; Bird, Karolyi, and Ruchti, 2017; Colak, Durnev, and Qian, 2017; Jens, 2017).

Using gubernatorial elections as a "policy laboratory" to capture variation in policy uncertainty has several advantages. First, a state government has substantial power in shaping the local economic environment such as taxes, subsidies, state budget, minimum wages (Peltzman, 1987; Besley and Case, 1995), which, in turn, impact businesses and households.[2] Second, the election dates are pre-scheduled and cannot be affected by households, thus can be viewed as mostly exogenous events where policy uncertainty arises. As a result, using gubernatorial election cycles as a source of policy uncertainty mitigates endogeneity concerns that changes in equity participation may be caused by changes in business cycles or state economic conditions. Third, our approach helps ease concerns that omitted variables could lead to a spurious association between stock market participation and policy uncertainty, because households located in different

[2] In particular, each state's executive branch is headed by a governor, whose powers generally include appointing officials and judges, drafting budgets, making legislative proposals, and vetoing state legislature bills. These powers result in governors having significant influence over the direction of the state budget and policy environment. It is also important to note that these powers may allow the governor to circumvent the state legislature.

states share the same national political and business cycles, and therefore face similar macroeconomic uncertainty at the aggregate level. Finally, unlike presidential elections, gubernatorial elections in different states occur in different years, creating staggered across- and within-state variations in addition to the time-series variation in the timing of gubernatorial elections.

Although our *difference-in-differences* (DD) setting alleviates possible endogeneity between policy-related uncertainty and general economic conditions, which may affect household participation in stock market, we nevertheless control for state-level macroeconomic conditions (GDP growth, unemployment rate, housing market), year and state fixed effects. It is important to note that the year fixed effects also capture nation-wide equity participation, implying that we estimate only the differential effect that exposure to policy uncertainty in a state has on households in that state. Since households may be exposed to elections in other states, our estimates are to be interpreted as a lower bound of the negative effects of policy uncertainty on the demand for equity. Finally, when examining the interaction effects between elections and households' demographics, we utilize joint *state-year* fixed effects in a *triple difference* setting (DDD). This framework controls for the impact of latent unobservable state-level shocks or trends and helps us understand the mechanisms driving the effect of policy uncertainty on households' stock market participation.

We find a significant 3.5% decrease in the probability of stock market participation, and a 5.8% decrease in the percentage of liquid wealth invested in the stock market for households in states with an upcoming gubernatorial election, relative to households in states without an upcoming election. These effects are robust to controlling for a rich set of other factors at the household and state levels that can influence stock market participation. We also find that the dampening effect of policy uncertainty on households' participation becomes stronger for close elections (using both

victory margin and pre-election poll data) and elections with outgoing incumbent governors due to term limits. Furthermore, we find that households move their capital from the stock market to safer assets such as savings account and bonds.

State elections allow us to divide households and firms into in-state and out-of-state. In-state firms are more affected by the policy uncertainty associated with state elections, and hence their stocks become less attractive when elections are upcoming. Furthermore, because there is a higher correlation between the performances of in-state firms and the labor income of in-state households, state elections also induce a stronger hedging demand to sell in-state stocks. The combination of both effects implies that households reduce in-state investments more than out-of-state investments. Using data on households' equity holdings from a large discount brokerage firm for the period 1991 to 1996, we examine the investment behavior of households in their in-state and out-of-state stocks around elections and find that policy uncertainty has a greater impact on in-state investments than that on out-of-state investments.

In an attempt to identify possible mechanisms through which policy uncertainty propagates, we investigate whether the negative effect of policy uncertainty on stock market participation exhibits heterogeneity in the cross-section using the DDD design. We find that households with (i) higher costs of accessing and processing information (those that are less educated and not employed in the financial sector), (ii) lower tolerance to risks associated with uncertainty (older, female, and less wealthy), and (iii) greater employment risk (those employed in public sectors or operating business in politically sensitive industries), reduce their stock market participation more when facing greater policy uncertainty.

If elections are associated with heightened levels of policy-related uncertainty, we would expect at least some of the uncertainty to be resolved after the elections and observe that the decline

in participation reverses. We find results consistent with this prediction. For the overall sample of elections, the post-election increase in stock market participation is almost the same as the pre-election decrease, suggesting a complete reversal in participation. However, for the subsample of elections where the ruling party changes, we do not observe a complete reversal. This evidence is again consistent with uncertainty affecting participation since, in this subsample, there is relatively lesser resolution of uncertainty after the election. This, in turn, implies that policy uncertainty can have a long lasting and disruptive effect on households' stock market participation.

Despite its advantage of being exogenous for identification purposes, the election indicator, by construction, does not capture the variation in policy-related uncertainty in non-election years, which can be a problem from a measurement viewpoint. To assuage this concern, we triangulate our evidence by employing the economic policy uncertainty index (henceforth EPU index) developed by Baker, Bloom, and Davis (2016) as another measure for policy uncertainty. One of the main challenges in this line of research is that identification may be compromised if the EPU index and more general economic uncertainty are correlated. We address this concern by controlling for potentially confounding macroeconomic factors and using political polarization as an instrumental variable (Gulen and Ion (2016) and Bonaime, Gulen, and Ion (2017)).

Consistent with our findings using gubernatorial elections, we observe a significantly negative relation between the EPU index and both the propensity and intensity of households' stock market participation. At the mean of the EPU index, a one-standard-deviation increase in the index is associated with a 3.0% decrease in the probability of participation. Likewise, a one-standard-deviation increase in the index is associated with a 7.5% decrease in the percentage of liquid wealth invested in the stock market. Our results survive even after we instrument the EPU index with a measure of political polarization.

To our knowledge, our paper is among the first studies to examine the extent to which policy uncertainty affects households' stock market participation. We document a new stylized fact regarding household behavior, namely, a tendency to reduce equity participation when policy uncertainty increases. Our identification comes from the exogenous and staggered nature of gubernatorial elections, allowing us to provide relatively clean evidence on the portfolio decisions of households. Furthermore, by documenting how the dampening effect of policy uncertainty varies in the cross section, we provide evidence on the mechanisms by which uncertainty affects both the households and financial markets. Finally, by investigating how this relation evolves through time, we document that policy uncertainty can cause a real distortion and create a negative externality in financial markets.

The rest of the paper proceeds as follows. Section 2 briefly summarizes the theoretical model and discusses the predictions that motivate the empirical tests. Section 3 describes the data and construction of the key variables. Section 4 presents the effects of policy uncertainty on households' stock market participation. Section 5 investigates heterogeneity of our findings in the cross-section. Section 6 examines the post-election dynamics of stock market participation. Section 7 provides some robustness tests. In Section 8, we provide complementary evidence by using the EPU index as an alternative measure of policy uncertainty. Section 9 discusses the implications and concludes. The appendix includes the theoretical model that illustrates the effect of policy uncertainty on households' stock market participation decisions.

2. Motivation and Hypotheses

To motivate our empirical analysis, we consider a stock trading model with policy risk by incorporating participation cost and the demand to hedge labor income. Although there is a large

literature on the interaction between labor income and stock investment, most of the papers in the literature are dynamic partial equilibrium models that take the stock return process as exogenously given (for example, see Bertaut and Haliassos, 1997; Heaton and Lucas, 1997; Koo, 1998; Viceira, 2001; and Cocco, Gomes, and Maenhout, 2005). On the other hand, recent theoretical models on policy uncertainty and asset prices, such as Pástor and Veronesi, 2012, 2013), endogenize asset prices in the absence of participation and labor income. We endogenize participation and the stock return by analyzing an ad hoc one-period model a la Grossman and Stiglitz, 1980. The main purpose of the model is to provide certain theoretical guidance for the development of empirical hypotheses regarding the effect of policy uncertainty on the propensity and intensity of households' stock market participation. Below we briefly explain the model's key results, relegating the detailed analysis to the Appendix.

Specifically, we show that when the stock return is correlated with labor income, households' demand for the stock consists of two components: a speculative demand that depends on the mean and variance of the stock price, and a hedging demand that depends on labor income risk and its correlation between the stock return. State elections increase policy uncertainty, which increases the risk of the stock return and the risk of households' labor income. There are two forces that reduce households' investment in the stock. First, the riskier stock return makes the stock less attractive. Second, the riskier labor income provides households with stronger incentives to sell the stock to hedge their labor income. Because the average equity premium is positive, a reduced investment in the stock market means that the benefit of participating in stock trading becomes smaller; consequently, households whose participation cost is high enough decide to leave the market. Therefore, an increase in policy uncertainty leads to a reduction in both the extensive margin (participation in trading) and the intensive margin (investment in the stock).

In addition to the aggregate effect, the theoretical model also provides predictions with households that vary in different dimensions. When households differ in their labor income exposure to policy uncertainty, those with higher labor income exposure have stronger incentives to hedge, so they demonstrate a sharper reduction in stock market participation, in terms of both the extensive and intensive margin. Similarly, when households differ in their risk attitudes, an increase in policy uncertainty has a greater impact on households who are more risk-averse than those who are less risk-averse, resulting in a sharper reduction in participation for more risk-averse households.

Overall, the model predictions enable us to generate two testable hypotheses related to state elections: 1) at the aggregate level, state elections increase policy uncertainty and reduce households' stock market participation; and 2) across different households, those with higher labor income exposure or less risk tolerance demonstrate a greater reduction in participation as a reaction to upcoming state elections. The heterogeneous effects across different households, especially those with different exposures of labor income to political risk, show that, in addition to increased asset risk, labor income hedging is also a driving force that causes fluctuations in stock market participation around state elections.

3. Data and variable construction

3.1. SIPP panel data

Our sample of households is drawn from the 1996, 2001, 2004, and 2008 panels of the micro-level longitudinal Survey of Income and Program Participation (SIPP) data.[3] Each SIPP panel

[3] Each SIPP panel is a multi-stage stratified sample of U.S. civilian, non-institutionalized population, and a new set of households introduced at the start of each panel. The longitudinal design of SIPP dictates that all persons 15 years old and over, present as household members at the time of the first interview be part of the survey throughout the entire panel period. To meet this goal, the survey collects information useful in locating persons who move. In addition, field

tracks 30,233 to 44,347 households over a period of up to four years. The SIPP surveys are built around a core set of questions on demographic attributes, employment and income, and business ownership. Moreover, each panel also includes topical modules, which include detailed questions on assets and liabilities — such as the ownership and market value of different types of assets, including real estate, vehicles, and financial assets. We conduct our analysis at the household level and include only household heads who are 18 years or older. Our final sample of households includes 359,260 household-year observations for 152,095 unique households.

As is common in the literature (e.g., Guiso, Sapienza, and Zingales, 2008; Giannetti and Wang, 2016; Chetty, Sándor, and Szeidl, 2017), we use two proxies for stock market participation. Our first proxy, *Participation*, is an indicator variable that equals one if the household holds any stocks in publicly held corporations or mutual funds in a given period (extensive margin). We also separately gauge how policy uncertainty affects the extent of stock market participation through households' equity holdings (intensive margin). For this purpose, we define *% Stock share*, which reflects the value of equity investment as a fraction of the household's total liquid wealth. We define *Liquid wealth* as the sum of assets held in stocks, bonds, checking, and savings accounts, exclusive of retirement accounts. For the purpose of our study, following prior literature (Hong, Kubik, and Stein, 2004; Kozak and Sosyura, 2015; Chetty, Sándor, and Szeidl, 2017), we exclude stock investments in households' pension accounts or IRAs for three reasons. First, prior literature shows that households do not actively rebalance or trade in their retirement accounts (Agnew, Balduzzi, and Sunden, 2003; Mitchell et al., 2006; Benartzi and Thaler, 2007). Second,

procedures were established that allow for the transfer of sample cases between regional offices. Persons moving within a 100-mile radius of an original sampling area (a county or a group of counties) are followed and continue with the normal personal interviews. Those moving to a new residence that falls outside the 100-mile radius of any SIPP sampling area are interviewed by telephone. The geographic areas defined by these rules contain more than 95 percent of the U.S. population. The survey uses three different approaches to deal with missing data to correct for non-responses https://www.census.gov/programs-surveys/sipp/methodology/data-editing-and-imputation.html.

withdrawals of money from retirement accounts often incur significant penalties. Third, default investment choices have been shown to determine investments in the retirement accounts (Beshears et al., 2009).

Our data identify a worker's employer, the employer's 3-digit Census Industry Classification (CIC), and the Integrated Public Use Microdata Series (IPUMS) code for the worker's occupation. To measure financial literacy, we use an indicator variable that is equal to 1 if the household head is in a finance-related occupation (*Financial occupation*) and zero otherwise. In each survey year, the respondents are asked if they are employed in a state or local government office, and whether they operate a business. We construct a binary variable for public sector employees (*Government employee)* and for those who are self-employed in politically sensitive industries (*Business owner in PSI*). Following Herron et al. (1999), we classify businesses operating in transportation, warehousing, and utilities, public administration, educational, health and social services, and mining as politically sensitive.

Finally, our empirical specification recognizes additional individual characteristics that may impact the propensity of stock market participation. We consider a wide set of variables that are available in our survey such as total wealth, age, education, race, gender, and marital status (Haliassos and Bertaut, 1995; Guiso and Jappelli, 2002; Campbell, 2006). We compute *Total wealth* for each respondent in our sample, which includes financial assets as well as all real estate (including second homes), vehicles, and private business equity. For human capital, we identify various levels of formal education *(High school or less*; *Some college*, and *College or more*). We categorize age as *Old* (those with household heads aged above 60), *Middle aged* (those with household heads aged between 35 and 60), and *Young* (those with household heads aged between 18 and 34). We provide variable definitions in the Data Description preceding the tables.

Table 1 reports the summary statistics of the household variables. On average, about 22.3% of the households participate in the stock market during our sample period, and the average stock investment ratio is 10.4%.[4] If we include stocks held in IRA/401K/Keogh accounts, the participation rate increases to about 39%. In our sample, 4.1% of the households are employed in a finance-related job. The mean total wealth of all respondents is about $139,000 and significantly exceeds the median total wealth (of about $66,000), indicating a significant right skew in the distribution. The mean liquid wealth is about 17% of the mean total wealth and is also significantly right skewed. We observe that respondents' principal source of non-financial wealth is from home equity, and there is non-trivial equity in other real estate assets. As for education, 39% of the respondents have not gone beyond high school and 70% of them have not completed college. In terms of demographics, 18% are African-American, 51% are female, 53% are married, and about 19% are in the 18-34 age group, while about 30% are belong to the above 60 age group. Finally, 4.1% of the households are employed in a finance-related job, about 4% of households own businesses in politically sensitive industries, and 8.6% hold a job in a state or local government office.

3.2. Election data

Gubernatorial elections are pre-scheduled and thus exogenous. Unlike presidential elections, gubernatorial elections in different states occur in different years, creating a substantial across- and within-state variations in addition to the time-series variation in the timing of elections. Currently, the majority of the states hold gubernatorial elections every four years, with the exception of Vermont and New Hampshire, which choose to run their gubernatorial elections every two years.

[4] Our sample summary statistics are comparable to those in Chetty, Sándor, and Szeidl (2017); see Appendix DI, where they find 19.18% of households hold stocks and 12.27% of households' liquid wealth invested in stock market for the 1990 to 2008 SIPP data.

Five states, including Louisiana, Kentucky, Mississippi, New Jersey, and Virginia, elect their state governors in odd numbered years, whereas other states run their gubernatorial elections in even-numbered years. Thirty six states have term limits for governors, while the remaining fourteen states do not have term limits. Our main source of data on gubernatorial elections is from the Correlates of State Policy Project (CSPP) initiated by the IPPSR (Institute for Public Policy and Social Research). The dataset includes more than nine-hundred variables, with observations across the U.S. 50 states, from 1990 to 2016. These variables cover a broad range of political, social, or economic factors that may influence policy differences across the states (Jordan and Grossman, 2016). We augment the CSPP data with hand-collected vote margin and political party-affiliation data.

The SIPP data masks the identification of four small states (North Dakota, South Dakota, Maine, and Vermont) to help protect the confidentiality of respondents, leaving us 190 gubernatorial elections in our IPPSR sample between 1996 and 2011. *Election* is a binary variable that is equal to one if a state elects a governor in a year, and zero otherwise. *Presidential* is a binary variable that is equal to one if a presidential election occurs in a year, and zero otherwise. Following the identification of Julio and Yook (2012) and Jens (2017), we classify an election as being more uncertain if it is a close election, where the victory margin — defined as the percentage vote difference (difference between the percentage of votes obtained by the first and second place candidates) for an election — is in the lowest sample tercile. We also distinguish elections where incumbents are eligible for re-elections from elections where incumbents face term limits (*Lame duck last term*). Table 2 indicates that 63 of 190 gubernatorial elections are defined as close. While the average vote differential between the first and second place candidates is 3.84% for close elections, in 53 elections (27.8% of 190 elections), incumbent governors do not seek re-election due

to term limits.

3.3. State macro data

We use data on state unemployment (*Unemployment*), state GDP growth rate (*State GDP growth*), and appreciation in state housing price index (*State HPI appreciation*) to proxy for each state's time-varying economic conditions. We obtain the annual state unemployment data from the Bureau of Labor Statistics (BLS), annual state GDP growth data from the Bureau of Economic Analysis (BEA), and State HPI appreciation data from the Federal Housing Finance Agency. Untabulated results indicate that, during our sample period, the average state-level GDP growth, unemployment rate, and appreciation in HPI are equal to 2.5%, 5.6%, and 3.5%, respectively.

4. Policy uncertainty and stock market participation

In this section, we examine the relation between the policy uncertainty as captured by the gubernatorial elections and households' propensity (extensive margin) and intensity (intensive margin) of stock market participation. We start with the baseline model in Section 3.1, followed by investigations of close elections and elections where incumbent governors cannot stand for re-elections in Section 3.2. In Section 3.3, we explore the reallocation of capital by households during election cycles.

4.1. Baseline model and results

We employ a standard DD approach, which uses households in states without upcoming elections as the control group for a treated sample of households in states having elections in the same year. Such a setting allows us to separate out the effect of policy uncertainty from the nationwide economic conditions (which will be the same for treatment and control states at a given

point in time) and net out any pre-existing differences between states and households. Furthermore, the DD approach helps to address the potential omitted-variable problem, —i.e., some variables that affect both stock market participation and policy uncertainty are omitted in the model specification. To the extent that the omitted variable affects the treatment group and the control group in a similar way, we can still separate out the effect of policy uncertainty in a DD estimation. Specifically, we estimate the following empirical model:

$$StockMktPart_{i,s,t} = \beta_0 + \beta_1 Election_{s,t} + \mathbf{X}'_{i,s,t}\,\beta_2 + \delta_s + \mu_t + \alpha_i + \varepsilon_{i,s,t} \qquad (1)$$

Our dependent variable, $StockMktPart_{i,s,t}$, measures the stock market participation of household *i* in state *s* and period *t*. We use two different versions of the dependent variable. The first one, $Participation_{i,s,t}$, is an indicator variable that takes the value of one if household *i* in state *s* invests in the stock market in period *t*, and zero otherwise. This variable captures the propensity of a household's participation in the stock market. The second variable, $\%Stockshare_{i,s,t}$, captures the intensity of investments in the stock market, defined as the percentage of liquid wealth invested in stocks and mutual funds by household *i* in state *s* and period *t*.[5] Our key variable of interest is $Election_{s,t}$, which takes the value of one if state *s* in period *t* held a gubernatorial election, and zero otherwise.

Following the literature (e.g., Giannetti and Wang, 2016; Chetty, Sándor, and Szeidl, 2017), the vector of control variables, $\mathbf{X}_{i,s,t}$, includes a rich set of time-varying household- and state-level variables related to both the propensity and intensity of households' stock market

[5] Since households are interviewed in different months, when we merge the SIPP panels with the IPPSR election data in a given year and state, we verify that the period over which the questionnaires are answered precedes the election month. For example, a gubernatorial election was held on November 1998 in New Hampshire whereas a sample of SIPP households were asked questions over their assets and liabilities in October 1998. In this setting, we deem these respondents to be in an on-election year relative to this election. Similarly, those households for which the answers are provided as of November 1998, are deemed to be off-election year relative to the same election.

participation. Household variables include total wealth, age, education level, as well as respondents' marital status, business ownership, government employment, financial occupation, race and gender, where the last three controls are subsumed by the household-fixed effects. State-level variables include state GDP growth, state unemployment rate, and state housing price index (*HPI*) growth rate. We further include state fixed effects (δ_s) to control for time-invariant state characteristics, year fixed effects (μ_t) to control for macroeconomic conditions, and household fixed effects (α_i) to control for time-invariant household traits, such as IQ which is documented to have an impact on stock market participation (Grinblatt, Keloharju, and Linnainmaa, 2011). We estimate regression (1) using ordinary least squares even when the dependent variable is an indicator variable since our specifications include a large number of fixed effects (Giannetti and Wang, 2016). Standard errors are double clustered by state and year to account for the correlations in households' decisions to participate in the stock market from the same state and the correlations in the same year.

Table 3 presents the results for a DD estimation in regression (1). Columns (1) and (2) report results for whether a household participates in the stock market. Estimated slope coefficients on *Election* are all negative and significant at the 5% or 10% level (coeff. = –0.008 and –0.007 in Columns (1) and (2), respectively). This suggests that households in a given state are less likely to participate in the stock market in the period prior to that state holding gubernatorial elections in a given year. These findings are also economically large. Conditional on an election in a state, the rate of stock market participation goes down by 70 to 80 basis points, which implies a decrease of 3.1% to 3.5% in the unconditional probability of stock market participation at the mean (22.3%).

We draw similar inferences based on the findings for the intensity of a household's investments in the stock market, reported in the last two columns of Table 3. Estimated slope coefficients on

Election continue to be negative and significant at the 5% level or 1% level (coeff. = –0.005 and –0.006 in Columns (3) and (4)). These results imply that the percentage of a household's liquid wealth invested in the stock market (*% Stock share*) also decreases during periods of high policy uncertainty. Again, these results are economically meaningful. Compared to a non-election year, there is a decrease of 50 to 60 basis points in an election year, which corresponds to a 4.8% to 5.8% decrease in the level of investments in stocks and mutual funds that have a mean of 10.4%. The signs for the estimated coefficients on control variables are broadly consistent with the prior literature. Heads of households who are married, have higher level of education, aged between 18 and 60, and own higher wealth tend to have higher stock market participation (Grinblatt, Keloharju, and Linnainmaa, 2011; Giannetti and Wang, 2016).

Among state-level economic variables, state GDP growth and state HPI are positively related to stock market participation, while the sign on state unemployment rate is negative. This finding is intuitive, as better economic conditions should enhance participation in equity markets. Furthermore, as expected, the presidential election, another source of policy uncertainty but nationwide, has a negative relation with households' stock market participation. Overall, our baseline results show that increased policy uncertainty associated with gubernatorial elections leads to a decreased participation in the stock market, reflected by both a lower average participation rate in the stock market and a decreased percentage holding in stocks.

4.2. Further evidence from close elections and term limits

Following Atanassov, Julio, and Leng (2016), Bird, Karolyi, and Ruchti (2017), and Jens (2017), we identify two scenarios that are likely to be associated with greater policy uncertainty. These include close elections and elections where incumbents cannot stand for re-election due to

term limits. Therefore, we should expect to observe dampening effects of policy-related uncertainty to be stronger on households' stock market participation in both of these cases.

Close elections are elections with lower vote differential between the first and second place candidates. Such elections can therefore create a higher level of policy uncertainty *ex-ante*. We define *Close election* as one if the vote differential for an election is in the lowest tercile, and zero otherwise. For brevity, we present only the estimated coefficients on the *Election* and the *Close election* from the DD estimation for stock market participation in Table 4. The estimated coefficients on *Election* remain negative and significant, ranging from –0.004 to –0.006 in Columns (1) through (4). The coefficient on the *Close election* should capture the incremental effect of a close election over and above the effect of a non-close election on stock market participation. The negative and significant coefficients of –0.015 and –0.017 in Columns (1) and (2) indicate an additional decrease of 150 and 170 basis points (over the 60 and 50 basis points for non-close elections) in the probability of a household's stock market participation. Therefore, the total effect of a close election is a decrease of 210 to 220 basis points in the probability of stock market participation. These figures correspond to a 9.4% to 9.8% relative decrease in the unconditional probability of stock market participation at the mean (22.3%). We observe a similar negative relation between *Close election* and the percentage of a household's liquid wealth invested in the stock market in Columns (3) and (4). Both models indicate a decrease of 90 basis points in the percentage of liquid wealth invested in the stock market. The total effect adds up to a decrease of 130 to 140 basis points (after adding the 50 and 40 basis point effect for non-close elections), which represents a 12.5% to 13.5% relative decrease at the average value of the percentage of liquid wealth in the stock market (10.4%).

Moving on to our second case associated with greater policy uncertainty, we investigate term limits that prevent the incumbent governor from seeking re-election. Given the well-documented incumbency advantage (Erikson, 1971; Gelman and King, 1990), incumbents overwhelmingly win re-election. In our sample, incumbents win re-election 83% of the time. Hence, policy uncertainty can exacerbate when the incumbent governor is in his/her last term. Term limits are also plausibly exogenous because term limit legislations are specified in state constitutions and are therefore unlikely to be amendable by either governors or households to further their own interests. We define a variable *Lame duck last term* as an indicator variable that is equal to one if the incumbent governor is in his/her last term in a given year, and zero otherwise.

Table 5 presents the results. For brevity, we only report estimated coefficients on the *Election*, *Lame duck last term*, and the interaction term between *Election* and *Lame duck last term*. As in earlier specifications, the coefficient on *Election* continues to be negatively significant. The interaction term between *Election* and *Lame duck last term* has a significantly negative coefficient ranging from −0.008 to −0.011 in Columns (1) through (4). This shows an incremental effect of policy uncertainty on stock market participation in election years where incumbent governors are serving their last terms. Moreover, the *Lame duck last term* does not have a significant relation with households' stock market participation, which implies that the term limit by itself does not influence participation during non-election years. The total effect of elections with lame duck incumbents are a decrease of 160 to 170 basis points in the probability of a household's stock market participation, and a decrease of 100 to 130 basis points in the percentage of liquid wealth invested in the stock market (after adding the coefficients on *Election* and on the interaction of *Election* and *Lame duck last term*). These imply a 7.2% to 7.6% relative decrease in the

unconditional probability of stock market participation (22.3%) and 9.6% to 12.5% relative decrease in the unconditional percentage of liquid wealth invested in the stock market (10.4%).

Taken together, results in this section show that it is not the elections themselves, but the policy uncertainty associated with the elections that drives the stock market participation of households, further strengthening the causal interpretation of our findings.

4.3. How do households reallocate their assets?

The key insight from our empirical analysis so far is that households reduce their stock investments during times with elevated policy-related uncertainty. Then, a natural follow-up question is: How do households facing such uncertainty reallocate their assets? Does policy-related uncertainty trigger flight-to-safety activities? Or, does it instigate households to take new positions in relatively more illiquid non-financial assets such as real estate?

To address these questions, we define three new variables: (1) $\%\ Safe\ asset^W$ as a percentage of total wealth invested by the households in safer assets — such as government securities, municipal bonds, corporate bonds, money market deposit accounts, checking accounts, savings accounts; (2) $\%\ Stock\ share^W$ as a percentage of total wealth invested by the households in stocks and mutual funds; and (3) $\%\ Non\text{-}liquid^W$ as the percentage of total wealth invested in non-liquid assets — such as real estate, vehicles, private businesses, etc. We then estimate the regression in equation (1) using specifications analogous to models in columns (3) and (4) of Table 3, but this time using $\%\ Safe^W$, $\%\ Stock\ share^W$, and $\%\ Non\text{-}liquid^W$ respectively as our dependent variables. Note that we use the household's total wealth (sum of liquid and non-liquid wealth) in the denominator, rather than its liquid wealth (e.g., Giannetti and Wang, 2016), to control for any shocks to other parts of the household's portfolio that could be correlated with policy uncertainty in the state. Furthermore, normalizing by total wealth rather than liquid wealth avoids the

mechanical relation that a decrease in the percentage of liquid wealth invested in stocks always indicates an increase in the percentage of liquid wealth invested in safe assets since, by definition, these two fractions add up to one.

Columns 1 and 2 in Table 6 show that households reduce their stock investments by 4.4% (at the mean of 2.7%), while increasing their investments in relatively safer assets by 5.7% (at the mean of 19.1%). We find no significant impact of policy uncertainty on households' investments in non-liquid assets. This suggests that households in states with upcoming elections are more likely to shift from riskier to safer assets instead of non-liquid assets.

5. Heterogeneous effect of policy uncertainty on stock market participation

Our results so far show that policy uncertainty dampens the households' stock market participation. In this section, we investigate heterogeneous effects of policy uncertainty on stock market participation of households.

5.1. In-state and out-of-state investments

Prior research has shown that policy uncertainty can influence the real behavior of in-state firms. The theoretical model gives us two reasons to expect that state elections affect households' in-state investments more than out-of-state investments. First, state elections affect in-state firms more than out-of-state firms. As a result, in-state firms become riskier than out-of-state firms, which reduces the attractiveness of in-state stocks. Second, there is a higher correlation between households' labor income and the performance of in-state firms, which implies that households have greater incentives to reduce their investments in in-state firms than in out-of-state firms. We proceed to test this hypothesis.

Since we need to examine the changes in households' in-state and out-of-state equity holdings, which we do not observe in the SIPP data, we use information from a large discount brokerage firm for the period 1991 to 1996.[6] These data provide monthly information on common stock holdings for a large panel of households residing in different states. A series of papers use this data to study households' investments (Barber and Odean, 2000; Barber and Odean, 2001; Barber and Odean, 2002; Kumar, 2009; Giannetti and Wang, 2016). Before discussing our analysis and findings, we acknowledge two limitations of this data that can undermine the statistical power of our empirical tests. First, it is not as recent as the SIPP data and there is only an overlap of one year between the two datasets. Second, it does not cover as large a cross section of households as the SIPP data. Nevertheless, in absence of more recent and more comprehensive data, we attempt to provide the best possible evidence using the brokerage data.

Following Giannetti and Wang (2016), we compute the percentage changes in in-state and out-of-state equity holdings for household *i* at period *t* with holdings in *j* stocks as follows:

$$\Delta holding_{i,t}^{k} = \sum_{j} p_{j,t-1}\left(holding_{i,j,t} - holding_{i,j,t-1}\right) / \sum_{j} p_{j,t-1} holding_{i,j,t-1}, \qquad (2)$$

where $k = \{\text{in-state, out-of-state}\}$. Note that we fix the price of stock *j*, $p_{j,t-1}$, lagged by one period, since we wish to capture active changes in households' equity holdings that are not influenced by changes in stock prices. To be consistent with our previous analysis using the SIPP data, we compute the changes in in-state and out-of-state equity holdings during the one-year period prior to November each year since elections are typically held in November. Due to the positive skewness in percentage changes in holdings, we trim it at top 1% (bottom value is constrained at –100%).

[6] We thank Brad M. Barber and Terrance Odean for sharing this data with us.

Next, we analyze the effect of policy uncertainty on in-state and out-of-state holdings separately using $\Delta holding_{i,s,t}$ as our dependent variable and controlling for state-level time-varying macroeconomic factors — such as unemployment rate, GDP, and housing price index. Households' demographic information is time-invariant in the data, so we control for household fixed effects instead of using demographic characteristics directly. We include year fixed effects in the regression and cluster the standard errors only by state due to the short time-series of the panel data.

Table 7 presents the results. We find a statistically significant decrease in both in-state and out-of-state investments of households. Moreover, this finding is also economically meaningful. We find that households reduce their in-state equity holdings by 13.2% relative to an average holding of 21.2%. In contrast, the decline in out-of-state equity holdings is only 4.0% relative to an average of 28.7%.

5.2. Household characteristics and sensitivity of participation to policy uncertainty

In this section, we examine whether households with different demographics exhibit different sensitivities to policy uncertainty. This investigation helps shed light on the heterogeneous effects of policy uncertainty on different households.

First, due to the demographical differences, households have different risk tolerance levels that can affect the sensitivity of their stock market participation to policy uncertainty. Earlier work show that women are generally perceived to be more risk averse than men (e.g., Barsky et al., 1997; Powell and Ansic, 1997; Barber and Odean, 2001), wealthier households exhibit greater propensity to take risk and participate more in the stock market (Carroll, 2002; Campbell, 2006), and older households should be more risk averse and participate less in the stock market since they have shorter horizons compared to their younger peers (Banks and Tanner, 2002; Guiso and Jappelli,

2002; Bertaut and Starr-McCluer, 2002; and Iwaisako, 2009). Intuitively, more risk-averse households are more sensitive to increases in asset risk and have stronger incentives to hedge their labor income risk; we therefore hypothesize that male-headed, younger and wealthier households are more tolerant to risks and react less negatively to policy uncertainty, i.e., experience a smaller drop in stock market participation.

Second, households face different costs related to gathering and processing information to resolve policy uncertainty, which, in turn, can affect their decision to participate in stock market. One strand of literature suggests that policy uncertainty is associated with higher cost of information for market participants (Starks and Sun, 2016; Baloria and Mamo, 2017), while another strand shows that greater information costs could result in lower stock market participation rates (Haliassos and Bertaut, 1995; and Vissing-Jorgensen, 2003, Grinblatt, Keloharju, and Linnainmaa, 2011). Combining these two strands of literature, we hypothesize that households with lower information costs should be affected less by policy uncertainty compared to their peers. Relying on prior work (van Rooij, Lusardi, and Alessie, 2011; Cole, Paulson, and Shastry, 2014), we use higher education level and financial occupation of a household head as two proxies for lower information costs, since the cost of accessing and processing information about the risks and returns in the market is expected to be lower for people with higher level of financial literacy.

Third, households are likely to differ from each other with respect to their labor income exposure to policy uncertainty. For instance, Cahan (2017) finds that governors and their party allies may have the ability to raise employment levels leading up to elections, or delay employment-reducing decisions until afterwards.[7] In the two quarters following the election,

[7] Anecdotal evidence of manipulation by governors abounds. During his re-election campaign in 2014, Connecticut governor Dannel Malloy dismissed nonpartisan reports of a growing budget deficit only to, two weeks after winning re-election, announce a statewide freeze on hiring for all positions not "essential for critical agency operations" and

Cahan (2017) documents that local and state government employment growth is generally lower by similar magnitudes in those counties that have just experienced an election compared to those that did not, and such effects are absent in private sector employment. In a similar vein, households who are self-employed in politically sensitive industries are more susceptible to changes in political landscape than others (Kostovetsky, 2015). Because households with a greater labor income exposure to political risk have stronger incentives to hedge the exposure, we expect negative participation effects to be more pronounced for households employed by state/local government, and for those operating a business in politically sensitive industries, compared to other households.

We examine the differential sensitivities of households' stock market participation to policy uncertainty by estimating the following regression:

$$StockMktPart_{i,s,t} = \phi_0 + \phi_1 Election_{s,t} \times Demographics_{i,s,t} + \mathbf{X}'_{i,s,t}\,\phi_2 + \nu_{s,t} + \alpha_i + \varepsilon_{i,s,t} \qquad (3)$$

where $Demographics_{i,s,t}$ is a vector of demographic characteristics for household *i* from state *s* in period *t*, $Election_{s,t} \times Demographics_{i,s,t}$ is the interaction of $Election_{s,t}$ and $Demographics_{i,s,t}$. Because we are now differentiating the effects of policy uncertainty amongst different types of households, unlike equation (1), we can include joint state-year fixed effects, $\nu_{s,t}$, as well as household fixed effects, α_i. Through state-year fixed effects, we can exploit within-state cross-sectional variation in households' sensitivities to policy uncertainty, and absorb any time-varying state-level latent shocks including state economic conditions that could be correlated with equity participation and make our estimates spurious.

on state contracting. Republican lawmakers accused Malloy of misleadingly delaying the bad news until after the election (see http://www.courant.com/politics/hc-malloy-hiring-freeze-state-agencies-20141113-story.html).

Table 8 presents the results for cross-sectional differences in the effect of policy uncertainty on household stock market participation. For brevity, we only report the interaction terms between different demographic characteristics and *Election* in the table. Columns (1) and (2) report the results for the probability of stock market participation and the percentage of liquid wealth invested in the stock market, respectively. Consistent with our hypotheses, we find that households where the heads are male, younger, and with higher total wealth, react less negatively to policy uncertainty, i.e., they are more likely to participate in the stock market compared to their peers when uncertainty increases. Specifically, the estimated slope coefficients on the interactions of male, younger and middle age, and total wealth variables with election variable are all positive and significant (except for male interaction term in Column (2)). Note that since the overall average sensitivity is negative, a positive coefficient indicates a less negative effect of policy uncertainty on market participation.

These results are also economically meaningful. Male-headed households respond less negatively to policy uncertainty by 30 basis points (based on Column (1)), compared to female-headed households. More wealthy households (those with at least one standard deviation more than the average in the logarithm of total wealth) react less negatively to policy uncertainty by 75 basis points and 113 basis points based on Columns (1) and (2), respectively. Finally, compared to the older household heads (those with age of 60 or more), younger household heads aged between 18 and 34 react less negatively to policy uncertainty by 30 and 20 basis points based on Columns (1) and (2), respectively. Similarly, younger household heads aged between 35 and 60 also respond less negatively by 50 and 60 basis points, respectively.

Moving on to the information costs, household heads with financial occupation and more education are less negatively affected by policy uncertainty. This is consistent with the hypothesis

that households with lower costs to access and process information are more likely to participate during periods of high policy uncertainty, compared to their peers with higher information costs. Household heads with financial occupation react less negatively to policy uncertainty by 60 and 40 basis points based on Columns (1) and (2), respectively. Similarly, household heads with some college education respond less negatively by 30 and 10 basis points for Columns (1) and (2), respectively. Household heads that possess college or higher degrees are even less averse to participating in the stock market in response to greater policy uncertainty (by 40 and 30 basis points based on Columns (1) and (2), respectively).

Our third set of results investigate if dampening effects of policy uncertainty on equity participation is exacerbated or attenuated for households employed in state/local government offices and for those who are self-employed in politically sensitive industries. Following Herron et al. (1999), we classify businesses operating in transportation, warehousing, and utilities, public administration, educational, health and social services, and mining as politically sensitive. We set the *Government employee* and *Business owner* dummies to one for state/local government employees, and if the household owns a business in one of these politically sensitive industries, respectively. We then interact these dummy variables with the election year dummy to measure the cross-sectional heterogeneity in such households' exposure to policy uncertainty. We observe that state/local government employees, and business owners in politically sensitive industries decrease their probability of equity participation by 40 and 30 basis points on average based on Column (1) estimates. These results support the view that households employed in public sectors and business owners operating in politically sensitive industries are particularly sensitive to changes in policy uncertainty.

The evidence in this section provides strong empirical support for the idea that not all households are affected by policy uncertainty in the same way. An accurate assessment of the economic consequences of policy uncertainty must take into account cross-sectional differences in household characteristics that lead to different exposures to uncertainty. While this study investigates characteristics in three dimensions — risk aversion, information processing, and employment risk — we do not claim to have exhausted the list of factors that moderate the effects of uncertainty on stock market participation.

6. Dynamics of stock market participation during an election cycle

Our primary focus so far has been on whether households reduce stock market participation in the period right before a gubernatorial election when policy uncertainty is high. If uncertainty is resolved after the election is over, we expect the decline in participation to be temporary. In this section, we test this possibility and examine whether there is a complete or partial reversal in participation after the election. A complete reversal would suggest that there is only an intertemporal substitution of participation when households face uncertainty. In contrast, a partial reversal would indicate that uncertainty has a long-lasting and disruptive effect on participation.

The magnitude of reversal should depend on the degree of resolution in policy uncertainty after the election. For elections where a new governor from a different political party is elected, we expect the policy uncertainty to remain comparatively high for a long time. Different parties are likely to have different political ideologies and pander to different constituents, which can lead to differences in their stances on policy positions and political actions (Hibbs, 1977; Alesina, 1987; Alesina and Sachs, 1988). For these cases, the reversal could be slower compared to the other elections.

Following the methodology in Julio and Yook (2012), we modify the baseline model in regression (1) to examine the dynamics of stock market participation during an election cycle. Specifically, we add a binary variable, *Post-election*, which takes the value of one for periods after a gubernatorial election until the year before the next election, and zero otherwise. To gauge whether party switch has an incremental effect on the post-election participation, we also interact both *Election* and *Post-election* variables with a binary variable, *Party switch*, which takes the value of one for elections where the political party of the elected governor differs from the party of the outgoing governor, and zero otherwise.

We report the estimation results in Table 9. Columns (1) and (2) show the findings for the propensity of investments in stock market, and Columns (3) and (4) report the results for the intensity of investments in stock market. First, the estimated coefficients on the *Election* dummy are significantly negative in all specifications, confirming our previous finding that participation decreases in the election year. Second, the coefficient estimates on *Post-election* dummy are significantly positive in all specifications, indicating a post-election increase in stock market participation.

We examine the effect of party switch in Columns (2) and (4). Comparing to the findings for the whole sample in Columns (1) and (3), two patterns are noteworthy. First, in case of no party switch, there is a decrease in participation during the election year (coefficients of –0.007 and –0.005) followed by an increase till the next election (coefficients of 0.005 and 0.003). Second, when there is a party switch, we observe a larger decline in participation during the election year but the increase after the election is smaller. For example, based on the estimates in Column (2), there is a decline of 0.011 (i.e., (–0.007) + (–0.004)) followed by an increase of 0.004 (i.e., 0.006 + (–0.002)).

To evaluate the net effect on stock market participation during the election cycle, we conduct a test on the estimated coefficients on election and post-election variables. The null hypothesis is that the coefficients on the election and post-election variables sum to zero, which would suggest a complete reversal in participation after the election. We fail to reject this null hypothesis for estimates in Columns (1) and (3), which suggests that the decline in stock market participation completely reverses for the overall sample. In contrast, we reject the null in Columns (2) and (4), which indicates that for elections where there is a party switch, the pre-election decline is greater than the post-election increase in participation, i.e., a net reduction in stock market participation due to lower resolution in policy uncertainty after party switches.

Taken together, these results show that there is a reversal in households' stock market participation after the election. Moreover, the magnitude of reversal depends on the speed of resolution in uncertainty after the election. Specifically, when there is a party change after the election, the reversal is slower, implying a long-lasting and disruptive effect of uncertainty on households' stock market participation.

7. Robustness tests

In our tests, so far, we have focused on stock investment, directly or indirectly through mutual funds, outside retirement accounts because investments in these accounts are often affected by default choices (Beshears et al., 2009). To ensure that our results are robust to the inclusion of retirement accounts, we redefine our measure of stock market participation. The SIPP questionnaires ask only about the type of assets held in the IRA, 401K, and Keogh, but not about the dollar amount invested in risky assets in these retirement accounts. Accordingly, we modify the *Participation* dummy (extensive margin) as taking the value of one if the household holds any

shares in publicly held corporations, mutual funds, including holdings in their retirement accounts. Our re-estimated models deliver qualitatively, and quantitatively very similar results to those of earlier findings on the extensive margin.

In a different set of tests, we refine our definition of close elections. In Table 4, we measured a close election as having a vote differential in the lowest tercile of sample over 1996-2011. One drawback of this approach is that vote differentials are captured *ex post*, and an alternative would be to use an *ex ante* measure of closeness. We construct *ex ante* closeness by utilizing the pre-election poll data from RealClearPolitics.com We were able to hand-collect data on 1,859 polls for 104 elections that were conducted between 2002-2011. To measure closeness using poll data, we first compute the difference in percentage vote received for the first and second candidates in each poll, and then average the poll vote differential for each gubernatorial election. As before, we define an election as close if the election's average poll vote differential is in the lowest tercile of the sample of average poll vote differentials. This leaves us 34 close elections out of 104 total elections with vote differential between top two candidates being 3.75 percent. The correlation between the average poll margin and election results is 0.93, which suggests that the ex-post closeness measure obtained from election results is a good proxy for ex-ante election closeness obtained from polls. We re-estimate our model as in Table 4 and find results to be essentially identical.

8. Economic Policy Uncertainty (EPU) index and stock market participation

Although we focus on gubernatorial elections for our main analysis, we provide supplementary evidence using the policy uncertainty measure from Baker, Bloom, and Davis (2016), the EPU

index.[8] There are pros and cons of using this index. The advantage lies in the fact that it captures variations in policy uncertainty even during non-election years and policy uncertainty associated with events/macroeconomic conditions other than gubernatorial elections. However, one limitation is that it may be difficult to disentangle the general economic uncertainty from policy uncertainty when using the EPU index. Therefore, we conduct two sets of analyses, first using panel regressions after explicitly controlling for potential confounding macroeconomic factors, and then using a two-stage least squares (2SLS) regression with political polarization as an IV as in Gulen and Ion (2016).

8.1. Policy uncertainty index and macroeconomic data

The EPU index is calculated as a weighted average of (1) *News component*: the frequency of articles related to policy uncertainty in ten leading U.S. newspapers, (2) *Tax code component*: tax code change uncertainty, using data from the Congressional Budget Office, (3) *Monetary policy component*: monetary policy forecast disagreement, which draws on the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters, and (4) *Government spending component*: fiscal policy forecast disagreement. The overall index significantly correlates with events expected to generate policy-related uncertainty, and its components capture specific types of policy uncertainty. A more thorough discussion of the methodology used to calculate the policy uncertainty index can be found in Baker, Bloom, and Davis (2016).

Macroeconomic factors include uncertainty related to future equity market returns using the VIX index provided by the Chicago Board Options Exchange (CBOE), uncertainty about future economic growth using the one-year-ahead GDP forecasts from the Philadelphia Federal Reserve's

[8] We thank Scott Baker, Nick Bloom and Steven Davis for making the index and its components available at http://www.policyuncertainty.com/.

biannual Livingstone survey, macroeconomic uncertainty index from Jurado, Ludvigson, and Ng (2015), investor sentiment using the Investor Sentiment Index from Baker and Wurgler (2007), and equity market performance using the S&P 500 index return. We present summary statistics on the overall index, its components, and macro measures in Table 10.

8.2. Panel regression

To analyze the effect of policy uncertainty on households' stock market participation, we estimate the following panel regression:

$$StockMktPart_{i,s,t} = \gamma_0 + \gamma_1 EPU_t + \mathbf{X}'_{i,s,t}\gamma_2 + \alpha_i + \varepsilon_{i,s,t} \quad (4)$$

where EPU_t is the EPU index. To match the monthly index to our survey data and account for the positive skewness in the index, we use the natural logarithm of the EPU index at the beginning of the interview month. Since the EPU index is only time varying, we can only control for household fixed effects and exclude year fixed effects in this model. A vector of controls $\mathbf{X}_{i,s,t}$ include the macroeconomic factors, household demographics, and an indicator variable for the presidential elections. Standard errors are double clustered by households and year-month in estimating regression (4).

Panel A of Table 11 provides results for the stock market participation and Panel B presents the findings for the percentage of liquid wealth invested in the stock market. We find evidence of a strong and negative relation between the EPU index and households' stock market participation. This is consistent with our earlier findings using gubernatorial elections as a measure for policy uncertainty. We continue to observe lower stock market participation by households during periods of high policy uncertainty. At the mean of the EPU index (107.2), a one standard deviation (39.52) increase in the index is associated with 66 basis points (–0.021 x ln [(107.2 + 39.52) /107.2])

decrease in the probability of households' stock market participation. This implies a 3.0% decrease in the unconditional probability of stock market participation (22.3%). Likewise, at the mean of the EPU index, a one standard deviation increase in the index is associated with 78 basis points decrease in the percentage of liquid wealth invested in the stock market, which corresponds to a 7.5% in the unconditional percentage of investments in the stock market (10.4%).

Since EPU index is a broad measure of policy uncertainty capturing multiple dimensions of uncertainty, we repeat our analysis for each of the four components of the index instead of the index as the key independent variable to ascertain the component(s) that are significantly associated with households' stock market participation. We find that except for the monetary policy component, all the other three components (news, tax code, and government spending) of the index are significantly and negatively associated with stock market participation.

8.3. Two-stage least squares (2SLS) estimation

To address the possibility that unobservable omitted variables may influence both stock market participation and policy uncertainty, we use a plausibly exogenous instrument for policy uncertainty. For such an instrument to pass the validity criterion, it should have a significant relation with policy uncertainty and should affect households' stock market participation only through this relation. Following Gulen and Ion (2016), we use the level of political polarization in the United States Senate as our instrumental variable (IV). McCarty (2012) argues that partisan polarization "makes is harder to build legislative coalitions, leading to policy gridlock" and to "produce greater variation in policy". Baker, Bloom, and Davis (2016) also propose that political polarization could drive policy uncertainty by "producing more extreme policies, less policy stability, and less capacity of policy makers to address pressing problems." Therefore, we expect that higher levels of political polarization will result in a higher level of policy uncertainty. This

helps in the measure of political polarization satisfying the relevance criterion for an IV. At the same time, it is not obvious how the level of disagreement between politicians can directly affect households' stock market participation other than through its effect on policy uncertainty. We therefore believe that our IV also satisfies the exclusion requirement.

Our measure of political polarization is based on the DW-NOMINATE scores of McCarty, Poole, and Rosenthal (1997), which estimate the ideological locations of legislators over time.[9] We focus on the first dimension of the DW-NOMINATE scores, which can be interpreted as the legislators' position on government intervention in the economy (Poole and Rosenthal, 2000). Our IV is calculated as the average of these scores for the Republican party members in the Senate minus the average of the scores for the Democratic party members in the Senate.

In Table 12, we replicate our main results in Table 11 using this political polarization measure as an IV for policy uncertainty and using a two-stage least squares (2SLS) framework. In the first stage, we regress the EPU index on the IV and all the controls used in the second-stage regression. In the second stage, we estimate the same regression as in regression (4) using the fitted value from the first-stage regression. Since both the EPU index and the IV only vary over time but not cross-sectionally across households, their values are repeated for all households for a given period. This implies that the usual 2SLS methodology is not appropriate in this context, since it would mechanically overstate the correlation between the endogenous variable and its instrument. To overcome this problem, we bootstrap the standard errors to address the issues associated with using estimated regressors. The *F*-statistic for the first-stage estimation is 14.28, suggesting that the IV satisfies the relevance condition (Stock, Wright, and Yogo, 2002; Angrist and Pischke, 2009). Another test for the relevance of instruments is the Anderson-LR test of the null hypothesis that

[9] We obtain the data from https://legacy.voteview.com/dwnomin.htm.

correlations between the instrument and the endogenous variable is essentially zero. We obtain a test statistic value of 72.17 which strongly rejects the null (*p*-value =0.000), implying the IV is strongly correlated with the endogenous variables. Furthermore, our results show that the relation between policy uncertainty and households' stock market participation remains significantly negative even after addressing the omitted variable issue with an IV.

Collectively, our findings in this section using the EPU index and its components are consistent with those documented earlier using gubernatorial elections. That is, policy uncertainty negatively affects households' stock market participation even when we employ a broader measure of policy uncertainty.

9. Conclusions and implications of our findings

In this study, we provide new evidence on the effect of policy uncertainty on households' decision to participate in the stock market. Our theoretical framework predicts that an increase in policy uncertainty reduces households' participation in the stock market for two reasons. First, it causes an increase in asset risk and hence induces households to reduce their stock investment. Second, it increases the households' labor income risk and thus results in a hedging demand to sell stocks by the households. Consistent with the theoretical predictions, we document three major findings. First, we observe that an increase in policy uncertainty is associated with a significant decline in both the propensity and intensity of households to invest in the stock market. Households reallocate capital from stock market to safer assets, such as savings account and bonds. Second, we show that variations in the participation costs, risk preferences, and households' labor income exposure to policy uncertainty help explain the differential sensitivities of households' stock market participation to policy uncertainty. Third, we observe that the decline in stock market

participation reverses when there is resolution in policy uncertainty. For the subsample of elections where there is a change in the party of elected governor, there is only partial reversal since policy uncertainty is not fully resolved. Therefore, in some instances, there can be long-lasting and disruptive effect of policy uncertainty on households' stock market participation.

Our findings have implications for households, firms, and economy in general. There can be welfare implications for households if they choose to stay out of the stock market after periods of high policy uncertainty. Since the equity risk premium is positive, a lack of participation in the stock market can have significant negative effects on households' wealth accumulation and retirement savings. In addition to the welfare implications for households, our findings also have implications for firms' ability to raise capital through equity markets when there is more uncertainty about economic policy. If the demand for stocks is lower during periods of high uncertainty, then it is more costly for firms to raise capital, which might delay corporate investments. This in turn can worsen or slow down recovery from economic recessions as periods of high policy uncertainty and economic downturns tend to coincide. Finally, our finding that wealthier households tend to reduce their equity participation less after periods of high policy uncertainty suggests that such households can benefit from the equity premium in the long run, in contrast to the poor and middle class households. This has implications for income inequality and welfare policies. These implications are beyond the scope of this study but offer interesting avenues for future research.

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Variable Description

Variable Name	Description
Policy uncertainty variables	
Close election	a binary variable equal to 1 if the vote differential (i.e., difference between the percentage of votes obtained by the first and second place candidates) for an election is in the lowest sample tercile of vote differential, and 0 otherwise.
Election	a binary variable equal to 1 if a state in a given year holds a gubernatorial election, and 0 otherwise.
Post-election	a binary variable, which takes a value of 1 for years after current gubernatorial election until the next gubernatorial election in a state, and 0 otherwise.
Lame duck last term	a binary variable equal to 1 if the incumbent governor is prevented from seeking re-election by term limits, and 0 otherwise.
Party switch	a binary variable equal to 1 if the party of the new governor elected is different from the party of the outgoing one, and 0 otherwise.
Polarization	the DW-NOMINATE scores of McCarty, Poole, and Rosenthal (1997) for the Senate.
Presidential	a binary variable equal to 1 for years when presidential elections were held, and 0 otherwise.
EPU	policy uncertainty measure from Baker, Bloom, and Davis (2016).
News component	the frequency of articles related to policy uncertainty in ten leading U.S. newspapers.
Tax code component	tax code change uncertainty using data from the Congressional Budget Office.
Monetary policy component	monetary policy forecast disagreement, which draws on the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters.
Government spending component	fiscal policy forecast disagreement.
Household variables	
% Stock share	percentage of liquid wealth invested by the household in stocks and mutual funds in a given period.
% Stock share^{W}	percentage of total wealth invested by the household in (risky assets) stocks and mutual funds.
% Safe share^{W}	percentage of total wealth invested in safe assets — such as government securities, munis, corporate bonds, money market deposit accounts, checking accounts, savings accounts.
% Non-liquid^{W}	percentage of total wealth invested in non-liquid assets — such as real estate, vehicles, private businesses etc.
Business owner in PSI	a binary variable equal to 1 if the household head owns a business in politically sensitive industries, and 0 otherwise.
College or more	a binary variable equal to 1 if the household head has at least a college degree, and 0 otherwise.
Female	a binary variable equal to 1 if the household head is a female, and 0 otherwise.
Financial occupation	a binary variable equal to 1 for the household head in a finance-related occupation, and 0 otherwise.

Government employee	a binary variable if the household head is employed in a state or local government, and 0 otherwise.
High school or less	a binary variable equal to 1 if the household head has finished at most high school, and 0 otherwise.
Liquid wealth	sum of safe assets -- such as government securities, munis, corporate bonds, money market deposit accounts, checking accounts, savings accounts, and stockholdings.
Married	a binary variable equal to 1 if the household head is married, and 0 otherwise.
Middle aged	a binary variable equal to 1 if the household head's age is between 35 and 60, and 0 otherwise.
Old	a binary variable equal to 1 if the household head's age is at or over 60, and 0 otherwise.
Participation	a binary variable equal to 1 if the household holds any stocks in publicly held corporations, or mutual funds, and 0 otherwise.
Participation (with IRA/401K/Keogh)	a binary variable that equals 1 if the household holds any shares in publicly held corporations, mutual funds, including holdings in their retirement accounts, and 0 otherwise.
Race	a binary variable equal to 1 if the household head is white, and 0 otherwise.
Some college	a binary variable equal to 1 if the household head is a college drop-out, and 0 otherwise.
Total wealth	sum of financial assets, real estates, vehicles, and private business equity.
Young	a binary variable equal to 1 if the household head's age is between 18 and 34, and 0 otherwise.
Macro-level variables	
GDP forecast	expected real GDP growth based on one-year-ahead GDP forecasts from the Philadelphia Federal Reserve's biannual Livingston survey.
JLN index	measure of macroeconomic uncertainty from Jurado, Ludvigson, and Ng (2015).
Sentiment	monthly Investor Sentiment Index from Baker and Wurgler (2007).
SP return	S&P 500 index monthly return.
State HPI appreciation	percentage change in state's housing price index is the weighted index of single-family house prices obtained from Federal Housing Finance Agency.
State unemployment	state's number of unemployed as a percentage of the labor force.
State GDP growth	annual growth rate in state's GDP.
VIX	average monthly implied volatility of S&P 500 index options.

Table 1. Summary statistics: SIPP data

The sample includes households in SIPP for the 1996-2000, 2001-2003, 2004-2007, and 2008-2013 waves. All monetary values are in real 1996 dollars. 'Participation' is a binary variable equal to 1 if the household holds any stocks in publicly held corporations or mutual funds in a given period, and 0 otherwise. 'Participation (with IRA/401K/Keogh)' is a binary variable that equals 1 if the household holds any shares in publicly held corporations, mutual funds, including holdings in their retirement accounts, and 0 otherwise. '% Stock share' is the percentage of liquid wealth invested by the household in stocks and mutual funds in a given period. 'Female' is a binary variable that equals 1 if the household head is a female, and 0 otherwise. 'Married' is a binary variable that equals 1 if the household head is married, and 0 otherwise. 'Young' is a binary variable that equals 1 if the household head's age is between 18 and 34 years, and 0 otherwise. 'Middle aged' is a binary variable that equals 1 if the household head's age is between 35 and 60 years, and 0 otherwise. 'Old' is a binary variable that equals 1 if the household head's age is at or over 60 years, and 0 otherwise. 'High school or less' is a binary variable that equals 1 if the household head has finished at most high school, and 0 otherwise. 'Some college' is a binary variable that equals 1 if the household head is a college drop-out, and 0 otherwise. 'College or more' is a binary variable that equals 1 if the household head has at least a college degree, and 0 otherwise. 'Financial occupation' is a binary variable that equals 1 for the household head in finance-related occupations, and 0 otherwise. 'Race' is a binary variable that equals 1 if the household head is white, and 0 otherwise. 'Government employee' is a binary variable that equals 1 if the household head is employed in a local or state government, and 0 otherwise. 'Business owner' is a binary variable if the household head is self-employed or owns a business in politically sensitive industries, and 0 otherwise. 'Total wealth' includes financial assets as well as all real estate (including second homes), vehicles, and private business equity. 'Liquid wealth' is defined as the sum of safe assets - such as bonds, checking accounts, and savings accounts - and stockholdings. 'Home equity' denotes the difference between the value of the household's property and the value of the household's mortgage. 'Equity in vehicles', 'Equity in other real estate', 'Business equity' are constructed as the difference between the value and total debt owed against the vehicle, other real estate (other than primary residence such as a vacation home or undeveloped lot), and business, respectively.

	Nobs	Mean	Median	Standard deviation
Participation	359,260	0.223	0.000	0.416
Participation (with IRA/401K/Keogh)	359,260	0.387	0.000	0.450
% Stock share (% of liquid wealth)	359,260	0.104	0.000	0.271
Female	359,260	0.510	1.000	0.499
Married	359,260	0.531	1.000	0.489
Age				
Young	359,260	0.189	0.000	0.391
Middle aged	359,260	0.521	1.000	0.499
Old	359,260	0.290	0.000	0.453
Education				
High school or less	359,260	0.394	0.000	0.493
Some college	359,260	0.312	0.000	0.468
College or more	359,260	0.283	0.000	0.456
Financial occupation	359,260	0.041	0.000	0.198
Race (=white)	359,260	0.822	1.000	0.382
Government employee	359,260	0.086	0.000	0.281
Business owner	359,260	0.041	0.000	0.197
Total wealth	359,260	139,079	66,197	694,331
Liquid wealth	359,260	32,173	1,500	824,300

Table 2. Summary statistics: Gubernatorial elections

This table reports summary statistics for gubernatorial elections held between 1996 and 2013 in 46 U.S. states. 'Lame duck last term' is a binary variable that equals 1 if the incumbent governor is prevented from seeking re-election by term limits, and 0 otherwise. 'Party switch' is a binary variable that equals 1 if the party of the new governor elected is different from the party of the previous one, and 0 otherwise. 'Mid-year governor change' is a binary variable that equals 1 if there is a non-standard mid-year change in governors, and 0 otherwise. Non-standard means because of death, resignation, or impeachment. An election is called 'close' if the difference between the percentage of votes obtained by the first and second place candidates for an election is in the lowest sample tercile of vote differential.

	Nobs	Mean	Median	Standard deviation
Whole sample				
Gubernatorial elections (%)	736	25.81	0.00	43.79
Mid-year governor change (%)	736	2.445	0.00	15.46
Governor switch (%)	736	17.11	0.00	37.36
Lame duck last term (%)	736	32.03	0.00	46.69
Election =1				
Incumbent Republican (%)	190	51.87	1.00	50.06
Incumbent Democrat (%)	190	46.13	0.00	49.91
Incumbent Other (%)	190	2.000	0.00	14.80
Victory margin (%)	190	16.46	12.71	13.68
Close election victory margin (%)	63	3.84	0.00	2.22
Party switch (%)	190	37.82	0.00	28.33
Lame duck last term (%)	190	27.80	0.00	44.52

Table 3. Policy uncertainty, household stock market participation, and portfolio allocation

This table relates the gubernatorial elections to household stock market participation (Columns 1 and 2) and portfolio allocation (Columns 3 and 4). 'Participation' is an indicator variable that equals 1 if the household holds any stocks in publicly held corporations or mutual funds in a given period, and 0 otherwise. '% Stock share' is the percentage of liquid wealth invested by the household in stocks and mutual funds in a given period. 'Election' is an indicator variable that takes a value of one if a gubernatorial election occurred in a given state and year, and 0 otherwise. Omitted category in age is 'Old'. Omitted category for education is 'High school or less'. 'Total wealth' is in log-units. Other variables are as defined in the Data Description. All specifications include fixed effects as indicated in the table. Standard errors are clustered by state and year. *t*-statistics are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)
	Participation		% Stock share	
Election	–0.008**	–0.007*	–0.005***	–0.006**
	(–2.216)	(–1.875)	(–2.794)	(–1.980)
Married	0.025***	0.025***	0.021***	0.021***
	(5.192)	(5.375)	(3.719)	(3.782)
College or more	0.040***	0.040***	0.020***	0.020***
	(4.120)	(4.533)	(3.016)	(2.785)
Some college	0.012*	0.010	0.006	0.005
	(1.729)	(1.636)	(1.033)	(1.459)
Young	0.009*	0.007	0.006*	0.003
	(1.828)	(1.676)	(1.885)	(1.480)
Middle aged	0.016***	0.010**	0.008*	0.008*
	(3.525)	(2.251)	(1.677)	(1.923)
Total wealth	0.004***	0.004***	0.004***	0.004***
	(8.526)	(8.614)	(8.008)	(8.175)
Government employee	–0.005	–0.005	–0.006	–0.007
	(–1.182)	(–1.017)	(–1.392)	(–1.595)
Business owner	0.006	0.005	0.005	0.005
	(1.172)	(1.369)	(1.508)	(1.452)
State GDP growth	0.435***	0.342***	0.046**	–0.027
	(4.028)	(3.267)	(2.209)	(–1.483)
State unemployment	–0.392*	–0.137*	–0.290*	–0.155
	(–1.763)	(–1.702)	(–1.807)	(–1.266)
State HPI appreciation	0.034*	0.007	0.181**	0.121**
	(1.901)	(1.501)	(2.433)	(2.298)
Presidential	–0.003*		–0.017***	
	(–1.792)		(–2.928)	
Nobs	306,648	306,648	306,648	306,648
R-squared	0.842	0.842	0.731	0.731
State fixed effects	yes	yes	yes	yes
Year fixed effects	no	yes	no	yes
Household fixed effects	yes	yes	yes	yes

Table 4. Degree of policy uncertainty, household stock market participation and portfolio allocation

This table examines whether the degree of electoral uncertainty amplifies the effect of policy uncertainty on households' stock market participation (Columns 1 and 2) and portfolio allocation (Columns 3 and 4). 'Participation' is an indicator variable that equals 1 if the household holds any stocks in publicly held corporations or mutual funds in a given period, and 0 otherwise. '% Stock share' is the percentage of liquid wealth invested by the household in stocks and mutual funds in a given period. 'Close election' is a binary variable that equals 1 if the vote differential (i.e., difference between the percentage of votes obtained by the first and second place candidates) for an election is in the lowest sample tercile of vote differential, and 0 otherwise. Other variables are as defined in the Data Description. All specifications include fixed effects as indicated in the table. Standard errors are clustered by state and year. *t*-statistics are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)
	Participation		% Stock share	
Election	–0.006**	–0.005*	–0.005**	–0.004*
	(–1.952)	(–1.677)	(–2.018)	(–1.759)
Close election	–0.015***	–0.017***	–0.009***	–0.009***
	(–3.627)	(–2.893)	(–4.472)	(–3.008)
Nobs	306,648	306,648	306,648	306,648
R-squared	0.842	0.842	0.731	0.731
State fixed effects	yes	yes	yes	yes
Year fixed effects	no	yes	no	yes
Household fixed effects	yes	yes	yes	yes
Other controls	As in Table 3 Col. 1	As in Table 3 Col. 2	As in Table 3 Col. 3	As in Table 3 Col. 4

Table 5. Term limits, household stock market participation, and portfolio allocation

Dependent variable is households' stock market participation (Columns 1 and 2) and portfolio allocation (Columns 3 and 4). 'Participation' is an indicator variable that equals 1 if the household holds any stocks in publicly held corporations or mutual funds in a given period, and 0 otherwise. '% Stock share' is the percentage of liquid wealth invested by the household in stocks and mutual funds in a given period. 'Lame duck last term' is a binary variable that equals 1 if the incumbent governor is prevented from seeking re-election by term limits, and 0 otherwise. Other variables are as defined in Tables 1, 2, and 3. All specifications include fixed effects as indicated in the table. Standard errors are clustered by state and year. *t*-statistics are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level

	(1)	(2)	(3)	(4)
	Participation		% Stock share	
Election	–0.006*	–0.005	–0.004***	–0.002*
	(–1.754)	(–1.573)	(–2.606)	(–1.699)
Lame duck last term	–0.002	–0.003	–0.003	–0.003
	(–1.160)	(–0.918)	(–1.401)	(–1.001)
Election × Lame duck last term	–0.011***	–0.011***	–0.009***	–0.008***
	(–4.886)	(–3.705)	(–6.018)	(–5.015)
Nobs	306,648	306,648	306,648	306,648
R-squared	0.842	0.842	0.731	0.731
State fixed effects	Yes	yes	yes	yes
Year fixed effects	No	yes	no	yes
Household fixed effects	Yes	yes	yes	yes
Other controls	As in Table 3 Col. 1	As in Table 3 Col. 2	As in Table 3 Col. 3	As in Table 3 Col. 4

Table 6. How do households reallocate their assets?

This table reports the results on how policy uncertainty relates to investment decisions of households on risky assets (stocks and mutual funds), safe assets and non-liquid assets. '% Stock share^{W}' is the percentage of total wealth invested by the household in (risky assets) stocks and mutual funds. '% Safe share^{W}' is the percentage of total wealth invested in safe assets — such as government securities, munis, corporate bonds, money market deposit accounts, checking accounts, savings accounts. '% Non-liquid^{W}' is the percentage of total wealth invested in non-liquid assets — such as real estate, vehicles, private businesses etc. 'Election' is an indicator variable that takes a value of one if a gubernatorial election occurred in a given state and year, and 0 otherwise. Other variables are as defined in the Data Description. All specifications include fixed effects as indicated in the table. Standard errors are clustered by state and year. *t*-statistics are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
	% Stock share^{W}		% Safe share^{W}		% Non-liquid^{W}	
Election	–0.001**	–0.001**	0.012**	0.010*	–0.009	–0.012
	(–2.078)	(–2.369)	(2.247)	(1.809)	(–0.988)	(–1.035)
Nobs	306,648	306,648	306,648	306,648	306,648	306,648
R-squared	0.706	0.706	0.775	0.775	0.544	0.544
State fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	no	yes	no	yes	no	yes
Household fixed effects	yes	yes	yes	yes	yes	yes
Other controls	As in Table 3 Col. 3	As in Table 3 Col.4	As in Table 3 Col. 3	As in Table 3 Col. 4	As in Table 3 Col. 3	As in Table 3 Col. 4

Table 7. Effects of policy uncertainty on in-state and out-of-state investments using brokerage data

This table examines how policy uncertainty impacts households' equity investment in in-state and out-of-state stocks using the brokerage data from Barber and Odean (2000). This table provides the estimation results of panel regressions with household and year fixed effects. Standard errors are clustered at the state level. *t*-statistics are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1) In-state investment	(2) Out-of-state investment
Election	–0.132**	–0.040*
	(–3.497)	(–1.817)
State GDP growth	0.014	–0.003
	(1.021)	(–0.427)
State unemployment	–0.002	–0.005
	(–0.038)	(–0.187)
State HPI appreciation	–0.001	0.004
	(–0.084)	(0.632)
Nobs	3,621	20,743
R-squared	0.048	0.026
Household fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Table 8. Cross sectional differences in the effect of policy uncertainty on stock market participation

This table explores cross-sectional differences in the effect of policy uncertainty on stock market participation and portfolio decision of households. 'Participation' is an indicator variable that equals 1 if the household holds any stocks in publicly held corporations or mutual funds in a given period, and 0 otherwise. '% Stock share' is the percentage of liquid wealth invested by the household in stocks and mutual funds in a given period. Omitted category in age is 'Old'. Omitted category for education is 'High school or less'. 'Total wealth' is in log-units. Other variables are as defined in the Data Description. All regressions include the same controls as in Table 3 (Columns 2 and 4), and fixed effects as indicated in the table. The coefficients on 'State GDP growth', 'State unemployment', and 'State HPI' are subsumed by the state-year fixed effects. Standard errors clustered at the state and year level. *t*-values are presented in parentheses. ***, **, and are* denote significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Participation	% Stock share
Male × Election	0.003*	0.001
	(1.792)	(1.007)
Race × Election	–0.000	–0.002
	(–0.839)	(–1.366)
Financial occupation × Election	0.006**	0.004*
	(2.129)	(1.912)
Married × Election	–0.001	0.001
	(–1.335)	(1.066)
College or more × Election	0.004***	0.003***
	(3.018)	(3.100)
Some college × Election	0.003**	0.001*
	(2.119)	(1.882)
Young × Election	0.003*	0.002**
	(1.905)	(2.186)
Middle aged × Election	0.005	0.006*
	(1.536)	(1.699)
Total wealth × Election	0.002***	0.003***
	(4.527)	(4.020)
Government employee × Election	–0.004***	–0.003***
	(–2.883)	(–3.093)
Business owner in PSI × Election	–0.003*	0.002
	(–1.810)	(0.903)
Nobs	306,648	306,648
R-squared	0.842	0.731
Household fixed effects	Yes	yes
State-year fixed effects	Yes	yes
Other controls	As in Table 3 Col. 2 (except state-level time-varying controls)	As in Table 3 Col. 4 (except state-level time-varying controls)

Table 9. Dynamics of stock market participation during an election cycle

This table provides evidence on the evolution of stock market participation and portfolio allocation over the full gubernatorial election cycle. The dependent variables are 'Participant' (Columns 1 and 2) and '% Stock share' (Columns 3 and 4). 'Election' is a binary variable that equals 1 if a gubernatorial election occurred in that state in that year, and 0 otherwise. 'Post-election' is a binary variable, which takes a value of 1 for years after current gubernatorial election until the next gubernatorial election in a state, and 0 otherwise. 'Party switch' is a binary variable that equals 1 for gubernatorial elections, where the elected governor is from a different political party compared to the party of the outgoing governor, and 0 otherwise. Other unreported controls are defined in the Data Description. All specifications include fixed effects as indicated in the table. Clustered *t*-values are presented in parentheses. Bottom panel provides tests for the null hypothesis that the coefficients of election and post-election variables sum to zero. Standard errors are clustered by state and year. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) Participation	(2) Participation	(3) % Stock share	(4) % Stock share
Election	–0.007***	–0.007***	–0.005***	–0.004**
	(–3.626)	(–3.445)	(–2.769)	(–2.402)
Post-election	0.005**	0.006***	0.003**	0.003**
	(2.489)	(2.736)	(2.121)	(2.039)
Election × Party switch		–0.004**		–0.006***
		(–2.183)		(–2.753)
Post-election × Party switch		–0.002		–0.001
		(–1.616)		(–1.527)
Test for linear combinations of coefficients:				
Election + Post-election variables	–0.002	–0.007***	–0.002	–0.008 ***
Nobs	306,648	306,648	306,648	306,648
R-squared	0.842	0.842	0.731	0.731
State fixed effects	yes	yes	yes	Yes
Year fixed effects	yes	yes	yes	Yes
Household fixed effects	yes	yes	yes	Yes
Other controls	As in Table 3 Col. 2	As in Table 3 Col. 2	As in Table 3 Col. 4	As in Table 3 Col. 4

Table 10: Policy Uncertainty Index and Macroeconomic variables

This table summarizes the economic policy uncertainty (EPU) index, its four components (News component, Tax component, Government spending component, and CPI component), and macro variables in our sample. 'GDP forecast' is the expected real GDP growth, which is based on one-year-ahead GDP forecasts from the Philadelphia Federal Reserve's biannual Livingston survey. 'VIX' is average monthly implied volatility of S&P 500 index options. 'Sentiment' is monthly Investor Sentiment Index from Baker and Wurgler (2007). 'SP return' is the S&P 500 index monthly return. JLN index is an index of macroeconomic uncertainty from Jurado, Ludvigson, and Ng (2015).

Panel A: Summary statistics

	Mean	P10	Median	P90	Standard deviation
EPU index	103.49	68.12	91.40	159.73	36.34
News component	107.66	66.53	95.39	167.99	44.28
Tax component	307.22	13.81	126.04	1310.2	428.22
Government spending component	75.03	49.34	64.07	123.14	28.64
CPI component	93.26	68.01	82.07	128.57	26.65
VIX	22.29	12.95	20.92	32.64	8.67
Sentiment	0.16	–0.64	0.00	0.96	0.73
GDP forecast	4.79	4.16	4.72	5.51	0.53
SP return	0.00	–0.06	0.01	0.06	0.05
JLN index	0.67	0.57	0.65	0.75	0.09

Panel B: Correlation matrix

	EPU index	VIX	Sentiment	GDP forecast	SP return	JLN index
EPU index	1.000					
VIX	0.558	1.000				
Sentiment	–0.230	–0.055	1.000			
GDP forecast	–0.332	–0.286	0.022	1.000		
SP return	–0.171	–0.52	–0.138	0.66	1.000	
JLN index	0.448	0.515	–0.111	–0.290	–0.242	1.000

Table 11. Economic policy uncertainty and Household stock market participation

This table relates the economic policy uncertainty and its components (in log-units) to household stock market participation. Panel A is for extensive margin (*Participation*) and Panel B is for intensive margin (*% Stock Share*). Omitted category in age is 'Old' and omitted category for education is 'High school or less'. 'Total wealth' is in log-units. Other variables are as defined in the Data Description. All specifications include household fixed effects. Standard errors are double clustered by households and year-month. *t*-statistics are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Panel A. Extensive margin (*Participation*)

	(1)	(2)	(3)	(4)	(5)
EPU index	–0.021***				
	(–4.183)				
News component		–0.020***			
		(–4.268)			
Tax code component			–0.010***		
			(–6.092)		
Government spending component				–0.016**	
				(–2.167)	
Monetary policy component					0.008
					(1.226)
Married	0.027***	0.028***	0.027***	0.028***	0.028***
	(6.745)	(6.747)	(6.755)	(6.738)	(6.807)
College or more	0.034***	0.034***	0.034***	0.034***	0.033***
	(3.933)	(3.939)	(3.935)	(3.938)	(3.917)
Some college	0.012**	0.012**	0.012**	0.012**	0.012**
	(2.016)	(2.016)	(2.014)	(2.008)	(2.020)
Young	0.007	0.007	0.007	0.006	0.008
	(1.159)	(1.080)	(1.083)	(0.937)	(1.312)
Middle aged	0.014***	0.014***	0.014***	0.014***	0.015***
	(2.881)	(2.806)	(2.926)	(2.807)	(3.001)
Total wealth	0.004***	0.004***	0.004***	0.004***	0.004***
	(14.78)	(14.80)	(14.73)	(14.74)	(14.83)
Government employee	–0.007	–0.007	–0.007	–0.007	–0.007
	(–1.515)	(–1.515)	(–1.511)	(–1.519)	(–1.487)
Business owner	0.005	0.005	0.005	0.005	0.005
	(1.322)	(1.325)	(1.312)	(1.309)	(1.348)
Presidential	–0.004**	–0.002	–0.004***	–0.005***	–0.002
	(–2.501)	(–1.109)	(–2.660)	(–2.896)	(–0.899)
VIX	–0.006***	–0.008***	–0.009***	–0.007***	–0.007**
	(–3.993)	(–4.205)	(–3.071)	(–3.016)	(–2.451)
Sentiment	0.007***	0.007***	0.005***	0.008***	0.006***
	(7.480)	(7.463)	(3.729)	(6.666)	(5.553)
GDP forecast	0.007***	0.007***	0.008***	0.011***	0.008***
	(2.647)	(2.578)	(2.955)	(3.789)	(2.874)
SP return	0.043***	0.040***	0.033*	0.019	0.027
	(3.000)	(2.772)	(1.864)	(1.020)	(1.437)
JLN index	–0.054***	–0.057***	–0.053***	–0.066***	–0.063***
	(–5.687)	(–5.980)	(–5.719)	(–7.070)	(–6.920)
Nobs	310,816	310,816	310,816	310,816	310,816
R-squared	0.829	0.829	0.829	0.829	0.829
Household fixed effects	yes	yes	yes	yes	yes

Table 11. Economic policy uncertainty and portfolio choice (continued)

Panel B. Intensive margin (*% Stock share*)

	(1)	(2)	(3)	(4)	(5)
EPU index	–0.025***				
	(–3.279)				
News component		–0.019***			
		(–2.589)			
Tax code component			–0.012***		
			(–4.127)		
Government spending component				–0.016***	
				(–2.581)	
Monetary policy component					0.007
					(1.319)
Married	0.022***	0.022***	0.023***	0.022***	0.021***
	(5.801)	(5.818)	(5.893)	(5.876)	(5.857)
College or more	0.019***	0.019***	0.018***	0.018***	0.018***
	(2.788)	(2.785)	(2.723)	(2.753)	(2.770)
Some college	0.005	0.005	0.005	0.005	0.005
	(1.216)	(1.221)	(1.249)	(1.233)	(1.224)
Young	0.000	0.001	0.006	0.003	0.002
	(0.031)	(0.123)	(1.047)	(0.586)	(0.359)
Middle aged	0.008**	0.008**	0.011***	0.010**	0.009**
	(2.022)	(2.111)	(2.695)	(2.418)	(2.230)
Total wealth	0.004***	0.004***	0.004***	0.004***	0.004***
	(16.04)	(16.00)	(15.83)	(15.90)	(15.97)
Government employee	–0.007*	–0.007*	–0.007*	–0.007*	–0.007*
	(–1.929)	(–1.925)	(–1.866)	(–1.876)	(–1.923)
Business owner	0.005	0.005	0.005	0.005	0.005
	(1.481)	(1.487)	(1.618)	(1.564)	(1.477)
Presidential	–0.003**	–0.002*	–0.003*	–0.002*	–0.001
	(–1.992)	(–1.734)	(–1.908)	(–1.823)	(–1.459)
VIX	–0.001***	–0.001***	–0.001***	–0.001***	–0.001***
	(–2.910)	(–3.114)	(–5.323)	(–4.670)	(–4.804)
Sentiment	0.015***	0.015***	0.011***	0.021***	0.015***
	(5.437)	(5.461)	(6.162)	(4.951)	(5.712)
GDP forecast	0.023***	0.022***	0.024***	0.030***	0.020***
	(4.559)	(4.856)	(6.538)	(3.422)	(3.906)
SP return	0.007	0.005	–0.041	–0.004	–0.003
	(0.189)	(0.128)	(–1.605)	(–0.097)	(–0.070)
JLN index	–0.019***	–0.022***	–0.015***	–0.016***	–0.011***
	(–3.276)	(–3.018)	(–4.011)	(–3.019)	(–2.988)
Nobs	310,816	310,816	310,816	310,816	310,816
R-squared	0.729	0.729	0.729	0.729	0.729
Household fixed effects	yes	yes	yes	yes	yes

Table 12. Two stage least square estimation of economic policy uncertainty

We present two-stage least-squares (2SLS) results using the DW-NOMINATE (polarization) scores of McCarty, Poole and Rosenthal (1997) for the Senate as instrument for the policy uncertainty index. Both 'EPU index' and 'Polarization' are in log-units. Dependent variables are stock market participation ('Participation') in Column 1 and the stock share of liquid wealth ('% Stock share') in Column 2. The first stage *F*-statistic as well as Anderson *LR* test of the null hypothesis that our instrument and endogenous variable are not correlated are also reported. 'Total wealth' is in log-units. Omitted category in age is 'Old'. Omitted category for education is 'High school or less'. Other variables are as defined in the Data Description. First stage estimates also include the control variables that are used in the second stage. Standard errors are double clustered by households and year-month, and bootstrapped to account for the fact that the EPU index regressor is estimated. *t*-statistics are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

	(1) Participation	(2) % Stock share
EPU index (Instrument=Polarization)	–0.017**	–0.018**
	(–2.465)	(–1.979)
Married	0.026***	0.022***
	(4.186)	(3.618)
College or more	0.031***	0.019***
	(4.040)	(3.007)
Some college	0.010*	0.006
	(1.908)	(1.490)
Young	0.001	0.005
	(0.476)	(0.781)
Middle aged	0.013***	0.013**
	(2.680)	(2.018)
Total wealth	0.004***	0.004***
	(7.909)	(8.928)
Government employee	–0.001	–0.002
	(–0.977)	(–1.046)
Business owner	0.002	0.001
	(1.016)	(1.293)
VIX	–0.010**	–0.003*
	(–2.427)	(–1.927)
Sentiment	0.006***	0.005
	(3.116)	(0.552)
GDP forecast	0.003	0.044
	(0.200)	(0.800)
SP return	–0.007	0.065
	(–0.669)	(1.427)
JLN index	–0.012**	–0.074**
	(–2.176)	(–1.998)
Nobs	310,816	310,816
Household fixed effects	yes	yes
1st stage diagnostics		
Anderson-Rubin (AR) Wald test	72.17	
AR Wald test *p*-value	0.000	
F-statistics	14.28	

Appendix A

1. Model Setup

To motivate the empirical tests, we consider a stock market participation and trading model by incorporating participation cost and the correlation between the stock's payoff and households' labor income. The purpose of the model is to illustrate the effect of political risk on households' participation and trading decisions. Specifically, we show that an increase in political risk can lead to a lower participation rate and more cautious stock trading. In addition, we show that households who are more risk-averse or whose labor income are more exposed to political risk react more strongly to shocks in political risk. These results are consistent with the empirical findings reported in the paper. Below we describe the details of the model setup and derive the analytical solutions.

We assume that the state of the economy is captured by a random variable $\widetilde{M}$, which is normally distributed: $\widetilde{M} \sim N(\bar{M},\ \sigma_M^2)$. There are many sources of economic risk, among which political risk is an important one that has a huge impact on employment, investment, production, and consumption. For the purpose of this paper, we assume that $\widetilde{M}$ captures political risk that affects asset returns and households' labor income.[11] In view of this purpose, σ_M^2 serves as a measure of political uncertainty. When σ_M^2 is higher, there is more uncertainty about government

[11] In general, there can be multiple components of economic risk that may affect labor income and asset returns differently. For example, we can assume that the state of the economy is determined by two risk components: $\widetilde{\mathcal{M}} = \widetilde{M} + \widetilde{m}$, where $\widetilde{M}$ affects both asset returns and labor income, but $\widetilde{m}$ only affects labor income but does not affect asset returns. As can be shown, the second component $\widetilde{m}$ does not affect households' participation and trading decisions, and can thus be omitted.

policies; an example is government elections that can result in power turnover between opposing political parties. By analyzing how the magnitude of σ_M^2 affects the equilibrium outcome, we can obtain insights about the impact of policy uncertainty on households' participation and trading decisions.

There is a riskless asset and a risky asset that are traded in the market. The return on the riskless asset is normalized to be equal to one; that is, it can be viewed as cash. The risky asset can be viewed as a stock, whose value is $\tilde{V}$:

$$\tilde{V} = \beta\widetilde{M} + \tilde{s},$$

where $\beta\widetilde{M}$ represents the risk that is related to policy uncertainty and $\tilde{s}$ represents the risk that is not related to political risk. Hence β >0 measures the stock's exposure to policy uncertainty. We assume that $\tilde{s}$ follows the normal distribution $\tilde{s} \sim N(\bar{s},\ \sigma_s^2)$. Further, we assume that the two risk components are independent of each other, thus we have $\tilde{V} \sim N(\bar{V},\ \sigma_V^2)$, where $\bar{V} = \bar{M} + \bar{s}$, and $\sigma_V^2 = \beta^2\sigma_M^2 + \sigma_s^2$.

We assume that there is a continuum of measure one of households who have the CARA utility function: $u(W) = -exp(-\gamma W)$, where $\gamma > 0$ is the risk-aversion coefficient. In order to trade the stock, households need to incur a cost that varies individually. The participation cost can result from the time and effort devoted to stock trading and taxation for capital gains, which are not the same for all households. We assume that the participation cost follows the uniform distribution on the interval $[0,\ \bar{c}]$, where $\bar{c}$ is a constant large enough such that there are always some households who decide not to trade the stock. Households' participation decisions are endogenized in the model. In addition to heterogeneity in the participation cost, we will extend the analysis to cases

with cross-sectional variations in risk-aversion and the exposure of labor income to political risk after we fully analyze the basic case.

The supply of the stock absorbs trading by other exogenous investors, strategic or non-strategic, including noise traders, Specifically, we assume that the supply of the stock is equal to $\tilde{x} + \delta P$. The first component, $\tilde{x}$, follows the normal distribution, $\tilde{x} \sim N(\bar{x},\ \sigma_x^2)$ and is independent of all the other variables in the model. The second component is proportional to the stock price. We assume $\delta > 0$, so the second component can be interpreted as supply (demand) by arbitrageurs that is positively (negatively) related to the stock price.[12] When some households sell, others have to buy to clear the market; hence, the external liquidity supply is indispensable—without it, it would be impossible to change the aggregate endogenous trading volume, either due to participation or due to households' willingness to trade. For this purpose, we assume $\gamma\delta > \frac{1}{\sigma_V^2}$ so that the external liquidity supply is sufficiently large to absorb households' demand shocks.

For ease of exposition, we focus our exposition on the case with no information asymmetry. The extension to the case with information asymmetry (for example, in the fashion of Grossman and Stiglitz, 1980; Hellwig, 1980; and Diamond and Verrechia, 1981) is straightforward and can be solved similarly, but the solutions will be notationally cumbersome. For completeness, Appendix B presents the analysis with asymmetric information. When households' signals are very noisy, the case with information asymmetry converges to the one without information asymmetry. Considering that we are modelling retail investors' participation and trading decisions, it is reasonable to assume that individual investors do not have accurate signals about the stock's

[12] We can imagine that there exist risk-neutral arbitrageurs whose demand of the stock is $\delta(\bar{V} - P)$. Since demand is negative supply, it amounts to a supply equal to $\delta(P - \bar{V})$, where the constant part -$\delta\bar{V}$ is subsumed by $\bar{x}$.

payoff; therefore, the case without information asymmetry is a good approximation.

There are three dates: date 0, 1, and 2, and the sequence of events is as follows:

1) Date 0: Households receive their initial endowment and decide whether to participate in trading the stock. If they decide to trade the stock, they have to incur the participation cost. If they decide not to trade the stock, they simply invest in the riskless asset.

2) Date 1: Households make the optimal trading decisions based on the stock price. The stock price clears the market by equating the aggregate demand with the aggregate supply.

3) Date 2: The stock's payoff is realized. Households receive the cashflow from their investment in the stock; in addition, their labor income is also realized. They consume their final wealth, which determine their realized utility.

2. Households' Trading Strategy

We use R_i to denote household i's initial endowment at date 0. Its labor income at date 2 is denoted by $\alpha\widetilde{M}$, where $\alpha > 0$ is a constant capturing the labor income's exposure to the state of the economy. If the household decides not to trade the stock, then its terminal wealth at date 2 is

$$\widetilde{W}_i = R_i + \alpha\widetilde{M}.$$

If the household decides to trade the stock and buy θ_i shares of the stock, then it incurs a cost c_i and the terminal wealth is

$$\widetilde{W}_i = R_i - c_i + \theta_i\left(\tilde{V} - P\right) + \alpha\widetilde{M}.$$

It is well know that the CARA utility implies mean-variance maximization. Hence the household's optimization problem is:

$$Max_{\theta_i}\,(R_i - c_i - \theta_i P) + \theta_i E[\tilde{V}] + \alpha E[\widetilde{M}]$$

$$-\frac{\gamma}{2}\{\theta_i^2 Var[\tilde{V}] + \alpha_i{}^2 Var[\widetilde{M}] + 2\,\theta_i \alpha Cov[\tilde{V}, \widetilde{M}]\},$$

The solution to the optimization problem is

$$\theta_i = \frac{1}{\gamma}\frac{E[\tilde{V}] - P - \gamma\alpha Cov[\tilde{V}, \widetilde{M}]}{Var[\tilde{V}]}$$

$$= \frac{1}{\gamma}\frac{E[\tilde{V}] - P}{Var[\tilde{V}]} - \frac{\alpha Cov[\tilde{V}, \widetilde{M}]}{Var[\tilde{V}]}.$$

The solution shows that the household's demand consists of two parts. The first part, $\frac{1}{\gamma}\frac{E[\tilde{V}]-P}{Var[\tilde{V}]}$ is a speculative demand, which is positively related to the perceived equity premium, $E[\tilde{V}] - P$, and negatively related to the risk-aversion coefficient, γ, and the perceived risk, $Var[\tilde{V}]$. The second part is a hedging demand, $-\frac{\alpha Cov[\tilde{V},\widetilde{M}]}{Var[\tilde{V}]}$. Intuitively, households have incentives to hedge their labor income by selling or short-selling the stock. The magnitude of the hedging demand is increasing in the labor income's exposure to policy uncertainty, α, and the correlation between the stock's payoff and labor income, but is decreasing in the perceived risk of the stock.

3. Equilibrium Stock Price

Suppose that in equilibrium households with $c_i \leq \hat{c}$ participate in trading the stock. The market clearing condition is thus:

$$\int_{c_i \leq \hat{c}} \theta_i dF(c_i) = x + \delta P.$$

We define

$$\eta = \int_{c_i \leq \hat{c}} dF(c_i)$$

as the population of households who participate in stock trading. The market clearing condition can be rewritten as:

$$\eta \frac{1}{\gamma} \left\{ \frac{\bar{V} - P}{\sigma_V^2} - \frac{\gamma \alpha \beta \sigma_M^2}{\sigma_V^2} \right\} = x + \delta P.$$

By matching the coefficients on the constant term and the value of x, we can derive the following proposition.

Proposition 1: Given that households with $c_i \leq \hat{c}$ participate in trading the stock, the equilibrium price is $P = a + bx$, where $a = \frac{\frac{\bar{V}}{\sigma_V^2} - \gamma \frac{\alpha \beta \sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2} + \frac{\gamma \delta}{\eta}}$, and $b = \frac{-\frac{\gamma}{\eta}}{\frac{1}{\sigma_V^2} + \frac{\gamma \delta}{\eta}}$. The unconditional expected equity premium is equal to $\frac{\frac{\gamma \delta}{\eta} \bar{V} + \frac{\gamma}{\eta} \bar{x} + \gamma \frac{\alpha \beta \sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2} + \frac{\gamma \delta}{\eta}}$.

Proof: See Appendix B.

Proposition 1 shows that the equilibrium price is lineally decreasing in the random supply of the stock,x. As can be see, the exposure of labor income to political risk increases the unconditional equity premium—even if $\bar{V} = 0$ and $\bar{x} = 0$, there is a still a positive equity premium that results from households' hedging demand.

4. Participation Rate

In the analysis above, we took participation as exogenously given. As the final step of the

model solution, we solve the endogenous participation rate. If household i decides not to participate in trading the stock, its unconditional expected utility is denote by E_i^0:

$$E_i^0 = E\left[-exp\left(-\gamma\left(R_i + \alpha\widetilde{M}\right)\right)\right]$$

$$= -exp\left(-\gamma\left(R_i + \alpha\bar{M} - \frac{\gamma}{2}\alpha^2\sigma_M^2\right)\right).$$

If the household decides to participate in trading the stock, it incurs a cost c_i, and its unconditional expected utility is denoted by E_i^P:

$$E_i^P = E\left[-exp\left(-\gamma(R_i - c_i + \theta_i\left(\tilde{V} - P\right) + \alpha\widetilde{M})\right)\right],$$

where $\theta_i = \frac{1}{\gamma}\left\{\frac{\bar{V}-P}{\sigma_V^2} - \frac{\gamma\alpha\beta\sigma_M^2}{\sigma_V^2}\right\}$.

We use iterated expectations to derive E_i^P. Conditional on the realized value of x, we have

$$E_i^P(x) = E\left[-exp\left(-\gamma\left(R_i - c_i + \theta_i\left(\tilde{V} - P\right) + \alpha\widetilde{M}\right)\right)|x\right]$$

$$= E_i^0\ exp\left(-\gamma\left(-c_i + \frac{\gamma\sigma_V^2}{2}\left(\frac{1}{\gamma}\frac{\bar{V}-P}{\sigma_V^2} - \frac{\alpha\beta\sigma_M^2}{\sigma_V^2}\right)^2\right)\right)$$

$$= E_i^0 \exp(\gamma c_i)\ exp\left(-\frac{1}{2\sigma_V^2}\ (\bar{V} - (a + bx) - \gamma\alpha\beta\sigma_M^2)^2\right).$$

Because $E[bx] = b\bar{x}$ and $Var[bx] = b^2\sigma_x^2$, taking the expectation with respect to x, we get the unconditional expected utility:

$$E_i^P = E[E_i^P(x)]$$

$$= E_i^0\ exp(\gamma c_i)\ \mathrm{E}\left[exp\left(-\frac{1}{2\sigma_V^2}\ (\bar{V} - (a + bx) - \gamma\alpha\beta\sigma_M^2)^2\right)\right]$$

$$= \frac{E_i^0 \, exp(\gamma c_i)}{\sqrt{1 + \frac{b^2 \sigma_x^2}{\sigma_V^2}}} exp\left(\frac{-\frac{1}{2\sigma_V^2} \, (\bar{V} - (a + b\bar{x}) - \gamma\alpha\beta\sigma_M^2)^2}{1 + \frac{b^2\sigma_x^2}{\sigma_V^2}} \right).$$

So the participation cost of the marginal household who is indifferent between whether or not to participate in trading the stock satisfies $E_i^0 = E_i^P$, or

$$c_i = \frac{1}{2\gamma} \left\{ \frac{\frac{1}{\sigma_V^2} \, (\bar{V} - (a + b\bar{x}) - \gamma\alpha\beta\sigma_M^2)^2}{1 + \frac{b^2\sigma_x^2}{\sigma_V^2}} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right) \right\}.$$

Proposition 2: There is a threshold value $c^* \in [0, \bar{c}]$ such that households with $c_i \leq c^*$ participate in trading the stock and households with $c_i > c^*$ do not participate in trading the stock.

Proof: See Appendix B.

Now that we have fully solved the model, we will conduct comparative static analysis to see how political risk affects households' participation and trading decisions. Intuitively, as political risk increases, the payoff of the stock is more uncertain and, at the same time, households face more risky labor income. The increased uncertainty about the stock's payoff makes it less attractive; in addition, the increased uncertainty about the labor income provides households with greater incentives to hedge the risk. Overall, a shock in political risk reduces households' desire to hold the stock. The following proposition characterizes the effect of political risk on households' participation and trading decisions.

Proposition 3: When $\alpha < \frac{\delta\bar{V}+\bar{x}}{\gamma\delta\beta\sigma_M^2}$, households are on average stock buyers, and an increase in political risk, σ_M^2, is going to lead to:

1) a decrease in the number of households participating in trading the stock;

2) a decrease in the sensitivity of their trading volume to the perceived return premium; and

3) a decrease in each household's average trading volume.

Proof: See Appendix B.

Proposition 3 implies that, as political risk increases, the increased volatility in the stock's payoff and households' labor income makes the stock less attractive. As a result, the benefit of participating in stock trading decreases, resulting in fewer households willing to participate in stock trading. Theoretically, a surge in political risk reduces households' speculative motive, but increases their hedging motive for trading the stock. The assumption $\alpha < \frac{\delta\bar{V}+\bar{x}}{\gamma\delta\beta\sigma_M^2}$ implies that on average households are net buyers. This assumption holds when the stock's expected payoff ($\bar{V}$) is high or the supply ($\bar{x}$) is high so that the hedging demand does not result in an average demand for short selling the stock. This assumption is consistent with the empirical fact that average households are net buyers in the capital market. Because many stocks are difficult to sell short and few retail investors do short selling in the real world, empirically, it is not a concern that the assumption may be violated with a large value of α —instead of short selling the stock, households will just liquidate their stock holdings and leave the market, causing a decline in the participation rate.

5. Extension and Discussion

So far we have illustrated the effect of an increase in political risk on households' participation and trading decisions. The analysis is based on the assumption that households face heterogeneous costs in participating in stock trading. In the real world, household may vary in other dimensions, such as risk tolerance and the exposure of labor income to political risk. In this section, we briefly

discuss the model's implications with regard to these other cross-sectional variations and use numerical examples to illustrate these implications.

We first consider cross-sectional variations in the exposure of labor income to political risk. When there is a state election, some households, such as government employees, small business owners, and employees of politically sensitive industries, have their labor income more exposed to policy uncertainty than other households. In other words, these households have a higher value of α, whereas other households have a lower value of α. We can extend the above analysis to incorporate the difference in the exposure of labor income to policy uncertainty. Specifically, we assume that there are two types of households: one type with α_H and the other type with α_L<α_H. Within each type, there is a continuum of measure one of households whose participation costs are uniformly distributed on $[0,\ \bar{c}]$. Suppose the equilibrium participation rate for α_H-type households is η_H and that for α_L-type households is η_L. It can be shown that the equilibrium conditions are:

$$\eta_H \bar{c} = \frac{1}{2\gamma}\left\{\frac{\frac{1}{\sigma_V^2}\,(\bar{V} - \bar{P} - \gamma\alpha_H\beta\sigma_M^2)^2}{1 + \frac{b^2\sigma_x^2}{\sigma_V^2}} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\right\}$$

$$\eta_L \bar{c} = \frac{1}{2\gamma}\left\{\frac{\frac{1}{\sigma_V^2}\,(\bar{V} - \bar{P} - \gamma\alpha_L\beta\sigma_M^2)^2}{1 + \frac{b^2\sigma_x^2}{\sigma_V^2}} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\right\},$$

where P= $a + bx$, $a = \frac{\frac{\bar{V}}{\sigma_V^2} - \gamma\frac{\bar{\alpha}\beta\sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta_H + \eta_L}}$, $b = \frac{-\frac{\gamma}{\eta_H + \eta_L}}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta_H + \eta_L}}$, and $\bar{\alpha} = \frac{\eta_H\alpha_H + \eta_L\alpha_H}{\eta_H + \eta_L}$.

Because α_H is greater than α_L, the right hand side of the first equation above is smaller than the right hand side of the second equation, implying that η_H is smaller than η_L.

Similarly, we can extend the analysis to incorporate the cross-sectional variation in households' risk attitude. Specifically, we assume that there are two types of households: high risk-averse ones with γ_H and low risk-averse ones with γ_L<γ_H. Within each type, there is a continuum of measure one of households whose participation costs are uniformly distributed on $[0,\ \bar{c}]$. Suppose the equilibrium participation rate for γ_H-type households is $\hat{\eta}_H$ and that for γ_L-type households is $\hat{\eta}_L$. It can be shown that the equilibrium conditions are:

$$\hat{\eta}_H \bar{c} = \frac{1}{2\gamma_H}\left\{\frac{\frac{1}{\sigma_V^2}\ (\bar{V} - \bar{P} - \gamma_H \alpha\beta\sigma_M^2)^2}{1 + \frac{b^2\sigma_x^2}{\sigma_V^2}} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\right\}$$

$$\hat{\eta}_L \bar{c} = \frac{1}{2\gamma_L}\left\{\frac{\frac{1}{\sigma_V^2}\ (\bar{V} - \bar{P} - \gamma_L \alpha\beta\sigma_M^2)^2}{1 + \frac{b^2\sigma_x^2}{\sigma_V^2}} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\right\},$$

where P= $a + bx$, $a = \frac{\frac{\bar{V}}{\sigma_V^2} - \hat{\gamma}\frac{\alpha\beta\sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2} + \frac{\hat{\gamma}\delta}{\hat{\eta}}}$, $b = \frac{-\frac{\hat{\gamma}\delta}{\hat{\eta}}}{\frac{1}{\sigma_V^2} + \frac{\hat{\gamma}\delta}{\hat{\eta}}}$, $\hat{\eta} = \hat{\eta}_H + \hat{\eta}_L$, $\hat{\gamma} = \frac{\hat{\eta}\gamma_H\gamma_L}{\hat{\eta}_H\gamma_L + \hat{\eta}_L\gamma_H}$.

Because γ_H is greater than γ_L, the right hand side of the first equation above is smaller than the right hand side of the second equation, implying that $\hat{\eta}_H$ is smaller than $\hat{\eta}_L$.

Finally, we would like to mention briefly that the model can also be extended to capture the differential effect of policy uncertainty on households with different information skills. We can assume that there are two types of households and one type is better informed than the other type. Within each type, there is a continuum of measure one of households whose participation costs are uniformly distributed on $[0,\ \bar{c}]$. Intuitively, better-informed households benefit more from participation, so in equilibrium we would observe more participation from better-informed

households than worse-informed agents. Appendix B characterized the model solutions for the case with asymmetric information.

Appendix B

We first analyze a more general case where households who incur the participation cost receive private signals about the stock's payoff before they make trading decisions. Specifically, if a household decides to participate, then it receives a noisy signal about the idiosyncratic component:

$$\tilde{S}_i = V + \tilde{\varepsilon}_i,$$

where $\tilde{\varepsilon}_i$ is a normally distributed random noise that follows the distribution $N(0,\ \sigma_\varepsilon^2)$. In this case, Hence the household's optimization problem is:

$$Max\ _{\theta_i}\ (R_i - \theta_i P) + \theta_i E_i[\tilde{V}\ |\mathcal{F}_i] + \alpha E_i[\widetilde{M}|\mathcal{F}_i]$$

$$-\frac{\gamma}{2}\{\theta_i^2 Var_i[\tilde{V}\ |\mathcal{F}_i] + \alpha^2 Var_i\left[\widetilde{M}|\mathcal{F}_i\right] + 2\ \theta_i \alpha Cov_i[\tilde{V}, \widetilde{M}|\mathcal{F}_i]\},$$

where $\mathcal{F}_i = \{s_i, P\}$ denotes household i's information set, while $E[\ .|\mathcal{F}_i\ ]$, $Var_i[\ .|\mathcal{F}_i\ ]$, and $Cov_i[\tilde{V}, \widetilde{M}|\mathcal{F}_i]$ denote household i's beliefs conditional on the information received. The solution to the optimization problem is

$$\theta_i = \frac{1}{\gamma}\frac{E_i[\tilde{V}\ \left|\mathcal{F}_i\right] - P - \gamma\alpha Cov_i\left[\tilde{V}, \widetilde{M}\right|\mathcal{F}_i]}{Var_i[\tilde{V}\ |\mathcal{F}_i]}$$

$$= \frac{1}{\gamma}\frac{E_i[\tilde{V}\ \left|\mathcal{F}_i\right] - P}{Var_i[\tilde{V}\ |\mathcal{F}_i]} - \frac{\alpha Cov_i\left[\tilde{V}, \widetilde{M}\right|\mathcal{F}_i]}{Var_i[\tilde{V}\ |\mathcal{F}_i]}.$$

In a linear rational expectations equilibrium, we conjecture that the price is a linear function

$$P = a + b(V - kx).$$

Based on conditional normal distributions, we have

$$Var_i[\widetilde{V}\ |\mathcal{F}_i] = \frac{\sigma_V^2 k^2 \sigma_x^2 \sigma_\varepsilon^2}{\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2},$$

$$E_i[\widetilde{V}\ |\mathcal{F}_i] = \frac{\sigma_V^2 k^2 \sigma_x^2 \sigma_\varepsilon^2 \left[\frac{\bar{V}}{\sigma_V^2} + \frac{\bar{x}}{k\sigma_x^2} + \frac{P-a}{bk^2\sigma_x^2} + \frac{S_i}{\sigma_\varepsilon^2}\right]}{\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2},$$

$$Cov_i[\widetilde{V}, \widetilde{M}\ |\mathcal{F}_i] = \frac{\beta\sigma_M^2 k^2 \sigma_x^2 \sigma_\varepsilon^2}{\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2}.$$

Hence, household i's demand for the stock is:

$$\theta_i(\mathcal{F}_i) = \frac{1}{\gamma}\left\{\frac{\bar{V}}{\sigma_V^2} + \frac{\bar{x}}{k\sigma_x^2} + \frac{S_i}{\sigma_\varepsilon^2} + \frac{P-a}{bk^2\sigma_x^2} - \frac{P[\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2]}{\sigma_V^2 k^2\sigma_x^2\sigma_\varepsilon^2} - \frac{\gamma\alpha\beta\sigma_M^2}{\sigma_V^2}\right\}.$$

And the market clearing condition is:

$$\int_{c_i \le \hat{c}} \theta_i(\mathcal{F}_i) dF(c_i) = x + \delta P, \text{ or}$$

$$\frac{\eta}{\gamma}\left\{\frac{\bar{V}}{\sigma_V^2} + \frac{\bar{x}}{k\sigma_x^2} + \frac{V}{\sigma_\varepsilon^2} + \frac{P-a}{bk^2\sigma_x^2} - \frac{P[\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2]}{\sigma_V^2 k^2\sigma_x^2\sigma_\varepsilon^2} - \frac{\gamma\alpha\beta\sigma_M^2}{\sigma_V^2}\right\} = x + \delta P.$$

Note that the noises in individual signals do not affect the aggregate demand; that is $\int_{c_i \le \hat{c}} \varepsilon_i dF(c_i) = 0$. Rearranging the terms, we get

$$P = \frac{\frac{\bar{V}}{\sigma_V^2} + \frac{\bar{x}}{k\sigma_x^2} - \gamma\frac{\alpha\beta\sigma_M^2}{\sigma_V^2} + \frac{1}{\sigma_\varepsilon^2}\left(V - \frac{\gamma\sigma_\varepsilon^2}{\eta}x\right) + \frac{1}{k^2\sigma_x^2}(V - kx)}{\frac{\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2}{\sigma_V^2 k^2\sigma_x^2\sigma_\varepsilon^2} + \frac{\gamma\delta}{\eta}}.$$

Therefore, we have:

$$k = \frac{\gamma\sigma_\varepsilon^2}{\eta},$$

$$a = \frac{\frac{\bar{V}}{\sigma_V^2} + \frac{\bar{x}}{k\sigma_x^2} - \gamma\frac{\alpha\beta\sigma_M^2}{\sigma_V^2}}{\frac{\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2}{\sigma_V^2 k^2\sigma_x^2\sigma_\varepsilon^2} + \frac{\gamma\delta}{\eta}},$$

$$b = \frac{\frac{1}{\sigma_\varepsilon^2} + \frac{1}{k^2\sigma_x^2}}{\frac{\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2}{\sigma_V^2 k^2\sigma_x^2\sigma_\varepsilon^2} + \frac{\gamma\delta}{\eta}}.$$

If household i decides not to participate in trading the stock, its unconditional expected utility is denote by E_i^0:

$$E_i^0 = E\left[-exp\left(-\gamma\left(R_i + \alpha\widetilde{M}\right)\right)\right]$$

$$= -exp\left(-\gamma\left(R_i + \alpha\bar{M} - \frac{\gamma}{2}\alpha^2\sigma_M^2\right)\right).$$

If the household decides to participate in trading the stock, its unconditional expected utility is denote by E_i^P:

$$E_i^P = E\left[-exp\left(-\gamma(R_i - c_i + \theta_i\left(\tilde{V} - P\right) + \alpha\widetilde{M})\right)\right],$$

where $\theta_i(\mathcal{F}_i) = \frac{1}{\gamma}\left\{\frac{\bar{V}}{\sigma_V^2} + \frac{\bar{x}}{k\sigma_x^2} + \frac{S_i}{\sigma_\varepsilon^2} + \frac{P-a}{bk^2\sigma_x^2} - \frac{P\left[\sigma_V^2\left(k^2\sigma_x^2+\sigma_\varepsilon^2\right)+k^2\sigma_x^2\sigma_\varepsilon^2\right]}{\sigma_V^2 k^2\sigma_x^2\sigma_\varepsilon^2} - \frac{\gamma\alpha\beta\sigma_M^2}{\sigma_V^2}\right\}$.

We use a series of iterated expectations to derive E_i^P.

First, conditional on $\mathcal{F}_i = \{S_i, P\}$, we define

$$\hat{Y} \equiv E[\tilde{V}\,|\mathcal{F}_i] - \bar{V} = \frac{\sigma_V^2\{k^2\sigma_x^2(S_i - \bar{V}) + \sigma_\varepsilon^2[(V - kx) - (\bar{V} - k\bar{x})]\}}{\sigma_V^2(k^2\sigma_x^2 + \sigma_\varepsilon^2) + k^2\sigma_x^2\sigma_\varepsilon^2}, and$$

$$\hat{V} \equiv Var\left[\widetilde{V}\ \left|\mathcal{F}_i\right.\right],$$

then $E\left[\widetilde{M}\middle|\mathcal{F}_i\right] = \bar{M} + \frac{\beta\sigma_M^2}{\sigma_V^2}\hat{Y},\ \theta_i(\mathcal{F}_i) = \frac{1}{\gamma}\left\{\frac{1}{\gamma}\frac{\hat{Y}+\bar{V}-P}{Var[\widetilde{V}\,|\mathcal{F}_i]} - \frac{\gamma\alpha\beta\sigma_M^2}{\sigma_V^2}\right\}, and$

$$E_i^P(\mathcal{F}_i) = E\left[-exp\left(-\gamma\left(R_i - c_i + \theta_i\left(\widetilde{V} - P\right) + \alpha\widetilde{M}\right)\right)|\mathcal{F}_i\right]$$

$$= -exp\left(-\gamma\left(R_i - c_i + \alpha\left[\widetilde{M}\middle|\mathcal{F}_i\right] - \frac{\gamma\alpha^2}{2}Var\left[\widetilde{M}\middle|\mathcal{F}_i\right] + \frac{\gamma Var\left[\widetilde{V}\ \middle|\mathcal{F}_i\right]}{2}\ \theta_i^2\right)\right)$$

$$= E_i^0\ exp\left(-\gamma\left(-c_i + \alpha\frac{\beta\sigma_M^2}{\sigma_V^2}\hat{Y} + \frac{\gamma\alpha^2}{2}(\sigma_M^2 - Var\left[\widetilde{M}\middle|\mathcal{F}_i\right]) + \frac{\gamma\hat{V}}{2}\ (\frac{1}{\gamma}\frac{\bar{V}+\hat{Y}-P}{\hat{V}} - \frac{\alpha\beta\sigma_M^2}{\sigma_V^2})^2\right)\right).$$

Next we calculated the expected utility conditional on $\hat{Y}$. The conditional distribution of $\hat{Y} - P$ on $\hat{Y}$ is normal with mean equal to $\left(1 - \frac{Cov(P,\hat{Y})}{Var(\hat{Y})}\right)\hat{Y} - \bar{P}$ and variance equal to $\frac{Var(\hat{Y})Var(P) - Cov^2(P,\hat{Y})}{Var(\hat{Y})}$. Further, because $Var\left(\hat{Y}\right) = \hat{V}^2\left[\sigma_V^2\left(\frac{1}{\sigma_\varepsilon^2} + \frac{1}{k^2\sigma_x^2}\right)^2 + \frac{1}{\sigma_\varepsilon^2} + \frac{1}{k^2\sigma_x^2}\right]$, $Var(P) = b^2(\sigma_V^2 + k^2\sigma_x^2)$, and $Cov\left(P,\hat{Y}\right) = b\hat{V}\left[\sigma_V^2\left(\frac{1}{\sigma_\varepsilon^2} + \frac{1}{k^2\sigma_x^2}\right) + 1\right]$, we have

$$E\left[\hat{Y} - P|\hat{Y}\right] = \frac{\frac{\gamma\delta}{\eta}}{\frac{1}{\hat{V}} + \frac{\gamma\delta}{\eta}}\ \hat{Y} - \bar{P}, \qquad and$$

$$Var\left[\hat{Y} - P|\hat{Y}\right] = b^2\frac{k^4\sigma_x^4}{k^2\sigma_x^2 + \sigma_\varepsilon^2}.$$

Hence,

$$E[E_i^P(\mathcal{F}_i)|\hat{Y}] = \frac{E_i^0\ exp\left(-\gamma\left(-c_i + \alpha\frac{\beta\sigma_M^2}{\sigma_V^2}\hat{Y} + \frac{\gamma\alpha^2}{2}(\sigma_M^2 - Var\left[\widetilde{M}\middle|\mathcal{F}_i\right])\right)\right)exp\left(\frac{-\left(E[\hat{Y}-P|\hat{Y}] + \bar{V} - \frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2}\right)^2}{\hat{V} + Var[\hat{Y}-P|\hat{Y}]}\right)}{\sqrt{1 + \frac{Var[\hat{Y}-P|\hat{Y}]}{\hat{V}}}}.$$

Next we take the expectation with respect to $\hat{Y}$. We have

$$E_i^P = E[E[E_i^P(\mathcal{F}_i)|\hat{Y}]]$$

$$= \frac{E_i^0 \, exp\left(-\gamma\left(-c_i + \frac{\gamma\alpha^2}{2}(\sigma_M^2 - Var[\widetilde{M}|\mathcal{F}_i])\right)\right) G}{\sqrt{1 + \frac{Var[\hat{Y} - P|\hat{Y}]}{\hat{V}}}},$$

where

$$G = E\left[exp\left(-\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}\hat{Y} + \frac{-\left(E[\hat{Y}-P|\hat{Y}]+\bar{V}-\frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2}\right)^2}{\hat{V}+Var[\hat{Y}-P|\hat{Y}]}\right)\right]$$

$$= E\left[exp\left(-\frac{\left(A\hat{Y}+\bar{V}-\bar{P}-\frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2}\right)^2+\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}\hat{Y}[\hat{V}+Var[\hat{Y}-P|\hat{Y}]]}{\hat{V}+Var[\hat{Y}-P|\hat{Y}]}\right)\right]$$

$$= G_0 \, E\left[exp\left(-\frac{\left(A\hat{Y}+\bar{V}-\bar{P}-\frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2}+\frac{\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}[\hat{V}+Var[\hat{Y}-P|\hat{Y}]]}{2A}\right)^2}{\hat{V}+Var[\hat{Y}-P|\hat{Y}]}\right)\right]$$

$$= G_0 \frac{exp\left(\frac{-\left(\bar{V}-\bar{P}-\frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2}+\frac{\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}[\hat{V}+var[\hat{Y}-P|\hat{Y}]]}{2A}\right)^2}{\hat{V}+Var[\hat{Y}-P|\hat{Y}]+2A^2Var[\hat{Y}]}\right)}{\sqrt{1+\frac{2A^2Var[\hat{Y}]}{\hat{V}+Var[\hat{Y}-P|\hat{Y}]}}},$$

where $A = \frac{\frac{\gamma\delta}{\eta}}{\frac{1}{\hat{V}}+\frac{\gamma\delta}{\eta}}$ and $G_0 = exp\left(\frac{\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}}{2A}\left(\bar{V} - \bar{P} - \frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2} + \frac{\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}[\hat{V}+var[\hat{Y}-P|\hat{Y}]]}{2A}\right)\right)$.

A marginal household is indifferent between whether or not to trade the stock, so we have

$$E_i^0 = E_i^P, \quad \text{or}$$

$$c_i = \frac{\gamma\alpha^2}{2}\left(\sigma_M^2 - Var\left[\widetilde{M}\middle|\mathcal{F}_i\right]\right)$$

$$+\frac{1}{2}\ln\left(1 + \frac{Var_i\left[\hat{Y} - P|\hat{Y}\right] + 2A^2 Var\left[\hat{Y}\right]}{\hat{V}}\right)$$

$$+\frac{\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}}{2A}\left(\bar{V} - \bar{P} - \frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2} + \frac{\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}\left[\hat{V} + var\left[\hat{Y} - P|\hat{Y}\right]\right.}{2A}\right)$$

$$-\frac{\left(\bar{V} - \bar{P} - \frac{\gamma\hat{V}\alpha\beta\sigma_M^2}{\sigma_V^2} + \frac{\gamma\alpha\frac{\beta\sigma_M^2}{\sigma_V^2}\left[\hat{V} + var\left[\hat{Y} - P|\hat{Y}\right]\right.}{2A}\right)^2}{\hat{V} + Var\left[\hat{Y} - P|\hat{Y}\right] + 2A^2 Var\left[\hat{Y}\right]}.$$

As can be seen, although we have fully solved the case with asymmetric information. The solutions are notationally cumbersome and the intuition cannot be clearly illustrated. For ease of exposition, we assume that households' signals are very noisy (that is, we let σ_ε^2 go to infinity), and the case converges to the one without private signal. The analysis can be simplified, and the proofs of the propositions are as follows.

Proof of Proposition 1: The market clearing condition is:

$$\int_{c_i \le \hat{c}} \theta_i dF(c_i) = x + \delta P, \text{ or}$$

$$\frac{\eta}{\gamma}\left\{\frac{\bar{V} - P}{\sigma_V^2} - \frac{\gamma\alpha\beta\sigma_M^2}{\sigma_V^2}\right\} = x + \delta P.$$

Rearranging the terms, we get

$$P = \frac{\frac{\bar{V}}{\sigma_V^2} - \gamma \frac{\alpha\beta\sigma_M^2}{\sigma_V^2} - \frac{\gamma}{\eta} x}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta}}.$$

Therefore, we have:

$$a = \frac{\frac{\bar{V}}{\sigma_V^2} - \gamma \frac{\alpha\beta\sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta}} \ ,$$

$$b = \frac{-\frac{\gamma}{\eta}}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta}} \ .$$

As for the expected risk premium, we have

$$E(V - P) = E[V - a - bx]$$

$$= \bar{V} - a - b\bar{x}$$

$$= \frac{\frac{\gamma\delta}{\eta}\bar{V} + \frac{\gamma}{\eta}\bar{x} + \gamma \frac{\alpha\beta\sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta}}. \quad \blacksquare$$

Proof of Proposition 2: The marginal household who is indifferent between whether or not to participate in trading the stock satisfies $E_i^0 = E_i^P$, or

$$c_i = \frac{1}{2\gamma}\left\{\frac{\frac{1}{\sigma_V^2}\ (\bar{V} - (a + b\bar{x}) - \gamma\alpha\beta\sigma_M^2)^2}{1 + \frac{b^2\sigma_x^2}{\sigma_V^2}} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\right\}.$$

Plugging $a = \frac{\frac{\bar{V}}{\sigma_V^2} - \gamma \frac{\alpha\beta\sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta}}$ and $b = \frac{-\frac{\gamma}{\eta}}{\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta}}$, we have

$$c_i = \frac{1}{2\gamma}\left\{\frac{\frac{1}{\sigma_V^2}\left(\frac{\gamma\delta}{\eta}\bar{V} + \frac{\gamma}{\eta}\bar{x} - \frac{\gamma^2\delta}{\eta}\alpha\beta\sigma_M^2\right)^2}{\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\left(\frac{1}{\sigma_V^2} + \frac{\gamma\delta}{\eta}\right)^2} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\right\}$$

$$= \frac{1}{2\gamma}\left\{\frac{\frac{b^2}{\sigma_V^2}\,(\delta\bar{V} + \bar{x} - \gamma\delta\alpha\beta\sigma_M^2)^2}{\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)} + ln\left(1 + \frac{b^2\sigma_x^2}{\sigma_V^2}\right)\right\}.$$

Because the cost follows the uniform distribution on the interval $[0, \bar{c}]$, if the participation rate is η, then $c_i = \eta\bar{c}$. We therefore obtain a equation with one variable, η. The left hand side is linearly increasing in η, with the slope equal to $\bar{c}$. On the other hand, the right hand side is decreasing in η (it is increasing in b^2, which is decreasing in η). Further, when $\eta = 0$, the left hand side is equal to zero, whereas the right hand side is positive. When $\eta = 1$, the left hand side is equal to $\bar{c}$; the assumption that $\bar{c}$ is sufficiently large guarantees that the left hand side is greater than the right hand side. Therefore, there is a unique $\eta^* \in [0, 1]$ that solves the equation, and the corresponding c^* is equal to $\eta^*\bar{c}$. ■

Proof of Proposition 3: Defining $G \equiv \frac{b^2}{\sigma_V^2}$, we can rewrite the marginal household's participation condition as $F(\sigma_M^2, \eta) = 0$, where

$$F(\sigma_M^2, \eta) \equiv \eta\bar{c} - \frac{1}{2\gamma}\left\{\frac{G\,(\delta\bar{V} + \bar{x} - \gamma\delta\alpha\beta\sigma_M^2)^2}{(1 + G\sigma_x^2)} + ln(1 + G\sigma_x^2)\right\}.$$

Based on the implicit function theorem,

$$\frac{\partial\eta}{\partial\sigma_M^2} = -\frac{\frac{\partial F(\sigma_M^2, \eta)}{\partial\sigma_M^2}}{\frac{\partial F(\sigma_M^2, \eta)}{\partial\eta}}$$

$$= -\frac{\frac{\partial F(\sigma_M^2,\eta)}{\partial G}\frac{\partial G}{\partial \sigma_M^2} + \frac{\delta\alpha\beta G\,(\delta\bar{V} + \bar{x} - \gamma\delta\alpha\beta\sigma_M^2)}{(1 + G\sigma_x^2)}}{\bar{c} + \frac{\partial F(\sigma_M^2,\eta)}{\partial G}\frac{\partial G}{\partial \eta}}.$$

The assumption that $\bar{c}$ is sufficiently large guarantees that the denominator is greater than zero. As for the numerator, we have

$$\frac{\partial F(\sigma_M^2,\eta)}{\partial G} = -\frac{1}{2\gamma}\left\{\frac{(\delta\bar{V} + \bar{x} - \gamma\delta\alpha\beta\sigma_M^2)^2}{(1 + G\sigma_x^2)^{\,2}} + \frac{\sigma_x^2}{1 + G\sigma_x^2}\right\} < 0.$$

Further, based on the assumption $\gamma\delta > \frac{1}{\sigma_V^2}$, we have

$$\frac{\partial G}{\partial \sigma_M^2} = \frac{G\beta^2(\frac{1}{\sigma_V^2} - \frac{\gamma\delta}{\eta})}{1 + \frac{\gamma\delta}{\eta}\sigma_V^2} < 0.$$

Hence, the assumption $\delta\bar{V} + \bar{x} - \gamma\delta\alpha\beta\sigma_M^2 > 0$ is a sufficient condition to guarantee that

$$\frac{\partial F(\sigma_M^2,\eta)}{\partial G}\frac{\partial G}{\partial \sigma_M^2} + \frac{\delta\alpha\beta G\,(\delta\bar{V} + \bar{x} - \gamma\delta\alpha\beta\sigma_M^2)}{(1 + G\sigma_x^2)},$$

implying that the participation rate η^* is decreasing in political risk captured by σ_M^2.

Because an increase in σ_M^2 leads to an increase in σ_V^2, it is trivial to see that households' trading strategies are less sensitive with respect to the equity premium, $\bar{V} - P$. Further, the hedging demand, -$\frac{\gamma\alpha\beta\sigma_M^2}{\sigma_V^2}$, is decreasing in σ_M^2, indicating that households want to sell more as σ_M^2 increases. The average trading amount is: $E[\theta_i] = \frac{1}{\gamma\sigma_V^2}\,(E[V - P] - \gamma\alpha\beta\sigma_M^2) = \frac{1}{\eta + \gamma\delta\sigma_V^2}(\delta\bar{V} + \bar{x} - \alpha\beta\gamma\delta\sigma_M^2)$. It is trivial to see that $\delta\bar{V} + \bar{x} - \alpha\beta\gamma\delta\sigma_M^2$ is decreasing in σ_M^2. In addition, we have

$\frac{\partial(\eta+\gamma\delta\sigma_V^2)}{\partial\sigma_M^2} = \frac{\partial\eta}{\partial\sigma_M^2} + \gamma\delta\beta^2$, which is positive if $\bar{c}$ is sufficiently large. Hence, $E[\theta_i]$ is decreasing in σ_M^2.

Finally, the unconditional equity premium is $E[V-P] = \frac{\frac{\gamma\delta}{\eta}\bar{V}+\frac{\gamma}{\eta}\bar{x}+\gamma\frac{\alpha\beta\sigma_M^2}{\sigma_V^2}}{\frac{1}{\sigma_V^2}+\frac{\gamma\delta}{\eta}} = \gamma\frac{(\delta\bar{V}+\bar{x})\sigma_V^2+\alpha\beta\eta\sigma_M^2}{\eta+\gamma\delta\sigma_V^2}$. We have

$$\frac{\partial E[V-P]}{\partial\sigma_M^2} = \gamma\frac{\alpha\beta\eta(\eta+\gamma\delta\sigma_s^2)+\beta^2\eta(\delta\bar{V}+\bar{x})-\frac{\partial\eta}{\partial\sigma_M^2}\,(\delta\bar{V}+\bar{x}-\gamma\delta\alpha\beta\sigma_M^2)}{(\eta+\gamma\delta\sigma_V^2)^2}.$$

Because $\delta\bar{V}+\bar{x}-\gamma\delta\alpha\beta\sigma_M^2$ is assumed to be positive and we have proved $\frac{\partial\eta}{\partial\sigma_M^2} < 0$, we have $\frac{\partial E[V-P]}{\partial\sigma_M^2} > 0$. ■