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ABSTRACT

We empirically analyze the pricing of political uncertainty, guided by a theoretical model of government policy choice. After deriving the model's predictions for option prices, we test those predictions in an international sample of national elections and global summits. We find that political uncertainty is priced in the option market in ways predicted by the theory. Options whose lives span political events tend to be more expensive. Such options provide valuable protection against the risk associated with political events, including not only price risk but also variance and tail risks. This protection is more valuable in a weaker economy as well as amid higher political uncertainty.

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1. Introduction

Political uncertainty has featured prominently in the economic landscape of recent years. In the United States, much uncertainty surrounded the government bailouts during the financial crisis of 2008, the reforms of health care and financial regulation, the Federal Reserve's innovative monetary policy, tax policy, as well as the political brinkmanship over the debt ceiling in 2011 and 2013. Standard & Poor's named political uncertainty as a key reason for its first-ever downgrade of the U.S. Treasury debt in 2011. In Europe, the sovereign debt crisis has witnessed tremendous uncertainty about the actions of European politicians, central bankers, and Greek voters. Alas, despite the salience of political uncertainty, our understanding of its effects on financial markets is only beginning to emerge.

In this paper, we empirically analyze the asset pricing implications of political uncertainty. Specifically, we investigate whether and how the uncertainty associated with major political events, such as elections and summits, is priced in the option market. Options are uniquely well suited for this analysis, for two reasons. First, they have relatively short maturities, which we can choose to cover the dates of political events. An option whose life spans a political event provides protection against the risk associated with that event. Since the political event is often the main event that occurs during the option's short life, the option's price is informative about the value of protection against political risk. Second, options come with different strike prices, which allow us to examine various types of risk associated with political events, such as tail risk. Elections and summits are also well suited for our analysis because they can result in major policy shifts and, since their dates are usually determined far in advance, they are a source of exogenous variation in political uncertainty.

Our analysis is guided by the theoretical model of Pástor and Veronesi (2013; hereafter PV). In this model, the government decides which policy to adopt and investors are uncertain about the future policy choice. We use this model directly when analyzing global summits. When we analyze national elections, we reinterpret the PV model so that voters decide whom to elect and investors face uncertainty about the election outcome. Under this election interpretation, *political uncertainty* is uncertainty about who will be elected; in the original version of the model, it is uncertainty about which government policy will be chosen.[1]

We analyze the option pricing implications of the PV model. We focus on put options

[1] Both interpretations of political uncertainty are mentioned in the following recent quote: "When economists talk of political risk, they usually mean... national elections... But there is another kind of political risk: the temptation for governments of all political colours to change the rules, whether they relate to tax, the way that companies operate or how markets behave. And that risk has increased significantly since the 2008 crisis." (The Economist, Buttonwood, November 9, 2013)

whose lives span a political event. After deriving a closed-form expression for the price of such options, we calculate three option-market variables: the implied volatility of an at-the-money option, the slope of the function relating implied volatility to moneyness, and the variance risk premium. These variables capture the value of option protection against three aspects of risk associated with political events: price risk, tail risk, and variance risk, respectively. In response to a political event, stock prices might drop (price risk), the price drop might be large (tail risk), and return volatility might rise (variance risk). The three types of risk are correlated inside the PV model; for example, the adoption of a risky new government policy can increase volatility while depressing stock prices. The model implies that all three option-market variables should be larger, on average, than the same variables calculated from the prices of options whose lives do not span a political event.

The model also predicts a negative relation between all three option-based variables and economic conditions. This prediction follows from a key result of the PV model: when the economy is weaker, a structural change is more likely, which creates uncertainty about the post-change regime. Specifically, in the original version of the PV model, the current government policy is less likely to be retained in a weaker economy, creating uncertainty about which new policy will be adopted instead. Similarly, in the election version of the model, the incumbent government is less likely to be reelected in a weaker economy, creating uncertainty about the new government. Options provide protection against an unfavorable policy decision or an undesirable election outcome. Since the probability of such an outcome is higher in a weaker economy, so is the value of the option protection.

Finally, the model predicts that all three option-based variables tend to be larger amid higher political uncertainty. When there is no such uncertainty, option prices are governed by the Black-Scholes formula, so that implied volatility equals expected volatility and both the implied volatility slope and the variance risk premium are zero. When the uncertainty is present, it is positively related to all three variables, indicating that option protection against the three dimensions of political risk is more valuable when the risk is higher.

In our empirical analysis, we test the model's predictions on option data from 20 countries. We analyze two types of political events: national elections and global summits. Each summit counts as a separate event for all countries participating in the summit, while elections count only for the country in which they are held. For each political event, we calculate the three option-market variables based on options whose lives span the event, adjusting each variable for its mean calculated for neighboring options whose lives do not span the event. As a result of this mean adjustment, a positive value of each variable implies that option protection against the corresponding risk associated with the political event is valuable.

We find strong empirical support for the model's predictions. First, we find that the unconditional means of all three variables are significantly positive, for both elections and summits. The average (mean-adjusted) implied volatility is 1.43% per year, which implies that one-month at-the-money put options whose lives span political events tend to be more expensive by about 5.1% compared to neighboring options. Implied volatilities are particularly high shortly before pivotal events such as the 2008 U.S. presidential election and the 2012 Greek election, both of which took place during major financial crises. The positive average slope means that investors value the protection that deep-out-of-the-money put options provide against the tail risk inherent in political events. For example, among one-month puts that are 5% out-of-the-money, options whose lives span political events are more expensive by 9.6% compared to neighboring options, on average, while among options that are 10% out-of-the-money, they are more expensive by 16.0%. The average variance risk premium is also positive, 0.0107 per year, implying that insurance against variance risk costs significantly more ahead of political events.

Second, we find that all three option-market variables tend to take larger values in weaker economic conditions. These findings hold across four different country-level measures of economic conditions, such as GDP growth and the stock market return. The findings apply to both elections and summits, and they emerge from both regressions and simple mean comparisons. Option protection against the three aspects of political risk is thus more valuable when the economy is weaker. For example, one-month at-the-money options providing protection against political events are about 8% more expensive when the economy is weak but only about 1% more expensive when the economy is strong.

Finally, we find that the option-market variables tend to be larger when there is more uncertainty about the election outcome, as measured by a lower electoral poll spread. The relation to uncertainty is significantly positive for both implied volatility and the variance risk premium, but it is insignificant for the implied volatility slope. These results suggest that higher uncertainty increases the value of option protection against both price and variance risks associated with the election outcome.

To summarize our empirical results, we find that political uncertainty is priced in the option market. Option protection against three types of risk associated with political events—price risk, tail risk, and variance risk—is more valuable when the economy is weaker as well as when the uncertainty is higher, consistent with the theory. Our results survive several robustness tests, including placebo tests designed to detect any relations between option prices and economic conditions that are unrelated to political uncertainty.

Our paper is related to the empirical studies of the risk premium associated with political uncertainty, such as Erb, Harvey, and Viskanta (1996) and Brogaard and Detzel (2013). The former study relies on measures of political risk from the International Country Risk Guide, while the latter uses the policy uncertainty index of Baker, Bloom, and Davis (2013). Using the same index, PV find evidence of a political risk premium. They also find that stocks are more volatile and more highly correlated when political uncertainty is high. Bittlingmayer (1998) and Voth (2002) find a positive relation between political uncertainty and stock volatility by using data from the interwar period. Santa-Clara and Valkanov (2003) relate the equity risk premium to political cycles. Belo, Gala, and Li (2013) link the cross-section of stock returns to firms' exposures to the government sector. All of these studies focus on stocks; none of them analyze options. While these studies share our focus on the financial effects of political uncertainty, others have analyzed the real effects.[2]

This paper is even more closely related to studies that empirically analyze the financial effects of electoral uncertainty. Pantzalis, Stangeland, and Turtle (2000) examine 33 countries and find abnormally high stock returns in the two weeks preceding national elections. Li and Born (2006) find a similar result for U.S. presidential elections. Gao and Qi (2013) show that municipal bond yields rise temporarily around U.S. gubernatorial elections. These results are suggestive of a risk premium for electoral uncertainty, though Bialkowski, Gottschalk, and Wisniewski (2008) find an insignificant premium in their sample of elections in 27 countries. Bialkowski et al. also find that stock market returns tend to be more volatile around national elections, measuring volatility by the GARCH model. Boutchkova et al. (2012) find a similar result at the industry level: using realized volatility of weekly stock returns, they find that industries sensitive to politics have more volatile returns around national elections. Two studies analyze implied volatilities around elections. Gemmill (1992) finds that the implied volatility of the FTSE 100 index rose in the last two weeks before the British parliamentary election of 1987. Goodell and Vahamaa (2013) find that the implied volatility of the S&P 500 index is related to the probability of success of the eventual winner of U.S. presidential elections. While Gemmill has a sample of one, Goodell and Vahamaa's sample includes five elections. Our sample is much larger; in addition, we analyze not only implied volatility but

[2]For example, Fernández-Villaverde et al. (2012) find that changes in uncertainty about future fiscal policy, as measured by time-varying volatility of tax and spending processes, have a negative effect on economic activity. Baker, Bloom, and Davis (2013) find that policy uncertainty, as measured by their index, increases unemployment and reduces investment. Gulen and Ion (2013) find that this negative effect on investment is stronger for firms with a higher degree of investment irreversibility and firms that are more financially constrained. The literature on the real effects of electoral uncertainty includes Julio and Yook (2012), who find that firms reduce their investment before national elections, Jens (2013), who finds that firms reduce their investment before U.S. gubernatorial elections, Julio and Yook (2013), who find that U.S. firms cut FDI flows to foreign affiliates before elections in recipient countries, and Durnev (2012), who finds that corporate investment is less sensitive to stock prices during election years.

also its slope and the variance risk premium. Most important, unlike all studies mentioned in this paragraph, our empirical analysis has clear theoretical guidance. The lack of theory had been a major impediment to research on political uncertainty until recently.

Our theoretical contribution builds on PV, who in turn extend the simpler model of Pástor and Veronesi (2012). In that simpler model, all government policy choices are perceived as identical a priori, whereas PV consider heterogeneous policies. Policy heterogeneity is an important realistic feature that induces an endogenous increase in political uncertainty in poor economic conditions: when the conditions get worse, the probability of a policy change rises, and so does the importance of uncertainty about which of the potential new policies will be adopted. The remaining theoretical literature on the effects of government-induced uncertainty on asset prices is fairly small, quite different, and mostly focused on fiscal uncertainty. Sialm (2006) analyzes the effect of stochastic changes in taxes on asset prices. Tax uncertainty also features in Croce, Kung, Nguyen, and Schmid (2012), who explore its asset pricing implications in a production economy with recursive preferences. Croce, Nguyen, and Schmid (2012) examine the effects of fiscal uncertainty on long-term growth when agents facing model uncertainty care about the worst-case scenario. Finally, Ulrich (2013) analyzes the bond market implications of Knightian uncertainty about the effectiveness of government policies. Our paper is the first, to our knowledge, to derive theoretical predictions for the effects of political uncertainty on option prices.

We derive these predictions in a rich model that features economic and political shocks, endogenous uncertainty about the government's policy choice, and a potential jump in the government's impact on profitability. The model generates state-dependent risk premia, stochastic volatility, and a jump in stock prices at the time of the policy decision. Others recently derived option prices in different settings with jumps in the fundamentals, such as models of rare disasters (Backus, Chernov, and Martin, 2011; Seo and Wachter, 2013), habit formation (Du, 2011), and long-run risk (Benzoni, Collin-Dufresne, and Goldstein, 2011; Drechsler and Yaron, 2011). Unlike those models, our model features jumps that are caused by the resolution of political uncertainty at the time of the political event. The endogeneity of the jumps in our setting generates new testable predictions, such as those relating option prices to the state of the economy. Other related papers include empirical studies of option price behavior around non-political events, such as the announcements of macroeconomic news (e.g., Ederington and Lee, 1996, and Beber and Brandt, 2006) and corporate earnings (e.g., Patell and Wolfson, 1979, and Dubinsky and Johannes, 2006).

The paper is organized as follows. Section 2. reviews the theoretical model of government policy choice and derives the model's implications for option prices before political events.

Section 3. describes our data and the key variables used in our empirical analysis. Section 4. reports our empirical results. Section 5. concludes.

2. Theory

We begin this section by providing a verbal overview of the model of Pástor and Veronesi (2013). We then show how this model can be reinterpreted to study elections. In Section 2.2., we analyze the model's implications for option prices. After deriving a closed-form option pricing formula, we examine various aspects of option prices, such as implied volatility, its slope, and the variance risk premium, shortly before political events.

2.1. The model

PV develop a general equilibrium model in which firm profitability follows a stochastic process whose mean is affected by the current government policy. The policy's impact on the mean is constant and uncertain. Both the government and investors learn about this impact in a Bayesian fashion by observing realized profitability. At a given point in time, denoted by τ, the government makes a policy decision—it decides whether to change its policy and if so, which of potential new policies to adopt. If a policy change occurs, the agents' beliefs are reset: the posterior beliefs about the old policy's impact are replaced by the prior beliefs about the new policy's impact.

When making its policy decision, the "quasi-benevolent" government has both economic and non-economic motives: it cares about its citizens' economic welfare but also takes into account the political costs associated with adopting any given policy. These costs are uncertain until time τ, so that investors cannot fully anticipate which policy will be chosen by the government. Uncertainty about political costs is a key source of political uncertainty, or uncertainty about the government's future actions. Agents learn about political costs by observing political signals that represent the flow of news about various political events. For technical details of the model, see its formal exposition in the Appendix.

2.1.1. Election interpretation

The PV model of government policy choice can be naturally reinterpreted as a model of democratic elections. Let the original PV model be known as "version A" and its alternative election interpretation as "version B." In both versions, a structural change can potentially take place at time τ. In version A, τ is the time of the policy decision; in version B, it is the time of the election. In version A, the government decides whether to change its current policy and if so, which potential new policy to adopt. In version B, voters decide whether to replace the incumbent government and if so, which potential new government to elect. In version A, political uncertainty is uncertainty about which policy will be chosen; in version B, it is uncertainty about who will be elected. In version A, the government cares not only about economic well-being but also about the political costs of the available policy choices. In version B, voters care not only about economic well-being but also about non-economic aspects of the available electoral choices, such as the candidates' charisma and their attitudes toward religion, abortion, etc. In version A, agents learn about the impact of the current policy on profitability; in version B, they learn about the impact of the incumbent government. Both versions share exactly the same analytical framework—all the equations are identical, only their interpretations differ.

In our empirical analysis, we analyze two types of political events: national elections and global summits. When we study elections, we rely on the model's election interpretation (version B). For summits, we appeal to the original version of the model (version A). At any given summit, governments make decisions about potential policy changes that might affect the profitability of the private sector, just like in the original PV model.

2.2. Implications for option prices

Given our objective to analyze the pricing of political uncertainty, our main interest is in options whose lives span time τ when the political event occurs. We derive a closed-form expression for the model-implied price of such options in the following proposition.

Proposition 1: *At time $t < \tau$, the price of a European put option expiring at time $m > \tau$ is given by equation (A17) in the Appendix.*

At time τ, the government can either retain its current policy or adopt one of N potential new policies. At any time $t < \tau$, investors assign a probability to each of those $N + 1$ policy choices based on their information set. If one of those probabilities is equal to one, the option price is given by the standard Black-Scholes formula, with implied volatility equal to the average stock return volatility during the remaining life of the option (see Corollary A.1 in the Appendix). In general, though, the probabilities of the $N + 1$ policies depend on what the agents have learned about the impact of the current policy on profitability as well as about the political costs of the potential new policies. The option price in Proposition 1 is essentially a probability-weighted average of $N+1$ quantities, each of which is the expected present value of a Black-Scholes option price conditional on the corresponding policy choice. We use Proposition 1 to calculate the key option-market variables in Section 2.2.1.

In addition to option prices, we solve for the jump risk premium associated with political events. When the government announces its policy decision at time τ, stock prices jump. They jump because investors are unable to fully predict the government's policy choice, due to uncertainty about political costs. The expected value of the stock price jump at time τ represents the risk premium that compensates investors for the risk associated with holding stocks during the announcement of the policy decision. In version B of the model, this risk premium is compensation for uncertainty about the election outcome.

Proposition 2: *Immediately before time τ, the jump risk premium associated with the political event at time τ is given by equation (A18) in the Appendix.*

Let S_τ denote the information set available to investors immediately before time τ. This set includes the investors' assessment of the impact of the current government policy on profitability, as well as their assessments of the political costs of the potential new policies. We derive a closed-form expression for the jump risk premium, or $J(S_\tau)$, in three steps. First, for each of the $N+1$ potential policy choices, $n = 0, 1, \ldots, N$, we calculate the probability of policy n conditional on S_τ, and denote it by p_τ^n. Second, we compute the instantaneous stock return induced by the adoption of policy n in state S_τ, and denote it by R_τ^n. Finally, we calculate the jump risk premium as the expected value of the jump: $J(S_\tau) = \sum_{n=0}^{N} p_\tau^n R_\tau^n$. In equilibrium, this premium is also equal to the negative of the covariance between the jumps in the stock price and in the stochastic discount factor at time τ.

2.2.1. A two-policy example

In the rest of the theory section, we use a simple setting to illustrate the model's implications for option prices before political events. We consider a special case of $N = 2$, allowing the government to choose from two new policies, H and L, in addition to the old one. Both new policies provide the same level of utility a priori. Policy H has a more uncertain impact on firm profitability than policy L. To ensure that H and L yield the same utility, policy H also has a more favorable expected impact. This two-policy setting is identical to the one used by PV to analyze different implications of their model. We also use the same parameter values as PV (see their Table 1). Specifically, for the parameters (σ_g, σ_c, μ, σ, σ_1, T, τ, γ, h, $\sigma_{g,L}$, $\sigma_{g,H}$, $\mu_{g,L}$, $\mu_{g,H}$), all of which we define in the Appendix, we choose the annual values

(2%, 10%, 10%, 5%, 10%, 20, 10, 5, 5%, 1%, 3%, -0.8%, 0.8%).

We simulate a large number of paths of the state variables in the model. There are three stochastic state variables (the fourth state variable, time, is deterministic). The first variable is the posterior mean of the current policy's impact, denoted by $\widehat{g}_t$, which we discuss in more detail below. The other two variables are the posterior means of the political costs of policies H and L. We initialize all three variables at their prior means and draw their innovations randomly from the model-implied distributions.

For each simulated path, at time $\tau - \frac{1}{2}$, we consider one-period European put options that expire at time $\tau + \frac{1}{2}$. We denote a set of these options across different strike prices by $\mathcal{O}$. We calculate three option-market variables based on this set: implied volatility (IV), the variance risk premium (VRP), and the implied volatility slope (*Slope*).

The first variable, IV, captures the value of option protection against the price risk associated with the political event at time τ. To calculate IV, we first use Proposition 1 to calculate the price of an at-the-money put option in the set $\mathcal{O}$, or option $\mathcal{O}_{\text{ATM}}$, and then convert this price to a Black-Scholes implied volatility value.

The second variable, VRP, is the difference between the Black-Scholes implied variance and the objective expectation of future variance of returns. The variance risk premium reflects the value of option protection against variance risk, which stems from stochastic fluctuations in the variance of stock returns as well as any jumps in stock prices. To calculate VRP, we take the value of IV described in the previous paragraph, square it, and subtract the expected variance of realized log stock returns between times $\tau - \frac{1}{2}$ and $\tau + \frac{1}{2}$. We calculate this expected variance by taking into account the probabilities of the various policy choices as of time $\tau - \frac{1}{2}$ as well as the corresponding stock price jumps at time τ.

The third variable, *Slope*, compares the prices of put options with different moneyness. First, we use Proposition 1 to compute the prices of two options in the set $\mathcal{O}$, one that is 5% out-of-the-money (option $\mathcal{O}_{\text{OTM}}$) and the other 5% in-the-money ($\mathcal{O}_{\text{ITM}}$). After converting both prices into Black-Scholes implied volatilities, we calculate *Slope* as the difference between the implied volatilities of options $\mathcal{O}_{\text{OTM}}$ and $\mathcal{O}_{\text{ITM}}$. Since $\mathcal{O}_{\text{OTM}}$ provides more effective protection than $\mathcal{O}_{\text{ITM}}$ against a large drop in stock prices, we use *Slope* to measure the tail risk associated with the political event.

Next, we analyze the dependence of all three option-based variables on economic conditions (Sections 2.2.2. and 2.2.3.) and political uncertainty (Section 2.2.4.).

2.2.2. The role of economic conditions: Implied volatility

We measure the state of the economy by $\widehat{g}_t$, the posterior mean of the current policy's impact on firm profitability, which is the only economic state variable in the model. (The other two stochastic state variables are driven by political shocks that are orthogonal to fundamental economic shocks.) As a result of Bayesian updating, unexpected increases in profitability push $\widehat{g}_t$ up, while unexpected decreases push it down, so that $\widehat{g}_t$ captures persistent variation in aggregate profitability. The variable $\widehat{g}_t$ thus serves as a natural measure of economic conditions: a high $\widehat{g}_t$ denotes strong conditions, while a low $\widehat{g}_t$ denotes weak conditions.

Figure 1 plots IV as a function of $\widehat{g}_t$ at time $t = \tau - \frac{1}{2}$. Panel A plots the expected value of IV conditional on $\widehat{g}_t$. The expectation is computed by averaging the values of IV across a large number of simulated samples in which $\widehat{g}_t$ is within a narrow band of the value plotted on the horizontal axis. Panel B plots the actual values of IV for a large random subset of those simulated samples. In addition, Panel B plots the line of best fit from the regression of IV on $\widehat{g}_t$ estimated across the simulated samples.

Figure 1 shows a negative relation between IV and $\widehat{g}_t$, indicating that implied volatility is generally higher in weaker economic conditions. To understand this relation, we must recall an important result from the PV model: the government is more likely to change its policy in weaker economic conditions. Solving for the optimal government policy choice, PV find (in their Corollary 1) that a policy change occurs at time τ if and only if $\widehat{g}_\tau$ is below a threshold that involves political costs. Since those costs are uncertain before time τ, so is the outcome of the policy decision. The probability of a policy change is closely related to $\widehat{g}_t$. When $\widehat{g}_t$ is very low, the probability of a policy change is close to one. A low $\widehat{g}_t$ indicates that the current policy is "not working," so the government is likely to replace it. In contrast, when $\widehat{g}_t$ is high, the current policy is likely to be retained. It is possible for the government to replace the current policy even when $\widehat{g}_t$ is high—this happens if the government derives an unexpectedly large political benefit from one of the new policies—but such an event becomes increasingly unlikely as $\widehat{g}_t$ increases.

This result can be easily reinterpreted in the election version (version B) of the model: the incumbent government is more likely to be reelected when the economy is doing well, and more likely to be removed from power when the economy is doing poorly. Indeed, after surveying the empirical literature, Lewis-Beck and Stegmaier (2000) conclude that economic conditions are an important determinant of election outcomes: "Good times keep parties in office, bad times cast them out." (p. 183).

Armed with this result, we can understand why IV in Figure 1 is generally higher in weaker economic conditions. Recall that IV is the implied volatility at time $\tau - \frac{1}{2}$ of option $\mathcal{O}_{\text{ATM}}$ that expires at time $\tau + \frac{1}{2}$. Since the option's life spans time τ, a part of the option's value derives from the protection against the drop in stock prices that would result from an unfavorable policy decision at time τ. In good economic conditions, such a drop is unlikely because the current policy is likely to be retained. Since investors assign a high probability to the retention of the current policy, that decision is priced in before time τ, and there is no stock price jump at time τ when that decision is announced. In contrast, in bad economic conditions, the current policy is likely to be discarded, and prices jump when it becomes clear whether policy H or L is adopted. The adoption of the "risky" policy H is bad news for stockholders because the high uncertainty about H's impact increases discount rates (see PV's Corollary 8). Analogously, the "safe" policy L is good news because of lower discount rates. Option $\mathcal{O}_{\text{ATM}}$ provides protection against the price risk associated with the resolution of uncertainty about whether H or L is adopted when the economy is weak.

Option $\mathcal{O}_{\text{ATM}}$ provides protection not only against the jump in prices at time τ but also against continuous fluctuations in prices. If policy H is adopted at time τ, stock volatility between τ and $\tau + \frac{1}{2}$ is higher than under the old policy, whereas if L is adopted, the post-τ volatility is lower. Therefore, IV is generally high when the probability of policy H, or p_t^H, is high (for $t = \tau - \frac{1}{2}$). Indeed, in Panel B of Figure 1, many of the higher values of IV correspond to samples in which $p_t^H \approx 1$, whereas the lowest values obtain in samples in which $p_t^L \approx 1$. In fact, when $p_t^L \approx 1$, IV is slightly lower in bad conditions than in good ones due to the lower volatility under policy L. The highest values of IV obtain for samples in which $\widehat{g}_t$ is slightly below zero and policy H is perceived to provide a large political benefit to the government. In those samples, markets are unsure whether the government will adopt policy H or retain policy 0. IV is then particularly high because option $\mathcal{O}_{\text{ATM}}$ provides valuable protection against both the jump at time τ and high volatility after time τ.

The negative relation between IV and $\widehat{g}_t$ is most pronounced in "mild recessions", i.e., for values of $\widehat{g}_t$ that are slightly below their unconditional mean of zero.[3] For such values of $\widehat{g}_t$, the probability of a policy change is most sensitive to changes in $\widehat{g}_t$. In contrast, there is no relation between IV and $\widehat{g}_t$ in strong economic conditions. In fact, for $\widehat{g}_t > 0.5\%$ per year or so, all IV values are approximately equal to each other across the simulated samples. In such strong conditions, $p_t^0 \approx 1$. Since a policy change is extremely unlikely, option $\mathcal{O}_{\text{ATM}}$ is priced according to the standard Black-Scholes formula.

[3]The unconditional mean of $\widehat{g}_t$ is zero because $\widehat{g}_t$ is a martingale with the starting point of $\widehat{g}_0 = 0$.

2.2.3. The role of economic conditions: Other variables

Figure 2 relates *Slope* to economic conditions. Panel A plots the expected *Slope* conditional on $\widehat{g}_t$ at time $t = \tau - \frac{1}{2}$. Panel C plots the values of *Slope* for a large random subset of simulated samples, along with the line of best fit from the regression of *Slope* on $\widehat{g}_t$.

Figure 2 shows that *Slope* is generally higher in weaker economic conditions. Recall that *Slope* is the difference between the implied volatilities of put options $\mathcal{O}_{\text{OTM}}$ and $\mathcal{O}_{\text{ITM}}$; therefore, *Slope* is high whenever $\mathcal{O}_{\text{OTM}}$ is expensive relative to $\mathcal{O}_{\text{ITM}}$. The key difference between the two options is that $\mathcal{O}_{\text{OTM}}$ provides better protection against catastrophic events. Such an event can happen at time τ: if the high-risk policy H is adopted, stock prices can drop substantially, as discussed earlier. Since the adoption of policy H is more likely in bad economic conditions (because in good conditions, the current policy is usually retained), *Slope* tends to be higher when conditions are bad.

Catastrophic events make the distribution of stock returns negatively skewed. In Panels B and D of Figure 2, we plot the skewness of stock market returns between times $\tau - \frac{1}{2}$ and $\tau + \frac{1}{2}$, which is the lifespan of our options. Interestingly, Panels B and D are almost mirror images of Panels A and C: *Slope* tends to be high when future stock returns are highly negatively skewed.[4] This result supports our earlier argument that a high *Slope* reflects a concern about the possibility of a catastrophic event at time τ.

Panel C of Figure 2 shows that for many samples, $Slope \approx 0$. The most common reason is that investors assign a very high adoption probability to one of the three policies. If $p_t^n \approx 1$ for any $n \in \{0, H, L\}$, both $\mathcal{O}_{\text{OTM}}$ and $\mathcal{O}_{\text{ITM}}$ are priced according to the Black-Scholes formula, and their implied volatilities are equal, so that $Slope \approx 0$. For example, in good economic conditions, $p_t^0 \approx 1$, and we observe $Slope \approx 0$ for all such samples. *Slope* can also be negative; this happens in some samples in which $p_t^H \approx 0$. In those samples, stock returns exhibit positive skewness in Panel D. Since the probability of a catastrophic scenario is extremely low, protection against left-tail risk is cheap.

Figure 3 shows that VRP, the variance risk premium of option $\mathcal{O}_{\text{ATM}}$ whose life spans time τ, tends to be larger in weaker economic conditions. VRP is high if investors are willing to pay a lot for insurance against variance risk. This risk stems from two sources: stochastic fluctuations in return variance and the jump in stock prices at time τ.[5] Variance fluctuates

[4] In the same spirit, Bakshi, Kapadia, and Madan (2003) find empirically that the implied volatility curve is steeper when the risk-neutral distribution of the underlying stock returns is more negatively skewed.

[5] Todorov (2010) separates the jump component of VRP from the stochastic variance component in a semiparametric empirical framework. He finds that jumps play an important role in explaining VRP.

stochastically before time τ as a result of political shocks. In addition, the resolution of political uncertainty at time τ makes both variance and stock prices jump: if policy H is adopted, variance jumps up and prices down; if L is adopted, variance jumps down and prices up. In good economic conditions, $VRP \approx 0$ because $p_t^0 \approx 1$ so that political shocks do not matter much and there is little risk of a jump at time τ. In bad conditions, though, political shocks do matter and the risk of a jump is higher, and so is VRP.

The highest values of VRP in Panel C of Figure 3 obtain in samples in which $\widehat{g}_t$ is slightly below average and $p_t^L \approx 0$. In such samples, investors find variance risk particularly undesirable. Recall that when $\widehat{g}_t$ is slightly below average, the probability of a policy change is especially sensitive to $\widehat{g}_t$. Therefore, downward revisions in $\widehat{g}_t$ have two effects: they depress stock prices due to lower expected future profitability, while also increasing the probability of policy H, whose adoption would push up the post-τ variance of stock returns. Revisions in $\widehat{g}_t$ thus induce a negative correlation between stock returns and shocks to expected future variance, making variance risk especially undesirable to investors.

Figure 3 also shows that JRP, the jump risk premium from Proposition 2, is generally larger in weaker economic conditions. As argued earlier, in good conditions, the current policy is virtually certain to be retained, so that investors face essentially no jump risk associated with the policy announcement. In bad conditions, though, investors know that a policy change is coming, but they don't know which of the new policies will be adopted. As a result, they demand a larger compensation for jump risk in weaker conditions. Since the jump in stock prices at time τ is a part of the stock return variance between times $\tau - \frac{1}{2}$ and $\tau + \frac{1}{2}$, these results about JRP lend further support to our arguments about VRP. The similarity between the patterns of VRP in Panel C and JRP in Panel D suggests that jumps induced by political events account for a substantial part of the variance risk premium.

2.2.4. The role of political uncertainty

We interpret political uncertainty broadly as uncertainty about future government actions. In version A of the model, this is uncertainty about the government's policy choice at time τ; in version B, it is uncertainty about the election outcome. In the analysis below, we measure political uncertainty by the entropy of the probabilities of the three available policies: $-p_t^H \log p_t^H - p_t^L \log p_t^L - p_t^0 \log p_t^0$, where the policy probabilities are computed as of time $t = \tau - \frac{1}{2}$. This measure of uncertainty reaches its maximum value of $-\log(\frac{1}{3})$, or 1.1, when all probabilities are equal: $p_t^H = p_t^L = p_t^0 = \frac{1}{3}$. Uncertainty reaches its minimum value of zero when any of the three probabilities is one, which is equally intuitive.

Figure 4 plots IV, the implied volatility of option $\mathcal{O}_{\text{ATM}}$, against uncertainty. Both the expected IV in Panel A and the line of best fit in Panel B show that IV tends to increase with uncertainty. Higher uncertainty generally makes $\mathcal{O}_{\text{ATM}}$ more valuable because it increases the value of the protection the option provides against an unfavorable policy decision.

While the relation between IV and uncertainty is positive on average, it is fairly complicated. The reason is that IV reflects not only the value of protection against a bad policy decision but also the expected level of future stock variance. For example, the highest achievable uncertainty, 1.1, corresponds to a high IV, about 15% per year, but there exist samples with lower uncertainty and higher IV. The highest values of IV, about 20%, obtain in samples in which $p_t^L \approx 0$ and investors are uncertain between policies H and 0. Since both of those policies produce higher post-τ variance levels than policy L, expected future variance in such samples is particularly high, contributing to high IV. For another example, note that IV can take three different values when the uncertainty is zero. There are three scenarios in which there is no uncertainty: $p_t^L = 1$, $p_t^0 = 1$, and $p_t^H = 1$. The values of IV in those scenarios are 6.1%, 8.1%, and 15.4%, respectively. These differences in IV are entirely driven by differences in expected future variance under the three policy choices.

One interesting feature of the plot in Panel B of Figure 4 is the high concentration of datapoints along a parabola-like curve whose vertex is located at the uncertainty value of 0.69 and $IV = 16\%$. This curve plots the samples in which $p_t^0 \approx 0$, i.e., samples in which investors assign a very high probability to a policy change at time τ. Different locations on this "policy change" curve correspond to different values of p_t^H and p_t^L, which add up to one. Two points on this curve, for $p_t^L = 1$ and $p_t^H = 1$, are mentioned in the previous paragraph. The highest point on this curve, at which $IV = 16.9\%$, obtains for samples in which p_t^H is only slightly higher than p_t^L. In such samples, uncertainty is close to its two-policy maximum of $-\log(0.5)$, or 0.69, which obtains when $p_t^H = p_t^L = 0.5$. The reason why the highest level of IV obtains for p_t^H slightly higher than 0.5 is that IV is affected not only by uncertainty but also by expected future variance, which is higher under policy H.

The parabola-like policy change curve helps us understand why expected IV in Panel A is not monotonically increasing in uncertainty. When uncertainty increases beyond 0.69, expected IV declines briefly, before resuming its ascent. The reason is that a substantial fraction of our samples lie on the policy change curve near its vertex. For about a fifth of our samples, $\widehat{g}_t$ is sufficiently low so that $p_t^0 < 0.001$, putting these samples on the policy change curve. Many of those samples also have $p_t^H \approx p_t^L$, which happens whenever the political costs of policies H and L are perceived to be similar (they are perceived to be equal a priori, before learning from political shocks). In short, many of our samples lie on the policy change curve near its vertex, and those samples exhibit high IV, as discussed earlier. When uncertainty increases beyond 0.69, all of those high-IV samples abruptly disappear from the set of samples that are averaged in the calculation of expected IV, resulting in a drop in expected IV. While several patterns in Figure 4 seem interesting, they do not change the basic conclusion that IV largely increases with uncertainty.

Figure 5 plots *Slope* and VRP against uncertainty. Both variables are generally positively related to uncertainty, though the relations are complicated, for similar reasons as in Figure 4. In both panels of Figure 5, we observe high concentrations of datapoints along lasso-like policy change curves, which plot samples in which $p_t^0 \approx 0$. When there is no uncertainty, we have $Slope = VRP = 0$, because options are priced according to the Black-Scholes formula (also $JRP = 0$ because there is no jump risk). In the presence of uncertainty, both *Slope* and VRP are mostly positive and largely increasing with uncertainty.

Finally, the model implies that all three variables, IV, VRP, and *Slope*, should take larger values, on average, than their counterparts calculated from options whose lives do not span a political event. The absence of a political event is a special case of our setting in which the probability of a structural change at time τ is zero (i.e., $p_t^0 = 1$). If it is known with certainty that the current policy will be retained (or that the incumbent government will be reelected), then the event at time τ is really a non-event. In that case, the Black-Scholes formula applies, and the three variables take the same values as in Figures 1, 2, and 3 when $\widehat{g}_t \rightarrow \infty$: $IV = 0.08$ and $Slope = VRP = 0$. These values are lower, on average, than the unconditional means of these variables in the presence of political risk.

3. Data and key variables

We construct an international dataset of political events, option prices, and macroeconomic variables. In this section, we describe our dataset and introduce the variables used in our empirical analysis. These variables include three option-market quantities—differences in implied volatility, variance risk premium, and implied volatility slope—as well as four measures of economic conditions and a proxy for uncertainty about the election outcome.

3.1. Options

The main source of our option data is OptionMetrics. We use daily data on implied volatilities, deltas, and open interest for 20 countries. For 15 of these countries, OptionMetrics provides data on options on the country's premier stock market index. For five additional countries, for which such data are unavailable, we use data on U.S.-traded options on the iShares exchange-traded fund (ETF) for the country's MSCI index.[6] Table 1 lists the 20 countries along with the indices underlying the country options and the corresponding sample periods. For most countries, the option data begin between 2002 and 2006; for all countries, the data end in 2012. The longest sample, beginning in 1990, is available for the U.S. S&P 500 index. OptionMetrics provides S&P 500 index option data back to 1996. Our pre-1996 S&P 500 data are from Market Data Express (MDR).

3.1.1. Implied volatility

Let $IV_{t,m}$ denote the implied volatility at time t of an option that matures at time $m > t$. For each option in our sample, this implied volatility is calculated by OptionMetrics.[7] Our main interest is in options whose lives span the dates of political events. Denoting the date of any such event by τ, as in Section 2., our interest is in $IV_{t,m}$ for $t < \tau < m$.

For all countries in our sample, equity options expire on a regular monthly grid.[8] We find the location of each political event τ relative to this grid. We label the expiration dates that straddle τ as a and b, so that $a < \tau < b$. Our choice of a and b depends on the distance from τ to the nearest expiration date. If this distance is more than five days, we choose a and b that are one month apart (i.e., $b = a + 1$ month). But if τ is within five days of the nearest expiration date, we choose a and b that are two months apart so that neither of them is within five days of τ. By imposing this minimum-distance requirement, we avoid two potential problems. First, some of the uncertainty about the outcome of a political event could be resolved a few days before the event (e.g., summit documents are sometimes leaked

[6] The only other countries for which we have found option data in OptionMetrics are Hong Kong, India, Peru, and Malaysia. We exclude Hong Kong because it is technically not an independent country but rather a special administrative region of the People's Republic of China. We exclude India and Peru as they do not appear in the database until 2011. We exclude Malaysia due to insufficient option data for the only Malaysian election that took place during the country's option sample period.

[7] For European options, OptionMetrics first calculates the theoretical option price as the midpoint of the best closing bid and offer prices, and then computes the implied volatility by inverting the Black-Scholes formula. This calculation applies to the 15 countries in our sample for which we have options on the country's premier stock index. For American options, OptionMetrics obtains implied volatilies by applying a proprietary pricing algorithm based on the Cox-Ross-Rubinstein binomial tree model. This calculation applies to the five countries for which we use ETF options on the MSCI country indices. We discard options with implied volatilities exceeding 100% per year. This filter affects only one of the political events in our sample. The implied volatility in question appears to be a data error for Australia as it deviates dramatically from the implied volatilities of other Australian options with similar t and m.

[8] In the U.S., the expiration date is the Saturday that follows the third Friday of each month. All countries in our sample have the same option expiration schedule as the U.S., except for Australia, where the expiration date is the third Thursday, and Japan and Korea, where it is the second Friday.

to the press) or after the event (e.g., the election outcome is not always clear immediately). Second, we avoid using ultra-short-maturity options, which option studies typically exclude from their analyses. Given our five-day requirement, our procedure outlined below never uses options that have six or fewer days to maturity.[9] After choosing a and b, we define c as the expiration date immediately following b, so that b and c are always one month apart. See Figure 6 for the timeline. Our main interest is in $IV_{b-s,b}$, where $b - s < \tau < b$.

In our theoretical analysis in Section 2., we analyze the dependence of $IV_{b-s,b}$ on economic conditions and political uncertainty. In our empirical analysis, we modify $IV_{b-s,b}$ in two ways to account for realistic departures from our simple theoretical setting. First, we subtract the average of the implied volatilities of the options with neighboring expiration dates, by constructing the difference $IV_{b-s,b} - \frac{1}{2}(IV_{a-s,a} + IV_{c-s,c})$. The goal of this modification is to remove the effects on IV of any persistent influences that are absent from our theoretical model, such as differences in volatility levels across countries or low-frequency time variation in volatility. Second, we replace $IV_{b-s,b}$, $IV_{a-s,a}$, and $IV_{c-s,c}$ for any given s by averages of implied volatilities across multiple values of s. Since the theory is silent on the relevant time to maturity, we average across many values of s to reduce noise in the estimation.

For each political event τ, we define the *implied volatility difference*, IVD_τ, as

$$IVD_\tau = \overline{IV}_b - \frac{1}{2}(\overline{IV}_a + \overline{IV}_c) \ , \tag{1}$$

where $\overline{IV}_a$, $\overline{IV}_b$, and $\overline{IV}_c$ are square roots of averages of implied variances computed across all acceptable put and call options expiring at times a, b, and c, respectively. Acceptable options satisfy three criteria. First, they are at-the-money (ATM) options, which we define as options whose deltas satisfy $0.4 < |\Delta| < 0.5$. We choose this definition to obtain a liquid set of ATM options since it is well known that options that are slightly out-of-the-money (OTM) tend to be more liquid than options that are in-the-money (ITM). If multiple options satisfy this definition of ATM, they are all used in the average. Second, acceptable options have positive open interest. The only exception is U.S. data prior to 1996, for which we require positive volume instead because the pre-1996 data come from a different source (MDR), which does not report open interest. Third, acceptable options have s days until expiration, where s belongs to a given time window. Specifically, we define $\overline{IV}_b$ as follows:

$$\overline{IV}_b = \text{Mean}\left\{IV_{b-s,b} : b - s \in [\tau - 20, \tau - 1]\right\} \ , \tag{2}$$

which is the equal-weighted average of $IV_{b-s,b}$ across the values of s for which $b - s$ is in the 20-trading-day window preceding time τ. We choose this window of 20 trading days, or

[9]Ultra-short-maturity options have very small time premiums. Their implied volatilities tend to be inaccurate due to high sensitivity to price nonsynchronicity and other measurement errors. Beber and Brandt (2006), among many others, exclude options with less than a week to maturity.

about one month, to smooth out the noisy day-to-day fluctuations in international option prices. In short, $\overline{IV}_b$ is the average implied volatility across all ATM options with open interest that expire at time b and whose values are computed in the month before τ.

$\overline{IV}_a$ and $\overline{IV}_c$ are defined analogously. For those variables, we choose 20-day windows that end $b - \tau + 1$ trading days before a and c, respectively, to ensure that the times to maturity for options entering into $\overline{IV}_a$, $\overline{IV}_b$, and $\overline{IV}_c$ are fully comparable. By combining $\overline{IV}_a$, $\overline{IV}_b$, and $\overline{IV}_c$, we obtain the implied volatility difference, IVD_τ, in equation (1). A positive value of IVD_τ indicates that options whose lives span time τ are more expensive, on average, than the neighboring options whose lives do not span τ.

3.1.2. Variance risk premium

Empirical studies typically calculate the variance risk premium as the difference between the implied and realized variances (e.g., Bollerslev, Tauchen, and Zhou, 2009). Following that approach, we construct a daily panel of variance risk premia for each country as

$$VRP_{t,m} = IV_{t,m}^2 - RV_{t,m}^2 \, , \tag{3}$$

where $IV_{t,m}^2$ is the implied variance at time t of an ATM option that matures at time $m > t$, and $RV_{t,m}^2$ is the average realized variance of the same underlying country stock index over the life of the option (i.e., between times t and m). The average realized variance provides an unbiased estimate of the expected variance over the option's life.[10]

Our realized variance data come from two sources. Our first choice is the Oxford-Man Institute's Realized Library (`http://realized.oxford-man.ox.ac.uk/`), which estimates daily realized variance from intraday returns. From this source, we obtain data for 14 countries: Brazil, Canada, France, Germany, Italy, Japan, Korea, Mexico, Netherlands, Singapore, Spain, Switzerland, UK, and U.S. For the remaining six countries, the Oxford-Man data are unavailable, so we estimate their variance by exponential smoothing.[11]

[10] We obtain similar empirical results if we construct $VRP_{t,m}$ in equation (3) in three alternative ways: (i) by replacing $RV_{t,m}^2$ with the variance realized on day t, (ii) by replacing $RV_{t,m}^2$ with a variance forecast from an AR(1) model, and (iii) by replacing $IV_{t,m}^2$, which is model-based (see footnote 7), with a model-free implied variance. In all three cases, the results are slightly noisier, which makes sense: approach (i) uses a single-day variance, approach (ii) relies heavily on the AR model, and approach (iii) requires a wide range of strike prices, which shrinks the sample size. Yet all three sets of results lead to the same conclusions.

[11] See, for example, Andersen et al. (2006). The exponential smoothing method estimates the current variance by an exponentially-weighted moving average of past squared returns. We use the smoothing parameter of 0.2, which maximizes the correlation between the smoothed series and the realized variance series for the countries that have realized variance data in the Oxford-Man database.

For each political event τ, we determine the option expiration dates a, b, and c as in the previous subsection. We define the *variance risk premium difference*, $VRPD_\tau$, as

$$VRPD_\tau = \overline{VRP}_b - \frac{1}{2}(\overline{VRP}_a + \overline{VRP}_c) \ , \tag{4}$$

where $\overline{VRP}_a$, $\overline{VRP}_b$, and $\overline{VRP}_c$ are averages of variance risk premia calculated in the same way as their implied volatility counterparts. That is, analogous to equation (2), we define

$$\overline{VRP}_b = \text{Mean}\left\{VRP_{b-s,b} : b - s \in [\tau - 20, \tau - 1]\right\} \ , \tag{5}$$

where the mean is calculated across all acceptable options expiring at time b, and the set of acceptable options is identical to the set used previously for $\overline{IV}_b$. The averages $\overline{VRP}_a$ and $\overline{VRP}_c$ are also calculated in a manner analogous to $\overline{IV}_a$ and $\overline{IV}_c$, respectively. A positive value of $VRPD_\tau$ in equation (4) indicates that option-market investors pay more for insurance against variance risk over intervals that include time τ, on average, than over neighboring intervals that do not include τ.

3.1.3. Implied volatility slope

The implied volatility slope measures the steepness of the function that relates implied volatility to moneyness. For each country, we construct a daily panel of such slopes, $Slope_{t,m}$, similar to the panels for $IV_{t,m}$ and $VRP_{t,m}$ described earlier. We define OTM put options as those whose deltas satisfy $-0.5 < \Delta < -0.1$.[12] At any time t, we consider all OTM put options that mature at time m and have positive open interest. If there exist at least three such options, we calculate $Slope_{t,m}$ as the slope coefficient from the regression of these options' implied volatilities on the same options' deltas. (If there are at most two such options, we treat $Slope_{t,m}$ as missing.) A positive slope indicates that options that are deeper OTM are relatively more expensive (since $\Delta < 0$ for puts).

For each political event τ, we define the *implied volatility slope difference* as

$$SlopeD_\tau = \overline{Slope}_b - \frac{1}{2}(\overline{Slope}_a + \overline{Slope}_c) \ , \tag{6}$$

where $\overline{Slope}_a$, $\overline{Slope}_b$, and $\overline{Slope}_c$ are averages of $Slope_{t,m}$ values calculated in the same manner as the averages of implied volatilities and variance risk premia in the previous two subsections. A positive value of $SlopeD_\tau$ indicates that deep-OTM put options are particularly expensive shortly before time τ, suggesting that investors are willing to pay for protection against the downside tail risk associated with political events.

[12] We avoid the deepest OTM put options, those with $\Delta \approx 0$, because their implied volatilities are extremely sensitive to small measurement errors in option prices (e.g., Hentschel, 2003, Beber and Brandt, 2006, etc.).

3.2. Economic conditions

Our data on economic conditions come from the Organization for Economic Cooperation and Development (OECD), International Monetary Fund (IMF), and Datastream. We construct four country-level variables that proxy for the model's variable $\widehat{g}_t$, which captures the perceived state of the country's economy. The first variable, GDP, is the country's real GDP growth in the current quarter. We collect quarterly real GDP growth data from OECD. These data are seasonally adjusted and available throughout our sample. The second variable, FST, is the most recent real GDP growth forecast for the subsequent year. We obtain these forecast data from the IMF World Economic Outlook. The data begin in 1999. The third variable, CLI, is the country's Composite Leading Indicator in the current month. We collect these data from OECD's Main Economic Indicators. OECD constructs these monthly series by aggregating a variety of component indicators that comove with the business cycle and tend to turn earlier than the business cycle. OECD does not calculate CLI for Taiwan and Singapore, but it does for the remaining 18 countries in our sample. Finally, MKT is the country's stock market index return over the previous three months. We collect monthly total returns on each country's headline stock market index from Datastream. A high value of any of the four variables indicates strong economic conditions.

In subsequent analysis, we sometimes separate strong from weak economic conditions by comparing a given measure of these conditions to zero. Since the three real macroeconomic variables (GDP, FST, and CLI) tend to take positive values, we standardize each of them to have zero mean and unit variance within each country. We perform this standardization by using data from 1990 through 2012, which is the longest available sample period in Table 1 (only for FST, we go back to 1999 when its data begin). We do not standardize MKT because positive and negative stock returns occur with nearly equal frequency in our sample.

3.3. Political events

We hand-collect data on two types of political events: national elections and global summits. For election data, our starting point is the advanced search feature of the Election Guide website provided by the International Foundation for Electoral Systems.[13] Our data include the date and type of the election, the election outcome, the percentage shares of votes cast

[13]See `http://www.electionguide.org`. We augment this source with a variety of other online sources, such as Psephos, Parline Database on National Parliaments, Election Resources on the Internet, European Election Database, Wikipedia, World Bank Database of Political Institutions, Gallup, and Angus Reid Public Opinion. All of these sources are freely available online.

for both the winner and the runner-up, and the opinion poll data for the top contenders. In addition, we investigate each parliamentary election for potential ex-ante coalitions of multiple parties. If we find such coalitions, we view them as stand-alone entities for the purpose of calculating votes cast as well as opinion poll spreads. In other words, both the winner and the runner-up could be a single party or a coalition of multiple parties, depending on the election. Whenever possible, we cross-check data across multiple databases.

For each country listed in Table 1, we collect data on all national elections that took place between the starting and ending dates of our option dataset. For all countries, we collect data on national parliamentary elections. In addition, we collect data on presidential elections for countries in which the president has executive power, such as the United States, Brazil, and France, but not for countries whose presidents' roles are largely ceremonial, such as Germany and Greece. If an election has two rounds, we consider both rounds as separate elections. We provide the full list of elections in Table A.1 of the Appendix.

In addition to elections for countries listed in Table 1, we add two extraordinary elections to our sample—the May and June 2012 Greek parliamentary elections.[14] While Greece is not in Table 1 due to the lack of option data, its 2012 elections seem particularly relevant to our analysis given their critical importance in the development of the eurozone debt crisis. At the time, these elections were widely viewed as a de facto referendum on Greece's continuation as a member of the eurozone.[15] With one of the leading political parties proposing renegotiating Greece's treaty with Europe, a plausible election outcome would have involved a Greek exit from the eurozone, with uncertain consequences for other vulnerable eurozone members such as Italy and Spain. While the inclusion of the Greek elections strengthens our conclusions in Section 4. about the pricing of political uncertainty, these elections are not outliers, and if they are excluded from our sample, our conclusions remain unchanged.

In subsequent analysis, we examine how the prices of options on a country's stock market index behave around that country's elections. For example, we study how German options behave around German elections, but not around French elections. We make one exception: Greece. Given the importance of the 2012 Greek elections for the future of the eurozone as a whole, we treat those elections as relevant for all European countries.

Our measure of uncertainty about the election outcome, UNC, is the negative of the

[14]The May 6, 2012 election ended inconclusively since none of the three largest parties (ND, SYRIZA, and PASOK) managed to form a new government, necessitating a follow-up election on June 17, 2012.

[15]For example, German Foreign Minister Guido Westerwelle said: "What's at stake isn't just the next Greek government. What's at stake is the Greek people's commitment to Europe and the euro." (Bloomberg, "Greek Vote Escalates Crisis as Schaeuble Raises Euro-Exit", May 15, 2012) The media were awash with headlines such as "The Greek election will determine the future of the eurozone."

poll spread. The poll spread is the most recent opinion poll spread before the election; if it is unavailable, we use the ex-post election margin instead. We calculate the opinion poll spread as the difference between the percentage shares of the poll leader and the runner-up. For example, if the leader is favored by 44% of the voters while the runner-up is favored by 38%, the spread is 6%. Similarly, we calculate the election margin as the difference between the percentage shares of votes cast for the winner and the runner-up.

In addition to national elections, we analyze all global summits that took place between January 2007 and December 2011. We consider three types of summits: G8 summits, G20 summits, and European summits. The European summits include both EU summits held by the European Council, which comprise leaders of all EU member states, and eurozone summits, which include only those EU states that have adopted the euro. While the G8 summits are annual, the G20 summits take place once or twice per year, and the European summits occur roughly every couple of months.

Given our focus on financial effects of political uncertainty, we are interested in only those meetings of global political leaders that could plausibly result in major changes in economic policy. To pick such a set, we adopt two screens. First, we consider only summits from 2007 through 2011, as noted earlier. This five-year period is dominated by two economic crises, the financial crisis of 2007–2008 and the eurozone debt crisis that began in 2009, which have been accompanied by extensive government interventions. Prior to 2007, few summits dealt with such pressing economic issues, and government interventions were less pervasive. Second, after reading the summit agendas, summaries, and press releases, we identify the subset of summits whose primary focus is on economic issues. All G20 summits fit that description. This makes sense since the Group of Twenty was formed in 1999 as a forum for cooperation on matters pertaining to the international financial system. In contrast, most G8 summits focus on non-economic issues: for example, the 2007 summit focused on global warming, struggle against poverty, and missile defense, while the 2008 summit focused on African development, climate change, and intellectual property rights. Such summits are unlikely to keep option market participants in suspense. We include only one G8 summit in our sample, the 2010 summit, which focused on economic recovery from global recession, financial reform, and the European debt crisis. Following the same description-based procedure, we include about two thirds of all European summits (including all summits since the breakout of the eurozone debt crisis in late 2009 but none before the Lehman Brothers collapse in 2008). In Table A.2 of the Appendix, we provide the list of all summits in 2007 through 2011, along with their brief descriptions and indicators of economic relevance. All summits whose primary focus is on economic issues are included in our sample.[16]

[16]In our robustness analysis in Section 4.4., we extend our sample to include all summits from Table A.2,

Table 2 reports the number of political events in our sample by event type and country. We count only events for which option data are available so that we can calculate IVD in equation (1).[17] The table shows 64 election observations and 216 summit observations. The number of summit observations is larger because we view each summit as pertaining to all countries participating in the summit. Specifically, we include G20 summits as observations relevant for all G20 countries, G8 summits for all G8 countries, and European summits for all European countries. In contrast, national elections pertain only to the country in which the elections are held. The only exception is Greece, as explained earlier—we include the 2012 Greek elections as observations relevant for all European countries, effectively treating those critical elections as if they were European summits.

The numbers of events in Table 2 do not necessarily "add up." For example, we count 57 parliamentary elections and 14 presidential elections, but only 64 elections total. The reason is that our totals represent the size of a set union, which may be smaller than the sum of the subset sizes. For example, if parliamentary and presidential elections take place on the same date (as they do every four years in the U.S.), we count them as one election in the total. In addition, we combine into a single observation all country events that are so close in calendar time that they are followed by the same first option expiration date. That is, we combine events that share the same expiration date b in Figure 6. For example, for Germany, we combine its parliamentary election on September 27, 2009 with the G20 summit on September 24-25, 2009. As a result, our count for Germany includes five elections and 21 summits, but only 25 events total. We combine summits in the same way, such as the G8 summit on June 25-26, 2010 and the G20 summit on June 26-27, 2010. By combining these summits, we avoid double counting since many of the same options would otherwise enter the calculations of our option-market variables for both summits. The combinations reduce the number of events by 44, bringing our total number of events to 271.

Whenever we combine events, we calculate the option-market variables (IVD, $VRPD$ and $SlopeD$) for the combined event by averaging the corresponding values for the individual events. If the combined events occur in the same calendar month, the values of their macroeconomic variables (GDP, FST, and CLI) are the same; if they occur in adjacent months, we choose the value corresponding to the earlier month. For example, if the events occur on October 29 and November 3, with the nearest option expiration on November 17, we choose the macro variables corresponding to October. If we combine two elections, we

regardless of their economic relevance. While most of our results get a bit weaker, as one would expect as a result of adding noise to the estimation, our main conclusions remain unchanged (see Table 9).

[17]Whenever IVD is available, so is $VRPD$ in equation (4) because both variables have the same data requirements. $SlopeD$ in equation (6) requires more data as it needs at least three OTM options.

calculate UNC for the combined event by taking the larger of the two uncertainty values. Finally, whenever we combine an election and a summit, we use the combined observation in both the "elections only" and "summits only" subsample tests.

4. Empirical results

In this section, we test the model's predictions for option prices around major political events. The model predicts that political uncertainty should be priced, and that its effects on prices should be stronger when economic conditions are weaker and when the uncertainty is higher. Specifically, the model makes predictions about the value of option protection against price risk (IVD), tail risk ($SlopeD$), and variance risk ($VRPD$). As shown in Section 2., IVD, $VRPD$ and $SlopeD$ should all be larger when the economy is weaker and when UNC is higher.[18] In addition, due to the differencing in the construction of the three variables, the model implies that all three of them should be positive, on average (i.e., IV, VRP and $Slope$ should be higher shortly before political events than otherwise). To preview our results, we find strong empirical support for eight of these nine predictions. Only the evidence for the ninth prediction, that $SlopeD$ is higher when UNC is higher, is insignificant.

4.1. Mean differences

Table 3 shows that the average value of IVD across all 271 political events is 1.43% per year, which is highly statistically significant ($t = 4.43$). The averages for the election and summit subsamples are similar in magnitude and also significant. The positivity of IVD means that options whose lives span political events—the "treatment-group" options—are more expensive, on average, than their chronological neighbors whose lives do not span the same events—the "control-group" options. This result suggests that the uncertainty associated with major political events is priced in the option market.

The price of political uncertainty is significant not only statistically but also economically. The mean of IVD, 1.43%, implies that, on average, investors are willing to pay about 5.1% extra for put options that provide protection against the price risk embedded in political

[18] In Section 2., we illustrate these predictions on variables IV, VRP and $Slope$, which are not differenced unlike their empirical counterparts IVD, $VRPD$ and $SlopeD$. However, when we construct such differenced empirical counterparts in the theory section, we find that the model's predictions for IVD, $VRPD$ and $SlopeD$ are identical to those for IV, VRP and $Slope$. We do not difference these variables in the theory section in the interest of simplicity. The purpose of the differencing is to account for realistic departures from our simple theoretical model, such as slow-moving variation in volatility, as explained earlier.

events. To obtain the 5.1% price premium, note that the average implied volatility across all control-group options is 27.8% per year. Therefore, the implied volatilities of treatment-group options are 5.1% (= 1.43/27.8) higher, on average, than the control group's implied volatilities. For ATM put options, a given percentage increase in implied volatility is approximately equal to the same percentage increase in the option's price.[19] Therefore, the IVD mean of 1.43% implies that spanning a political event makes ATM put options about 5.1% more expensive, on average.

Interestingly, the full-sample mean of IVD, 1.43%, is smaller than the weighted average of the two subsample means, 1.63% and 1.42%. The reason is that the election/summit combination observations, which appear in both subsamples, have higher values of IVD on average: 2.61%. One prominent example is the U.S. presidential election on November 4, 2008 (Obama vs. McCain), which is combined with the G20 summit on November 14-15, 2008 since both events share the same first post-event option expiration date (November 22). The value of IVD for this observation is 12.2%, which exceeds the full-sample mean by a factor of eight! It makes sense for such "combo" observations to have higher IVD: options expiring after multiple political events should be more valuable as they provide protection against the political risk associated with all of those events.

Another interesting example is the June 2012 Greek election. This election was perceived as crucial for the future of the eurozone, as noted earlier. Our results support that view. The average value of IVD across all European countries for this election is 6.7%, almost five times the full-sample mean. The countries that were the most affected by this election are Spain ($IVD = 10.3\%$) and Italy (7.7%), which were arguably "next in line" to exit the eurozone after Greece. The effects on Germany and France, the key eurozone players, are also large (7.4% and 7.2%, respectively). In contrast, the least affected European countries are Sweden and Switzerland, neither of which is a eurozone member. Similarly, in the May 2012 Greek election, the largest values of IVD are observed for Italy, France, and Spain, while the smallest values belong to the eurozone non-members U.K. and Switzerland.

Table 4 shows that the average value of $VRPD$ across all events is 0.0107 ($t = 2.61$), in annualized variance terms. The averages for the election and summit subsamples are similar in magnitude and also significant. The positive mean of $VRPD$ indicates that the variance risk premia of treatment-group options (whose lives span political events) exceed those of the control-group options, on average. This result suggests that options provide valuable

[19]Consider a forward ATM put option, whose strike price is equal to the current stock price compounded forward at the risk-free rate. It is easy to show that the elasticity of this option's price P to changes in implied volatility σ is approximately equal to one; i.e., $(dP/P)/(d\sigma/\sigma) \approx 1$.

protection against the variance risk associated with political events.

To judge the economic significance of $VRPD$, we convert variance risk premia from units of variance into option price premia. The mean of 0.0107 is equal to the difference between 0.0465, which is the average VRP of treatment-group options, and 0.0358, the average VRP of control-group options. The VRP of 0.0465 translates into a 48.1% price premium for a one-month forward ATM put option with realized volatility equal to the average volatility observed in the treatment group. The VRP of 0.0358 translates into a 36.5% price premium for the same option given the average volatility of the control group. That is, treatment-group options are about 48.1% more expensive relative to the Black-Scholes model, on average, whereas control-group options are 36.5% more expensive. These values indicate that investors are willing to pay a lot for option protection against variance risk in our international sample. They also show that this protection is proportionally more valuable for treatment-group options.

Table 4 also shows that the average value of $SlopeD$ across all events is 0.0173 and highly significant. The average $SlopeD$ is also positive and significant in both election and summit subsamples. This result indicates that the relative expensiveness of deep-OTM put options tends to be higher for treatment-group options, suggesting that such options provide valuable protection against the tail risk associated with political events.

To assess the economic value of this protection, we calculate the price premium that investors are willing to pay for OTM options in the treatment group relative to the control group. For both groups, we use their mean slope estimates to compute the implied volatilities of options that are 5% and 10% OTM, and then convert those implied volatilities into option prices for one-month puts. We find that treatment-group options that are 5% OTM are 9.6% more expensive than the control-group options with the same moneyness, on average, while treatment-group options that are 10% OTM are 16.0% more expensive. (For comparison, recall that treatment-group ATM options are 5.1% more expensive.) The price premium thus increases as the put options become progressively deeper OTM. These results indicate that investors are willing to pay substantially more for options that provide insurance against the tail risk linked to political events.

4.2. The role of economic conditions

Columns 2 through 5 of Table 3 report differences between the average values of IVD in weak versus strong economic conditions, as defined in Section 3.2. Specifically, we report the slope coefficient from the regression of IVD on an indicator variable that takes the value of one if the event occurs during weak conditions and zero otherwise. The estimated value of this coefficient is positive in all 12 specifications (four measures of economic conditions times three sets of events), and it is statistically significant in 11 of them.[20] IVD is clearly higher when the economy is weaker, on average. In other words, the value of option protection against political risk is larger in a weaker economy, as the model predicts.

To assess the economic significance of this result, we calculate the average percentage difference between the prices of ATM put options whose lives span political events and those whose lives do not, as we did in the second paragraph of Section 4.1., but now we do so separately for weak and strong conditions. We find that the option price mark-up for protection against political risk is large in weak conditions but relatively small in strong conditions. Across the four measures of economic conditions, the option price mark-up in weak conditions ranges from 7.1% for GDP to 9.0% for CLI, whereas in strong conditions, it ranges from 0.1% for FST to 1.2% for MKT. Put differently, when the economy is weak, options providing protection against political risk are more expensive by about 8%, but they are only slightly more expensive, by about 1%, when the economy is strong.

Table 4 is the counterpart of Table 3 for $VRPD$ and $SlopeD$. We find that the average values of both variables are higher in weak economic conditions than in strong conditions. For both variables, the weak-minus-strong average difference across all events is positive and statistically significant for each of the four measures of economic conditions. The same difference is also positive in both election and summit subsamples, and it is statistically significant in most of the subsample specifications. The results clearly show that both $VRPD$ and $SlopeD$ are higher when the economy is weaker, on average. In other words, the option protection against both variance and tail risks associated with political events is more valuable when the economy is weaker, consistent with the model.

Tables 3 and 4 analyze the role of economic conditions simply by comparing the average values of IVD, $VRPD$, and $SlopeD$ in weak versus strong conditions. In Tables 5, 6, and 7, we perform additional analysis by regressing each of the three option-market variables on economic conditions. Let $ECON$ denote any of the four measures of economic conditions defined in Section 3.2.: MKT, GDP, FST, and CLI. We scale all four $ECON$ variables to unit variance within each regression so that we can interpret the regression slope coefficient as a response of the dependent variable to a one-standard-deviation change in the independent variable. We regress each of the three option variables on $ECON$. We also run regressions

[20] To calculate standard errors, both here and in our subsequent regressions, we allow for two-way clustering of the residuals by month and country, following the procedure of Cameron, Gelbach, and Miller (2011).

on both $ECON$ and $ECON$ multiplied by an indicator for $ECON > 0$. This piecewise linear regression is motivated by the theoretical patterns in Figures 1, 2, and 3, which imply that IVD, $VRPD$, and $SlopeD$ should all be zero when the economy is sufficiently strong. In other words, the model implies no relation between the option variables and economic conditions when those conditions are strong enough, but a negative relation otherwise.

Table 5 shows a strong negative relation between IVD and $ECON$, for all four $ECON$ measures. The slope coefficient on $ECON$ is estimated to be negative in all 24 specifications (four measures of $ECON$ times three sets of events times two regressions), and it is statistically significant in 21 of them. The relation is economically significant as well: for example, a one-standard-deviation increase in GDP decreases IVD by 2.01% per year across all events. The effect is a bit weaker for FST and CLI but stronger for MKT, and somewhat stronger for summits than for elections. For both GDP and MKT, we also find a significant convex kink in the piecewise linear regression specification. This kink flattens the relation between IVD and $ECON$ for $ECON > 0$ (e.g., for MKT, the coefficient on $ECON$ is -3.58 while the coefficient on $ECON \cdot 1_{ECON>0}$ is 3.77, so the net coefficient for $ECON > 0$ is only 0.19, which is insignificantly different from zero). Overall, the empirical relation between IVD and $ECON$ in Table 5 is quite similar to that predicted by the model.

Figure 7 plots the individual data points underlying the regressions in Table 5. We plot IVD against $ECON$, with the four panels corresponding to the four $ECON$ measures. We also plot the lines of best fit from the simple linear and piecewise linear regressions estimated on all events. The figure complements the evidence from Table 5 with three additional observations. First, it shows that the negative relation between IVD and $ECON$ is not driven by outliers. Second, there is more dispersion in IVD for summit observations (marked as circles) than for election observations (marked as squares), but there is a fair amount of dispersion for both. Finally, there is much more dispersion in IVD in weak conditions than in strong conditions, as the model predicts.[21]

Table 6 shows that $VRPD$ is negatively related to $ECON$. The slope coefficient on $ECON$ is negative in all 24 specifications, and it is statistically significant in 19 of them. The relation is also economically significant: for example, a one-standard-deviation increase

[21] In the figure, the range of the three macroeconomic variables (GDP, FST, and CLI) is asymmetric around zero: from -4 or even -5 to about 2. To understand this asymmetry, recall from Section 3.2. that the three variables are scaled to zero mean and unit variance in each country by using data from 1990 through 2012. The data in Figure 7 come from different (option-based) time periods, which for all countries except the U.S. begin in 2002 or later (see Table 1). Those time periods exhibit weaker economic conditions (especially post-2006) and more macroeconomic volatility than the longer 1990-2012 period. Since the means and standard deviations used in the scaling come from the 1990-2012 period, macro variables such as GDP growth in early 2009 can be four or even five standard deviations below the mean for some countries.

in GDP decreases $VRPD$ by 0.02 per year (for comparison, recall our discussion of Table 4). The effect is a bit weaker for FST and CLI but stronger for MKT, and a bit stronger for summits than for elections, just like for IVD. The estimated kink in the piecewise linear regression is positive in 11 of the 12 specifications, though it is significant in only three of them. Taken together, the results in Table 5 are consistent with the model.

Figure 8 provides complementary evidence by plotting $VRPD$ against $ECON$ across all events. The results are similar to those for IVD in Figure 7. Figure 8 shows that the negative relation between $VRPD$ and $ECON$ is not driven by outliers. It also shows that there is more dispersion in $VRPD$ for summits than for elections, with significant dispersion for both. Finally, it shows that $VRPD$ is more disperse in weaker conditions.

Finally, Table 7 and Figure 9 analyze the relation between *SlopeD* and $ECON$. This relation is also negative: the slope coefficient on $ECON$ is negative in all 24 specifications, and it is statistically significant in 14 of them (at the 95% confidence level; in five additional specifications, it is significant at the 90% confidence level). The relation is stronger for the summit subsample. The estimated kink in the piecewise linear regression is mostly positive but significant in only three specifications. Figure 9 shows that the relation between *SlopeD* and $ECON$ is not due to outliers, and that the dispersion in *SlopeD* is larger for summits and when the economy is weaker. To summarize, we find strong negative relations between economic conditions and all three option-market variables, as predicted by the theory.

4.3. The role of political uncertainty

Table 8 relates our three option-market variables to UNC, uncertainty about the election outcome, which is defined in Section 3.3. Our sample includes only elections because the poll spread data used in the construction of UNC are obviously unavailable for summits. We scale UNC to unit variance within each regression to facilitate the interpretation of the regression slope coefficients, analogous to the scaling of $ECON$ in Tables 5 through 8.

Column 1 of Table 8 reports the slope coefficients from the simple regressions of IVD (Panel A), $VRPD$ (Panel B), and *SlopeD* (Panel C) on UNC. The point estimates are positive for all three variables, but they are significant only for IVD and $VRPD$. A one-standard-deviation increase in UNC increases IVD by 1.87% per year ($t = 5.39$), a magnitude that exceeds the unconditional mean of IVD from Table 3. The same increase in UNC increases $VRPD$ by 0.0106 ($t = 3.48$), which is also substantial and close to the mean of $VRPD$ from Table 4. In contrast, the effect of UNC on *SlopeD* is smaller (0.0025, about one seventh of the unconditional mean of *SlopeD*) and indistinguishable from zero.

The rest of Table 8 reports results from multiple regressions of the option variables on UNC and controls for economic conditions, in both linear and piecewise linear specifications. The $ECON$ controls enter with negative signs throughout, consistent with our earlier results. The results for IVD are essentially unaffected by the addition of the $ECON$ controls: the slope on UNC remains positive, large, and highly significant for all four $ECON$ measures. The results for $VRPD$ also remain significant after controlling for $ECON$, at the 95% confidence level for MKT and GDP and 90% confidence level for FST and CLI. In contrast, the results for *SlopeD* are weak: the point estimate of the slope on UNC is positive for three of the four $ECON$ measures, but it is never statistically significant. This insignificance might be related to the sample size, which can be as low as 50. Recall that we have 64 election observations, but we lose some of them due to unavailable macro data and especially due to the tighter option data requirements in the construction of *SlopeD*.

Figure 10 plots the individual data points underlying the simple regressions in Table 8. The three panels plot IVD, $VRPD$, and *SlopeD* against UNC across all election events, along with the lines of best fit. All three of these lines are upward-sloping, reflecting the positive slope estimates in Column 1 of Table 8. There are no obvious outliers. Finally, the dispersion in the option-market variables is generally higher when UNC is higher.

Overall, we find strong positive relations between UNC and both IVD and $VRPD$, consistent with the theory. These results suggest that higher uncertainty about the election outcome increases the value of option protection against both price and variance risks associated with elections. The relation between UNC and *SlopeD* is weak—while the point estimates are mostly positive, they are statistically insignificant.

4.4. Robustness

We conduct four tests to assess the robustness of our results. First, we repeat our regressions without combining political event observations that are close in calendar time. Recall from Section 3.3. that we combine into a single observation all country events that share the same expiration date b in Figure 6. When we uncombine these events and include them separately, we find results that are very similar to those presented earlier.

Second, we repeat our tests on all summit observations listed in Table A.2, instead of just the economically relevant subset. The total number of summit observations thus increases by more than 40%: from 216 to 310 for IVD and $VRPD$, and from 191 to 273 for *SlopeD*. Table 9 summarizes our key results from the regressions of IVD, $VRPD$ and *SlopeD* on

$ECON$. (There are no regressions on UNC because the poll data underlying UNC are not available for summits.) There are two main findings. First, the point estimates of the slope coefficient on $ECON$ are negative for all three option variables in all 24 specifications, and they are statistically significant in 22 of them. Therefore, our earlier conclusions about the role of economic conditions hold also for the broader set of summits. Second, the magnitudes of the slope coefficients on $ECON$ are smaller compared to the corresponding regressions based on the subset of economically relevant summits (cf. Panels C in Tables 5, 6, and 7), almost without exception (23 out of 24 times). This is exactly what we should expect to see a priori: option prices should be less affected by summits that are less economically relevant. Overall, Table 9 supports our main conclusions.

Third, we repeat our tests on the subset of events for which there is no doubt about the exogeneity of the event's timing for treatment-group options. This is a large subset because elections and summits are usually scheduled many months or even years in advance. In some cases, early elections and extraordinary summits are scheduled only weeks in advance. We find that all elections in our sample, as well as the vast majority of summits, had been scheduled more than four weeks in advance. Therefore, the timing of these events is known to investors at the time we calculate the prices of treatment-group options, which is at most 20 trading days before the event (see Section 3.1.). Any political uncertainty associated with those events is thus completely exogenous from the investors' perspective. For only five events in our sample, we are unable to rule out the possibility that they had been scheduled less than four weeks in advance.[22] When we exclude those five events from our sample, we find very similar results that lead to the same conclusions.

Finally, we conduct a placebo test to alleviate the potential concern that our results might be caused by interactions between option prices and economic conditions rather than by political events. For example, market volatility is well known to be higher during economic crises. If elections or summits are more likely to occur during crises, our finding of higher volatility (and thus higher option prices) before political events could in principle be caused by crises rather than political events. We do not expect this concern to be valid given the differencing applied in the construction of our option-market variables (see equations (1), (4), and (6)). For example, we construct IVD by calculating IV for the nearest future option expiration date and then subtracting the average IV for the adjacent expiration dates, which typically occur one month earlier and one month later. This differencing approach should eliminate concerns about a spurious relation between option prices and political events. Nonetheless, we also conduct a placebo test to provide additional evidence.

[22]All five events are European summits: 20081107, 20090301, 20100507, 20110721, and 20111026.

The idea behind our placebo test is to repeat our regression tests many times on randomly chosen placebo samples of "pseudo-event" dates in which the treatment effect—the political event—is absent. For each placebo sample, we repeat our main analysis and retain the estimated coefficients. By comparing the actual coefficient estimates to the distribution of the same estimates in the placebo samples, we infer the probability of the null hypothesis that our empirical results have nothing to do with political events.

We construct 10,000 placebo samples. Each of these samples contains 271 pseudo-events, the same as the total number of political events in our actual sample. We allocate these 271 pseudo-events to countries based on the frequency of actual events in the data (column 1 of Table 2). For each country, we draw its pseudo-event dates randomly from the set of all dates satisfying two conditions: first, the date must not occur within 30 days of any actual political event for that country, and second, option data must be available to calculate IVD for that date and country. For each placebo sample, we calculate IVD, $VRPD$ and $SlopeD$ for each pseudo-event, record the means of the three variables, and regress these variables on the actual economic conditions at the time of each pseudo-event. These calculations match those used in Tables 3 through 7. Finally, we use the 10,000 samples to calculate one-sided p-values as the fractions of placebo estimates that exceed the actual estimate in the direction predicted by theory. For example, since the theory predicts a negative relation between IVD and $ECON$, the p-value reported for the slope from the regression of IVD on $ECON$ is the fraction of placebo estimates that are more negative than the actual slope estimate.

Table 10 shows the placebo test results corresponding to Tables 3 and 4, while Table 11 shows the results corresponding to Tables 5, 6, and 7. (There is no placebo test for Table 8 because UNC cannot be calculated for pseudo-event dates due to non-existent poll spread data.) Most p-values in Table 10 are smaller than 0.001, and all of them are smaller than 0.02. The only nontrivial p-value, 0.017, obtains for the difference in average IVD in weak versus strong conditions as measured by MKT. We see that even placebo samples can generate a positive weak-minus-strong difference in average IVD, perhaps due to the volatility feedback effect, but they are very unlikely to generate a difference as large as that observed in the data. Similarly, most p-values in Table 11 corresponding to the slope coefficient on $ECON$ are smaller than 0.001, and the largest one is 0.014. Overall, Tables 10 and 11 show that it is extremely unlikely that our results could arise spuriously.[23]

[23]We also run two modified versions of the placebo test. First, we require that the pseudo-event dates must not occur within 60 (instead of 30) days of any actual political event. Second, we draw the pseudo-event dates from the subset of available dates that exhibit high market volatility; specifically, dates on which volatility exceeds the full-sample median volatility for the given country. Both versions of the placebo test produce results very similar to those reported in Tables 10 and 11.

5. Conclusions

We find that political uncertainty is priced in the option market. Options provide valuable protection against the risk associated with major political events. Option protection against price, variance, and tail risks is more expensive before a political event. This protection is more valuable when the economy is weaker and when political uncertainty is higher.

These empirical findings are consistent with the predictions of the theoretical model of government policy choice of Pástor and Veronesi (2012, 2013). In this model, as in reality, government policy affects many firms. As a result, government-related risk cannot be fully diversified away, and political uncertainty carries a risk premium. Moreover, this premium is larger when the economy is weaker because that is when policy changes and election upsets are more likely to occur. Our results indeed suggest sizable risk premia for various aspects of political uncertainty, with larger magnitudes in weaker economic conditions.

We analyze two types of political events: national elections and global summits. Since these events capture only a subset of the political uncertainty faced by investors, our findings represent a lower bound on the importance of political risk for asset prices. Future research can analyze the uncertainty associated with other political events, such as regulatory reforms, government shutdowns, and wars. Future work can also examine the effects of political risk on other assets, such as stocks, currencies, and sovereign debt. On the theory side, endogenizing political costs in the PV model could potentially lead to a richer set of testable predictions for the prices of options as well as other assets. In general, more work is needed to improve our understanding of the role of political risk, and government more broadly, in the pricing of financial assets.

Table 1
Option sample

The table gives an overview of our option sample. For each country listed in the first column, the second column reports the index underlying the country's options that are used in our analysis. The third and fourth columns report the beginning and ending dates for the available option data. All data come from OptionMetrics, except for pre-1996 U.S. data, which come from Market Data Express (MDR).

Country	Index	Start Date	End Date
Australia	ASX 200	20040102	20120604
Belgium	BEL20	20020102	20120831
Brazil	MSCI Brazil	20060525	20120131
Canada	MSCI Canada	20060302	20120131
Finland	OMXH25	20020102	20120831
France	CAC 40	20030414	20120831
Germany	DAX	20020102	20120831
Italy	FTSE MIB	20061011	20120831
Japan	NIKKEI 225	20040506	20120604
Korea	Kospi	20040503	20120131
Mexico	MSCI Mexico	20071129	20120131
Netherlands	AEX	20020102	20120831
Singapore	MSCI Singapore	20091118	20120131
South Africa	MSCI South Africa	20070524	20120131
Spain	IBEX 35	20070514	20120831
Sweden	OMXS30	20070126	20120831
Switzerland	SMI	20020102	20120831
Taiwan	TAIEX	20040102	20120131
UK	FTSE 100	20020102	20120831
USA	S&P 500	19900101	20120131

Table 2
Number of political events

The table reports the number of political events in our sample by event type and country. These are events for which option data are available so that it is possible to calculate IVD in equation (1). Totals represent the size of a set union, so they may be smaller than the sum of the subset sizes. For example, parliamentary and presidential elections may take place on the same date, in which case they are counted only once in the total. In addition, we combine into a single observation all country events that are so close together in calendar time that they are followed by the same first option expiration date (i.e., we combine events that share the same expiration date b in Figure 6). Euro summits are included as observations for all European countries; G8 summits for all G8 countries, and G20 summits for all G20 countries. The 2012 Greek elections are included as observations for all European countries.

		Elections			Summits		
	Total	Total	Parl.	Pres.	Total	Euro	G8/G20
All	271	64	57	14	216	170	74
Australia	6	1	1	0	5	0	5
Belgium	13	2	2	0	11	11	0
Brazil	9	4	2	4	6	0	6
Canada	7	2	2	0	6	0	6
Finland	1	0	0	0	1	1	0
France	27	6	4	2	21	21	7
Germany	25	5	5	0	21	21	7
Italy	24	3	3	0	21	21	7
Japan	10	4	4	0	6	0	6
Korea	8	2	1	1	6	0	6
Mexico	7	1	1	0	6	0	6
Netherlands	22	3	3	0	19	19	0
Singapore	2	2	1	1	0	0	0
South Africa	6	1	1	0	5	0	5
Spain	20	4	4	0	17	17	0
Sweden	19	2	2	0	18	18	0
Switzerland	24	5	5	0	20	20	0
Taiwan	2	2	1	1	0	0	0
UK	24	4	4	0	21	21	7
USA	15	11	11	5	6	0	6

Table 3
Mean implied volatility differences

Column 1 reports the average value of IVD, the implied volatility difference from equation (1), across all political events. Columns 2 through 5 report differences between the average values of IVD in weak economic conditions ($ECON < 0$) and strong economic conditions ($ECON \geq 0$). We use four measures of economic conditions: the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. IVD is in percent per year. The t-statistics, reported in parentheses, use standard errors with two-way clustering at the month and country levels. Panel A uses all observations while Panels B and C report results for election and summit events separately.

		Weak minus strong economy			
	All	MKT	GDP	FST	CLI
		Panel A: All political events			
Mean	1.43	2.57	1.94	2.22	3.00
	(4.43)	(3.79)	(3.34)	(3.78)	(4.61)
Obs.	271	271	271	266	267
		Panel B: Elections only			
Mean	1.63	2.63	1.73	2.51	2.36
	(3.13)	(2.73)	(1.78)	(2.34)	(2.39)
Obs.	64	64	64	59	60
		Panel C: Summits only			
Mean	1.42	2.68	2.13	2.40	3.25
	(3.76)	(3.27)	(3.17)	(3.56)	(4.30)
Obs.	216	216	216	216	216

Table 4
Variance risk premium and implied volatility slope: Mean differences

The left-hand side of the table reports results for $VRPD$, the variance risk premium difference from equation (4), whereas the right-hand side reports results for *SlopeD*, the implied volatility slope difference from equation (6). The first column on each side reports the average value of $VRPD$ (column 1) or *SlopeD* (column 6) across all political events. The remaining columns report differences between the average values of $VRPD$ or *SlopeD* in weak economic conditions ($ECON < 0$) and strong economic conditions ($ECON \geq 0$). We use four measures of economic conditions: the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. $VRPD$ is in decimals per year. Both $VRPD$ and *SlopeD* are multiplied by 100. The t-statistics, reported in parentheses, use standard errors with two-way clustering at the month and country levels. Panel A uses all observations while Panels B and C report results for election and summit events separately.

	Variance risk premium ($VRPD$)					Implied volatility slope (*SlopeD*)				
		Weak minus strong economy					Weak minus strong economy			
	All	MKT	GDP	FST	CLI	All	MKT	GDP	FST	CLI
					Panel A: All political events					
Mean	1.07	3.02	2.07	2.55	3.05	1.73	3.26	2.11	2.66	3.02
	(2.61)	(3.51)	(2.80)	(3.54)	(3.63)	(3.59)	(3.11)	(2.52)	(3.08)	(2.97)
Obs.	271	271	271	266	267	238	238	238	233	236
					Panel B: Elections only					
Mean	1.30	2.46	1.07	2.45	1.26	1.14	3.56	1.14	1.96	1.38
	(2.59)	(2.62)	(1.11)	(2.20)	(1.25)	(2.08)	(3.69)	(1.08)	(1.71)	(1.28)
Obs.	64	64	64	59	60	55	55	55	50	53
					Panel C: Summits only					
Mean	1.07	3.39	2.58	2.97	3.75	1.84	3.43	2.53	2.87	3.46
	(2.15)	(3.15)	(2.92)	(3.49)	(3.74)	(3.16)	(2.58)	(2.54)	(2.83)	(2.80)
Obs.	216	216	216	216	216	191	191	191	191	191

Table 5
Implied volatility difference and economic conditions

The table reports the slope coefficients from the regressions of IVD, the implied volatility difference from equation (1), on four different measures of economic conditions ($ECON$). For each of the four measures, we estimate a simple regression of IVD on $ECON$ as well as a piecewise linear regression of IVD on both $ECON$ and $ECON$ times an indicator for $ECON$ being positive. The four measures of economic conditions are the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. We then scale all four $ECON$ variables to unit variance within each regression. IVD is in percent per year. The t-statistics, reported in parentheses, use standard errors with two-way clustering at the month and country levels. Panel A uses all observations while Panels B and C report results for election and summit events separately.

	Measure of economic conditions							
	MKT		GDP		FST		CLI	
				Panel A: All political events				
$ECON$	-2.42	-3.58	-2.01	-2.71	-0.83	-0.63	-1.39	-1.47
	(-5.34)	(-5.10)	(-4.82)	(-5.01)	(-2.55)	(-1.37)	(-3.85)	(-2.74)
$ECON \cdot 1_{(ECON>0)}$		3.77		4.02		-0.96		0.26
		(3.33)		(3.85)		(-0.87)		(0.28)
R^2	0.21	0.25	0.14	0.18	0.02	0.03	0.07	0.07
Obs.	271	271	271	271	266	266	267	267
				Panel B: Elections only				
$ECON$	-1.72	-2.60	-1.56	-2.39	-1.69	-2.01	-1.34	-1.10
	(-3.49)	(-3.51)	(-3.03)	(-4.63)	(-3.00)	(-2.09)	(-2.15)	(-0.86)
$ECON \cdot 1_{(ECON>0)}$		2.69		3.26		1.18		-0.57
		(1.62)		(2.75)		(0.61)		(-0.34)
R^2	0.17	0.20	0.14	0.18	0.15	0.16	0.12	0.13
Obs.	64	64	64	64	59	59	60	60
				Panel C: Summits only				
$ECON$	-2.68	-3.93	-2.27	-3.02	-0.77	-0.54	-1.53	-1.88
	(-5.04)	(-4.86)	(-4.84)	(-5.08)	(-2.10)	(-1.10)	(-3.91)	(-3.18)
$ECON \cdot 1_{(ECON>0)}$		4.16		4.61		-1.26		1.23
		(3.24)		(3.89)		(-0.95)		(1.04)
R^2	0.23	0.28	0.17	0.20	0.02	0.02	0.08	0.08
Obs.	216	216	216	216	216	216	216	216

Table 6
Variance risk premium difference and economic conditions

The table reports the slope coefficients from the regressions of $VRPD$, the variance risk premium difference from equation (4), on four different measures of economic conditions ($ECON$). For each of the four measures, we estimate a simple regression of $VRPD$ on $ECON$ as well as a piecewise linear regression of $VRPD$ on both $ECON$ and $ECON$ times an indicator for $ECON$ being positive. The four measures of economic conditions are the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. We then scale all four $ECON$ variables to unit variance within each regression. $VRPD$ is annualized and multiplied by 100. The t-statistics, reported in parentheses, use standard errors with two-way clustering at the month and country levels. Panel A uses all observations while Panels B and C report results for election and summit events separately.

	Measure of economic conditions							
	MKT		GDP		FST		CLI	
	Panel A: All political events							
$ECON$	-2.98	-4.55	-1.97	-2.43	-1.32	-1.40	-1.72	-2.23
	(-4.56)	(-4.45)	(-3.52)	(-3.40)	(-3.42)	(-2.50)	(-3.38)	(-2.88)
$ECON \cdot 1_{(ECON>0)}$		5.10		2.62		0.35		1.75
		(3.41)		(1.67)		(0.27)		(1.44)
R^2	0.19	0.24	0.08	0.09	0.04	0.04	0.06	0.07
Obs.	271	271	271	271	266	266	267	267
	Panel B: Elections only							
$ECON$	-1.62	-2.22	-1.32	-2.79	-1.78	-1.76	-1.18	-1.79
	(-2.34)	(-1.90)	(-1.78)	(-3.80)	(-2.69)	(-1.70)	(-1.51)	(-1.18)
$ECON \cdot 1_{(ECON>0)}$		1.86		5.79		-0.09		1.40
		(0.92)		(3.73)		(-0.05)		(0.70)
R^2	0.16	0.18	0.11	0.25	0.18	0.18	0.09	0.10
Obs.	64	64	64	64	59	59	60	60
	Panel C: Summits only							
$ECON$	-3.45	-5.27	-2.32	-2.67	-1.40	-1.53	-2.01	-2.69
	(-4.52)	(-4.53)	(-3.67)	(-3.39)	(-3.13)	(-2.48)	(-3.56)	(-3.08)
$ECON \cdot 1_{(ECON>0)}$		6.07		2.17		0.71		2.37
		(3.59)		(1.18)		(0.46)		(1.56)
R^2	0.22	0.28	0.10	0.10	0.04	0.04	0.07	0.08
Obs.	216	216	216	216	216	216	216	216

Table 7
Implied volatility slope difference and economic conditions

The table reports the slope coefficients from the regressions of *SlopeD*, the implied volatility slope difference from equation (6), on four different measures of economic conditions ($ECON$). For each of the four measures, we estimate a simple regression of *SlopeD* on $ECON$ as well as a piecewise linear regression of *SlopeD* on both $ECON$ and $ECON$ times an indicator for $ECON$ being positive. The four measures of economic conditions are the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. We then scale all four $ECON$ variables to unit variance within each regression. *SlopeD* is multiplied by 100. The t-statistics, reported in parentheses, use standard errors with two-way clustering at the month and country levels. Panel A uses all observations while Panels B and C report results for election and summit events separately.

	Measure of economic conditions							
	MKT		GDP		FST		CLI	
	Panel A: All political events							
$ECON$	-3.19	-5.37	-2.20	-2.77	-0.78	-0.32	-1.62	-1.96
	(-3.82)	(-4.21)	(-3.02)	(-2.87)	(-1.66)	(-0.48)	(-2.47)	(-1.89)
$ECON \cdot 1_{(ECON>0)}$		6.86		3.11		-2.15		1.08
		(3.62)		(1.83)		(-1.34)		(0.66)
R^2	0.19	0.26	0.09	0.10	0.01	0.02	0.05	0.05
Obs.	238	238	238	238	233	233	236	236
	Panel B: Elections only							
$ECON$	-2.11	-1.70	-1.21	-2.34	-0.31	-0.18	-0.98	-1.05
	(-5.26)	(-2.13)	(-2.22)	(-3.50)	(-0.42)	(-0.16)	(-1.70)	(-0.81)
$ECON \cdot 1_{(ECON>0)}$		-1.17		3.38		-0.48		0.12
		(-0.77)		(2.13)		(-0.19)		(0.07)
R^2	0.27	0.28	0.09	0.15	0.01	0.01	0.06	0.06
Obs.	55	55	55	55	50	50	53	53
	Panel C: Summits only							
$ECON$	-3.54	-6.15	-2.49	-3.01	-0.88	-0.28	-1.78	-2.20
	(-3.58)	(-4.28)	(-3.01)	(-2.86)	(-1.66)	(-0.38)	(-2.41)	(-1.88)
$ECON \cdot 1_{(ECON>0)}$		8.42		3.13		-3.10		1.41
		(3.95)		(1.63)		(-1.68)		(0.69)
R^2	0.19	0.28	0.10	0.10	0.01	0.02	0.05	0.05
Obs.	191	191	191	191	191	191	191	191

Table 8
The role of election uncertainty

Panel A reports the slope coefficients from the regressions of IVD, the implied volatility difference from equation (1), on our measure of political uncertainty (UNC). Panel B replaces IVD with $VRPD$, the variance risk premium difference from equation (4), while Panel C replaces it with *SlopeD*, the implied volatility slope difference from equation (6). The uncertainty measure UNC, which is defined as the negative of the election poll spread, proxies for uncertainty about the election outcome. We estimate a simple regression on UNC as well as multiple regressions that include controls for four different measures of economic conditions ($ECON$), in both linear and piecewise linear specifications. The four measures are the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). Both IVD and $VRPD$ are annualized and multiplied by 100. *SlopeD* is also multiplied by 100. We scale UNC to unit variance within each regression. The t-statistics, reported in parentheses, use standard errors with two-way clustering at the month and country levels.

		Measure of economic conditions							
		MKT		GDP		FST		CLI	
				Panel A: Implied volatility (IVD)					
UNC	1.87	1.64	1.58	1.80	1.82	1.68	1.69	1.44	1.45
	(5.39)	(4.52)	(4.43)	(4.93)	(4.49)	(4.11)	(4.28)	(3.21)	(3.14)
$ECON$		-1.46	-2.17	-1.47	-2.34	-1.36	-1.72	-1.52	-1.61
		(-2.98)	(-2.85)	(-3.27)	(-5.57)	(-2.45)	(-1.89)	(-3.26)	(-1.77)
$ECON \cdot 1_{(ECON>0)}$			2.14		3.41		1.34		0.22
			(1.39)		(2.65)		(0.80)		(0.17)
R^2	0.20	0.31	0.34	0.32	0.37	0.29	0.30	0.26	0.26
Obs.	64	64	64	64	64	59	59	60	60
				Panel B: Variance risk premium ($VRPD$)					
UNC	1.06	0.82	0.78	0.99	1.03	0.74	0.74	0.89	1.00
	(3.48)	(2.39)	(2.32)	(2.54)	(2.31)	(1.91)	(1.89)	(1.75)	(1.76)
$ECON$		-1.49	-2.01	-1.27	-2.76	-1.64	-1.63	-1.29	-2.15
		(-2.10)	(-1.66)	(-1.75)	(-3.90)	(-2.38)	(-1.58)	(-1.80)	(-1.66)
$ECON \cdot 1_{(ECON>0)}$			1.59		5.87		-0.02		1.95
			(0.79)		(3.69)		(-0.01)		(1.09)
R^2	0.07	0.20	0.21	0.17	0.32	0.21	0.21	0.14	0.17
Obs.	64	64	64	64	64	59	59	60	60
				Panel C: Implied volatility slope (*SlopeD*)					
UNC	0.25	-0.11	-0.14	0.07	0.11	0.25	0.24	0.23	0.24
	(0.59)	(-0.33)	(-0.39)	(0.17)	(0.27)	(0.50)	(0.47)	(0.56)	(0.57)
$ECON$		-2.13	-1.71	-1.20	-2.33	-0.28	-0.17	-0.98	-1.07
		(-5.08)	(-2.12)	(-2.16)	(-3.39)	(-0.36)	(-0.15)	(-1.67)	(-0.82)
$ECON \cdot 1_{(ECON>0)}$			-1.20		3.40		-0.39		0.18
			(-0.78)		(2.13)		(-0.16)		(0.10)
R^2	0.00	0.27	0.28	0.09	0.15	0.01	0.01	0.06	0.06
Obs.	55	55	55	55	55	50	50	53	53

Table 9
Robustness: All summits

The table reports the slope coefficients from the regressions of IVD (Panel A), $VRPD$ (Panel B), and *SlopeD* (Panel C) on four different measures of economic conditions ($ECON$) using all summit events listed in Table A.2, regardless of their economic relevance. For each of the four measures, we estimate a simple regression of each dependent variable on $ECON$ as well as a piecewise linear regression of the dependent variable on both $ECON$ and $ECON$ times an indicator for $ECON$ being positive. The four measures of economic conditions are the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. We then scale all four $ECON$ variables to unit variance within each regression. IVD is in percent per year, $VRPD$ is in decimals per year, and both $VRPD$ and *SlopeD* are multiplied by 100. The t-statistics, reported in parentheses, use standard errors with two-way clustering at the month and country levels.

	Measure of economic conditions							
	MKT		GDP		FST		CLI	
	Panel A: Implied volatility (IVD)							
$ECON$	-1.85	-3.28	-1.74	-2.51	-0.69	-0.44	-1.13	-1.72
	(-4.11)	(-4.44)	(-4.46)	(-4.97)	(-2.54)	(-1.18)	(-3.49)	(-3.36)
$ECON \cdot 1_{(ECON>0)}$		4.00		4.27		-1.16		1.82
		(3.69)		(4.42)		(-1.13)		(1.97)
R^2	0.14	0.19	0.12	0.16	0.02	0.02	0.05	0.06
Obs.	310	310	310	310	310	310	310	310
	Panel B: $VRPD$							
$ECON$	-2.76	-4.72	-2.03	-2.36	-1.10	-1.06	-1.82	-2.74
	(-4.53)	(-4.62)	(-3.98)	(-3.55)	(-3.42)	(-2.25)	(-4.05)	(-3.55)
$ECON \cdot 1_{(ECON>0)}$		5.50		1.79		-0.16		2.82
		(3.88)		(1.29)		(-0.13)		(2.27)
R^2	0.18	0.25	0.10	0.10	0.03	0.03	0.08	0.09
Obs.	310	310	310	310	310	310	310	310
	Panel C: *SlopeD*							
$ECON$	-2.44	-4.95	-1.98	-2.55	-0.82	-0.22	-1.37	-2.17
	(-2.91)	(-3.64)	(-2.94)	(-2.86)	(-2.11)	(-0.38)	(-2.36)	(-2.18)
$ECON \cdot 1_{(ECON>0)}$		6.93		3.03		-2.80		2.34
		(3.60)		(1.92)		(-1.88)		(1.43)
R^2	0.11	0.19	0.07	0.08	0.01	0.02	0.03	0.04
Obs.	273	273	273	273	273	273	273	273

Table 10
Placebo events and mean differences

The first column in each panel compares the average values of IVD (Panel A), $VRPD$ (Panel B), and *SlopeD* (Panel C) from two samples: our actual data sample and a sample of placebo events. We generate 10,000 placebo samples, each including 271 placebo event dates that are randomly selected from the option samples listed in Table 1. We impose that the frequency of draws from each country's sample matches the frequency of events in column 1 of Table 2 and that placebo events do not occur within 30 days of an actual political event in our sample. The first column reports averages of IVD, $VRPD$, and *SlopeD* across all placebo events while the remaining columns report differences between the averages in weak economic conditions ($ECON < 0$) and strong economic conditions ($ECON \geq 0$). We use four measures of economic conditions: the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. IVD is in percent per year, $VRPD$ is in decimals per year, and both $VRPD$ and *SlopeD* are multiplied by 100. The reported p-values are the fraction of placebo estimates that exceed the actual estimate in the direction predicted by theory.

		Weak minus strong economy			
	All	MKT	GDP	FST	CLI
		Panel A: IVD			
Mean (data)	1.43	2.57	1.94	2.22	3.00
Mean (pseudo-events)	-0.32	1.35	-0.63	-1.63	-1.03
Difference	1.75	1.22	2.57	3.85	4.03
p-value	<0.001	0.017	<0.001	<0.001	<0.001
Obs.	271	271	271	266	267
		Panel B: $VRPD$			
Mean (data)	1.07	3.02	2.07	2.55	3.05
Mean (pseudo-events)	-0.26	0.21	-0.11	-0.44	-0.61
Difference	1.33	2.81	2.18	2.99	3.66
p-value	<0.001	<0.001	<0.001	<0.001	<0.001
Obs.	271	271	271	266	267
		Panel C: *SlopeD*			
Mean (data)	1.73	3.26	2.11	2.66	3.02
Mean (pseudo-events)	-0.31	0.41	-0.65	0.59	-0.46
Difference	2.04	2.85	2.75	2.06	3.48
p-value	<0.001	0.005	<0.001	<0.001	<0.001
Obs.	238	238	238	233	236

Table 11
Placebo events and economic conditions

The table compares the slope coefficients from the regressions of IVD (Panel A), $VRPD$ (Panel B), and $SlopeD$ (Panel C) on four different measures of economic conditions ($ECON$) from two samples: our actual data sample and a sample of placebo events. We generate 10,000 placebo samples, each including 271 placebo event dates that are randomly selected from the option samples listed in Table 1. We impose that the frequency of draws from each country's sample matches the frequency of events in column 1 of Table 2 and that placebo events do not occur within 30 days of an actual political event in our sample. For each of the four measures of economic conditions, we estimate a simple regression of each dependent variable on $ECON$ as well as a piecewise linear regression on both $ECON$ and $ECON$ times an indicator for $ECON$ being positive. The four measures of economic conditions are the country's stock market index return (MKT), real GDP growth (GDP), the IMF's GDP growth forecast (FST), and the OECD's Composite Leading Indicator (CLI). We standardize GDP, FST, and CLI to zero mean within each country by using data from 1990 through 2012. We then scale all four $ECON$ variables to unit variance within each regression. IVD is in percent per year, $VRPD$ is in decimals per year, and both $VRPD$ and $SlopeD$ are multiplied by 100. The reported p-values are the fraction of placebo estimates that exceed the actual estimate in the direction predicted by theory.

		Measure of economic conditions							
		MKT		GDP		FST		CLI	
					Panel A: IVD				
$ECON$	Data	-2.42	-3.58	-2.01	-2.71	-0.83	-0.63	-1.39	-1.47
	Placebo	-0.89	-1.29	0.77	1.21	0.81	0.95	0.79	1.10
	Difference	-1.53	-2.29	-2.77	-3.92	-1.64	-1.58	-2.18	-2.57
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
$ECON\cdot$	Data		3.77		4.02		-0.96		0.26
$1_{(ECON>0)}$	Placebo		1.00		-1.55		-0.32		-0.73
	Difference		2.77		5.57		-0.64		0.99
	p-value		<0.001		<0.001		0.593		0.102
Obs.		271	271	271	271	266	266	267	267
					Panel B: $VRPD$				
$ECON$	Data	-2.98	-4.55	-1.97	-2.43	-1.32	-1.40	-1.72	-2.23
	Placebo	-0.30	-0.51	0.51	0.88	0.38	0.73	0.47	1.12
	Difference	-2.68	-4.03	-2.48	-3.31	-1.70	-2.12	-2.19	-3.35
	p-value	<0.001	<0.001	<0.001	<0.001	0.002	0.003	0.001	0.002
$ECON\cdot$	Data		5.10		2.62		0.35		1.75
$1_{(ECON>0)}$	Placebo		0.68		-1.55		-0.72		-1.64
	Difference		4.42		4.17		1.07		3.39
	p-value		0.002		0.026		0.067		0.004
Obs.		271	271	271	271	266	266	267	267
					Panel C: $SlopeD$				
$ECON$	Data	-3.19	-5.37	-2.20	-2.77	-0.78	-0.32	-1.62	-1.96
	Placebo	-0.67	-1.00	0.71	1.27	0.52	0.71	0.74	1.22
	Difference	-2.52	-4.37	-2.91	-4.03	-1.30	-1.03	-2.36	-3.17
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	0.014	<0.001	<0.001
$ECON\cdot$	Data		6.86		3.11		-2.15		1.08
$1_{(ECON>0)}$	Placebo		0.55		-1.29		-0.83		-1.51
	Difference		6.31		4.40		-1.31		2.59
	p-value		<0.001		<0.001		0.601		0.001
Obs.		238	238	238	238	233	233	236	236

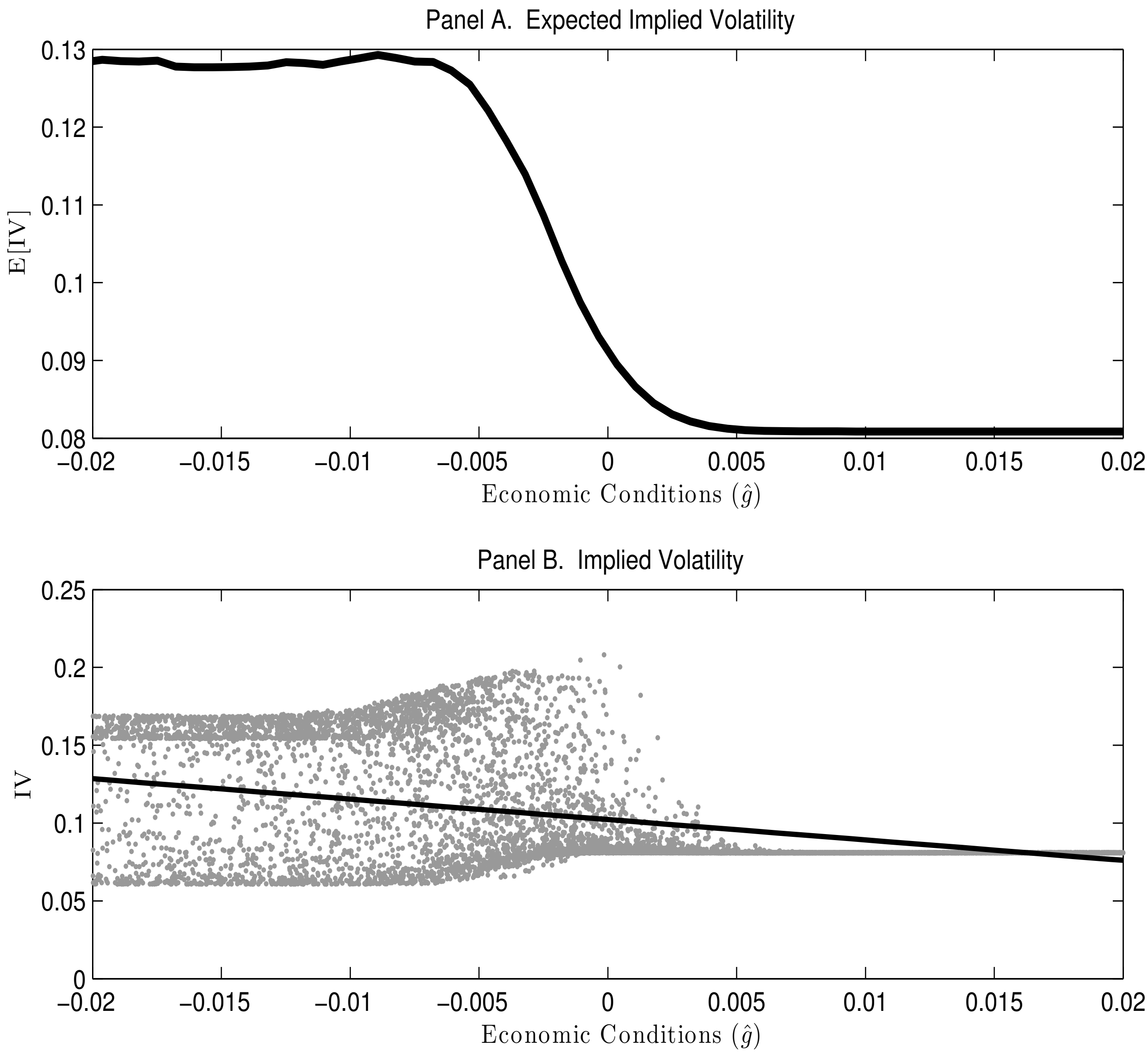

Figure 1. Implied volatility level vs. economic conditions: Theory. Panel A plots the expected value as of time $t = \tau - 1/2$ of the implied volatility of a one-period at-the-money option that expires at time $\tau + 1/2$, where τ is the event date. The expectation is computed by averaging realized implied volatility values across many samples simulated from the model. Panel B plots the realized implied volatility values for a large random subset of those simulated samples. In both panels, quantities are plotted as a function of $\hat{g}_t$, which is the posterior mean of the old policy's impact as of time $t = \tau - 1/2$. High values of $\hat{g}_t$ indicate strong economic conditions; low values indicate weak conditions. The straight line in Panel B is the regression line of best fit estimated across the simulated samples.

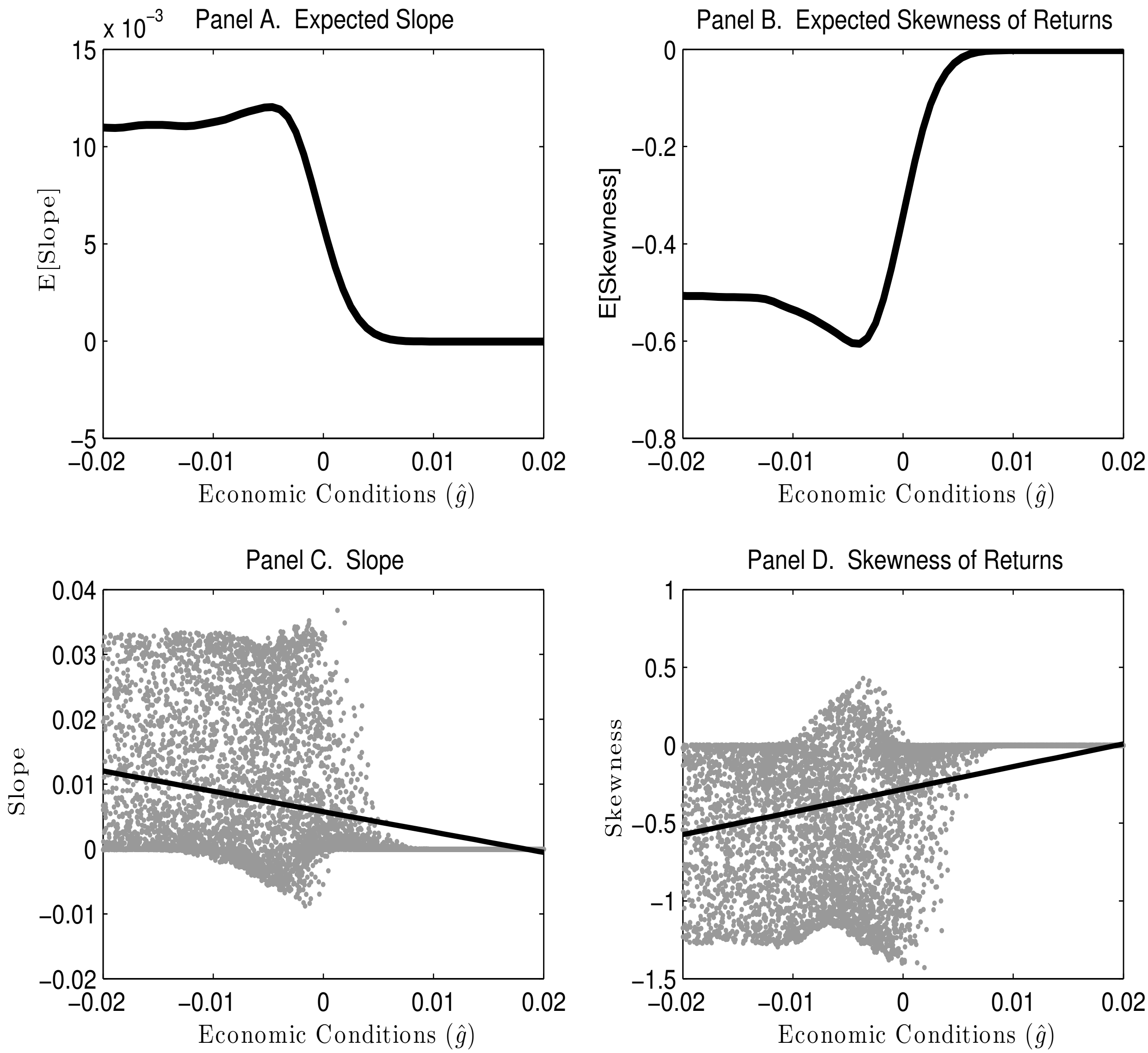

Figure 2. Implied volatility slope and return skewness vs. economic conditions: Theory. Panel A plots the expected value as of time $t = \tau - 1/2$ of the implied volatility slope of a one-period option that expires at time $\tau + 1/2$, where τ is the event date. The slope is computed as the difference between the implied volatilities of an option that is 5% out of the money and an option that is 5% in the money. The expected slope is computed by averaging realized slope values across many samples simulated from the model. Panel C plots the realized slope values for a large random subset of those simulated samples. Panel B plots the expected value as of time $t = \tau - 1/2$ of the skewness of log stock market returns between times $\tau - 1/2$ and $\tau + 1/2$. The expected skewness is computed by averaging realized skewness values across many samples simulated from the model. Panel D plots the realized skewness values for a large random subset of those simulated samples. In all four panels, quantities are plotted as a function of $\hat{g}_t$, which is the posterior mean of the old policy's impact as of time $t = \tau - 1/2$. High values of $\hat{g}_t$ indicate strong economic conditions; low values indicate weak conditions. The straight lines in Panels C and D are the regression lines of best fit estimated across the simulated samples.

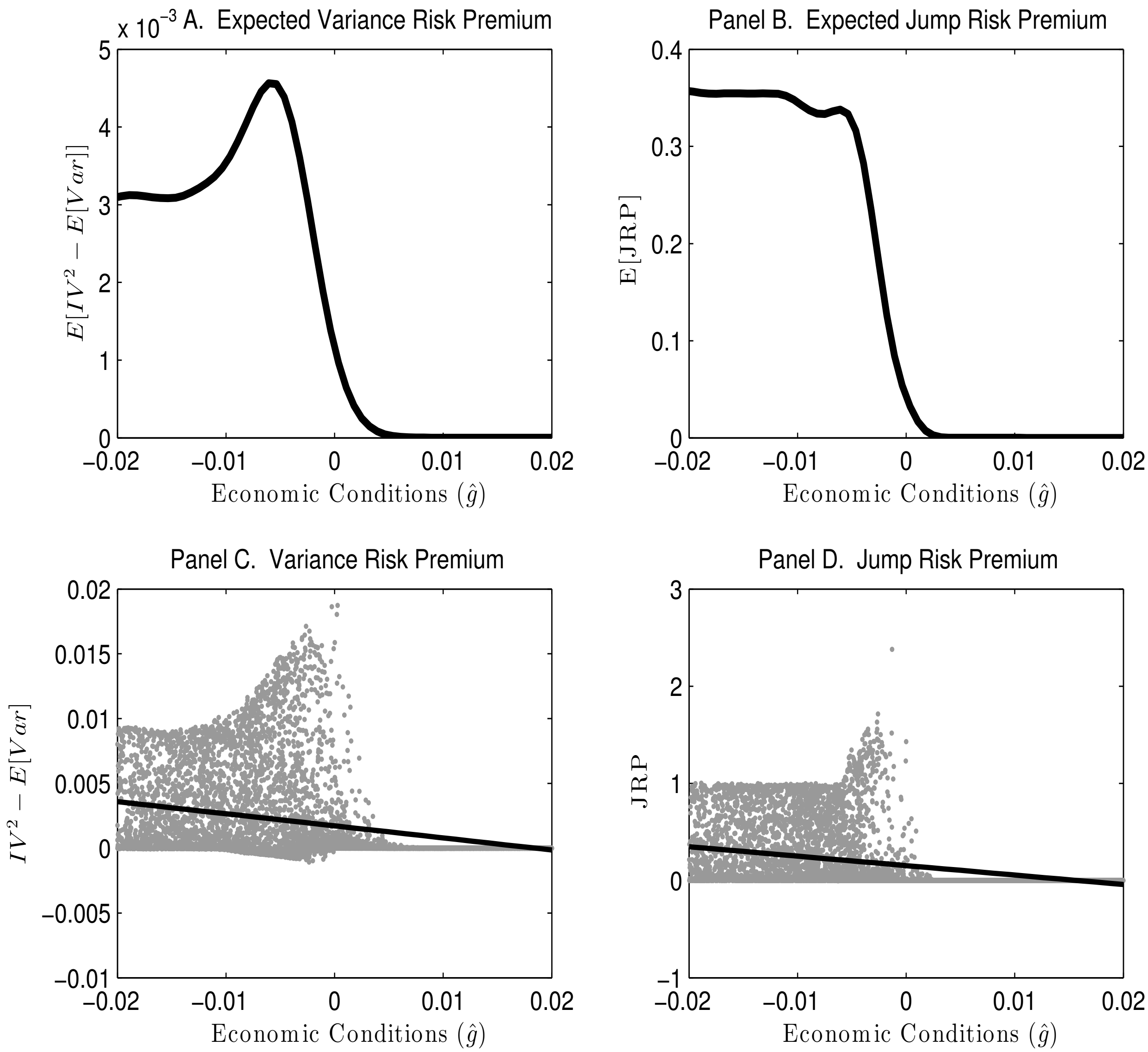

Figure 3. Variance risk premium and jump risk premium vs. economic conditions: Theory. Panel A plots the expected value as of time $t = \tau - 1/2$ of the variance risk premium (VRP) of a one-period at-the-money option that expires at time $\tau + 1/2$, where τ is the event date. The VRP is computed as the difference between the option's implied variance and the expected realized variance of stock market returns between times $\tau - 1/2$ and $\tau + 1/2$. The expected VRP is computed by averaging realized VRP values across many samples simulated from the model. Panel C plots the realized VRP values for a large random subset of those simulated samples. Panel B plots the expected value as of time $t = \tau - 1/2$ of the jump risk premium (JRP), which is equal to the expected instantaneous stock market return at time τ. The expected JRP is computed by averaging realized JRP values across many samples simulated from the model. Panel D plots the realized JRP values for a large random subset of those simulated samples. In all four panels, quantities are plotted as a function of $\hat{g}_t$, which is the posterior mean of the old policy's impact as of time $t = \tau - 1/2$. High values of $\hat{g}_t$ indicate strong economic conditions; low values indicate weak conditions. The straight lines in Panels C and D are the regression lines of best fit estimated across the simulated samples.

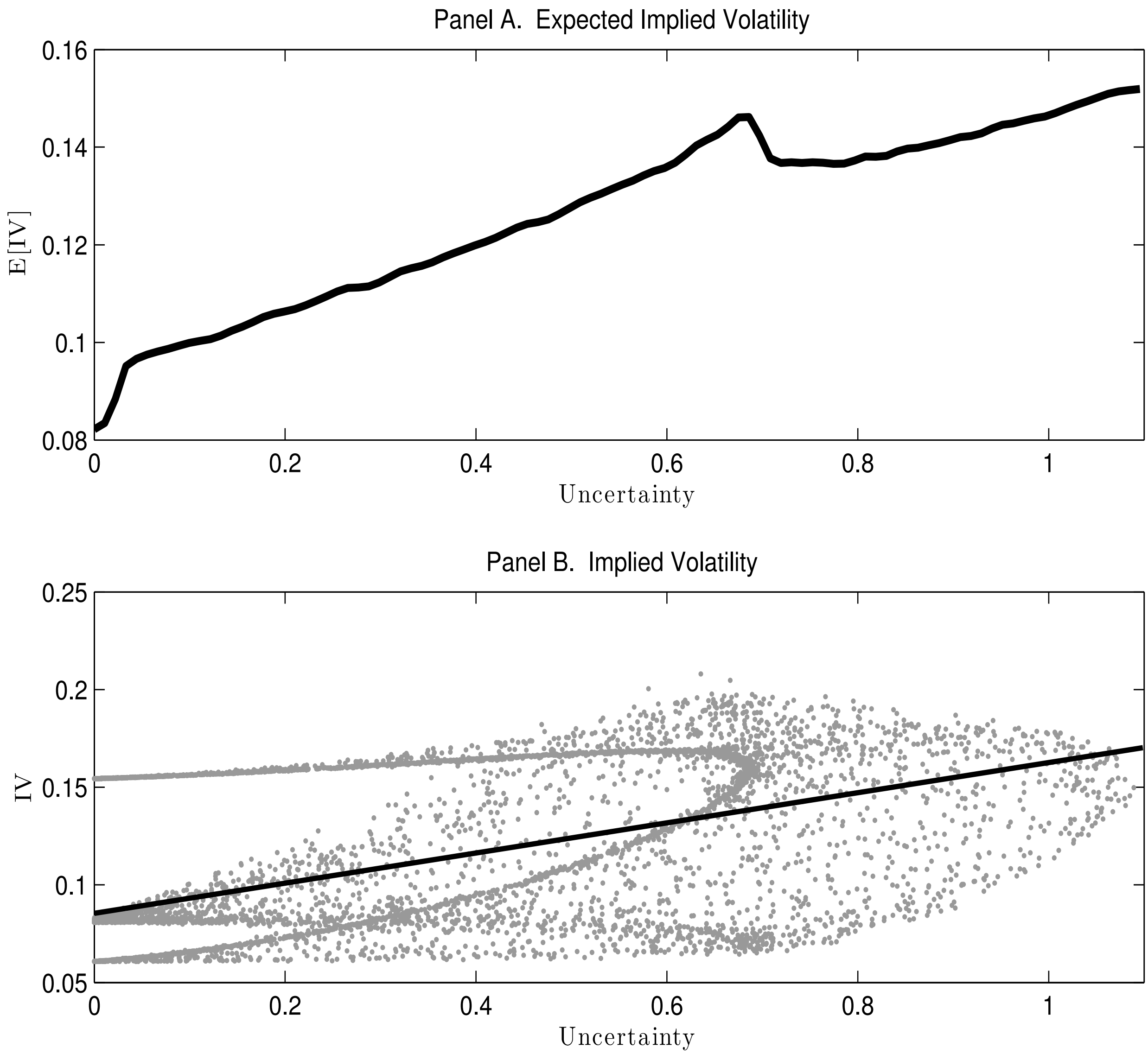

Figure 4. Implied volatility level vs. political uncertainty: Theory. Panel A plots the expected value as of time $t = \tau - 1/2$ of the implied volatility of a one-period at-the-money option that expires at time $\tau + 1/2$, where τ is the event date. The expectation is computed by averaging realized implied volatility values across many samples simulated from the model. Panel B plots the realized implied volatility values for a large random subset of those simulated samples. In both panels, quantities are plotted as a function of political uncertainty, which is measured by the entropy of the probabilities of the three available policies (the old/prevailing policy O and the potential new policies H and L). Specifically, uncertainty is equal to $-p_t^H \log p_t^H - p_t^L \log p_t^L - p_t^0 \log p_t^0$, where p_t^i denotes the probability of policy i as of time $\tau - 1/2$. The straight line in Panel B is the regression line of best fit estimated across the simulated samples.

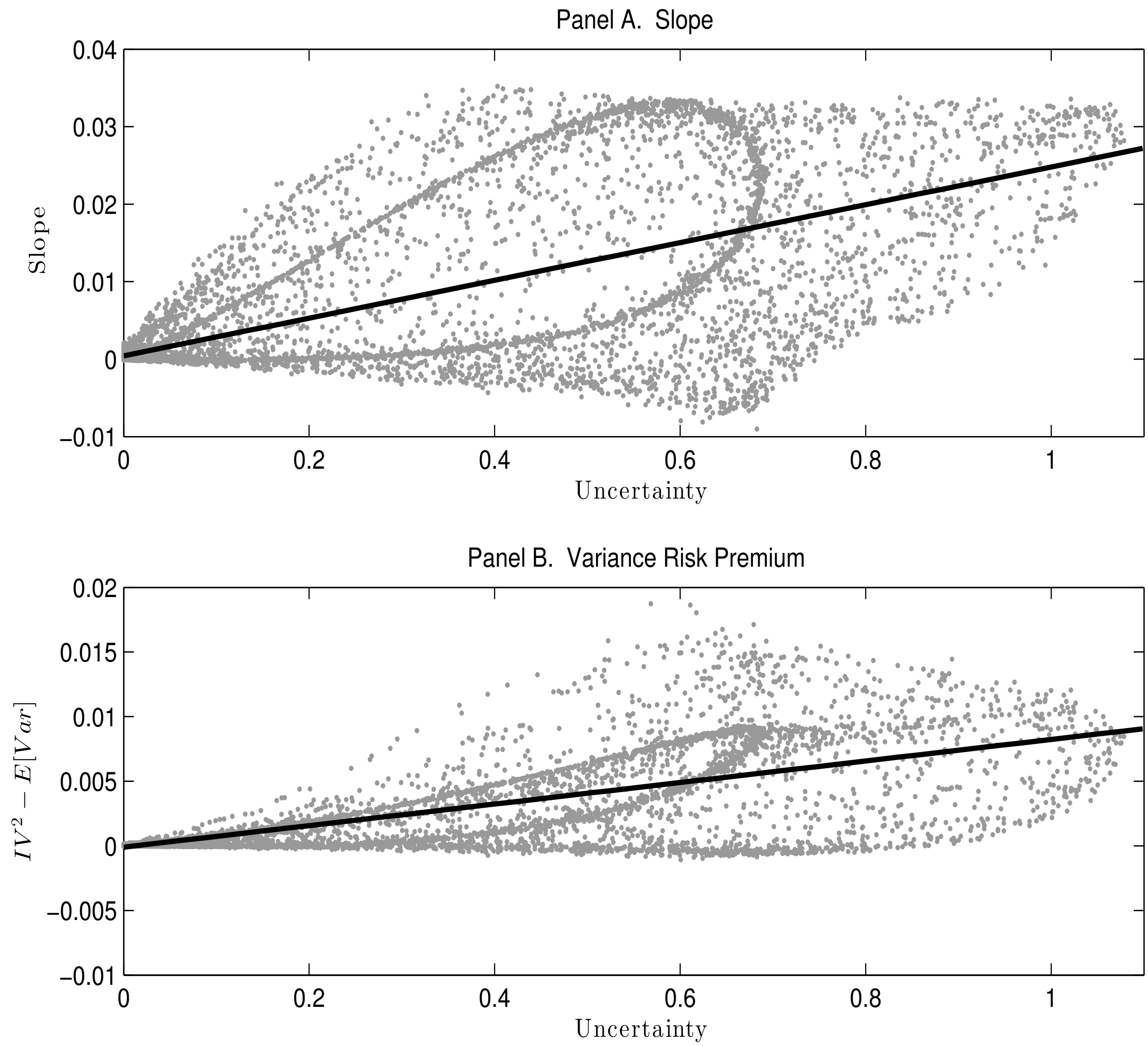

Figure 5. Implied volatility slope and variance risk premium vs. political uncertainty: Theory. Panel A plots the implied volatility slope at time $\tau - 1/2$, which is the difference between the implied volatilities of an option that is 5% out of the money and an option that is 5% in the money. Both of these options are one-period options that expire at time $\tau + 1/2$. Panel B plots the variance risk premium at time $\tau - 1/2$, which is the difference between the implied variance of a one-period at-the-money option that expires at time $\tau + 1/2$ and the expected realized variance of stock market returns between times $\tau - 1/2$ and $\tau + 1/2$. In both panels, quantities are plotted for a large number of samples simulated from the model as a function of political uncertainty, which is measured by the entropy of the probabilities of the three available policies (the old/prevailing policy O and the potential new policies H and L). Specifically, uncertainty is equal to $-p_t^H \log p_t^H - p_t^L \log p_t^L - p_t^0 \log p_t^0$, where p_t^i denotes the probability of policy i as of time $\tau - 1/2$. The straight line in both panels is the regression line of best fit estimated across the simulated samples.

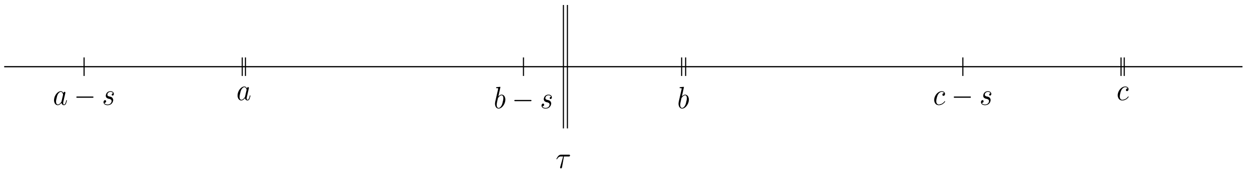

Figure 6. Timeline. Time τ is the date of the political event. Times a, b, and c are option expiration dates. We use option prices from various dates that are s days prior to expiration.

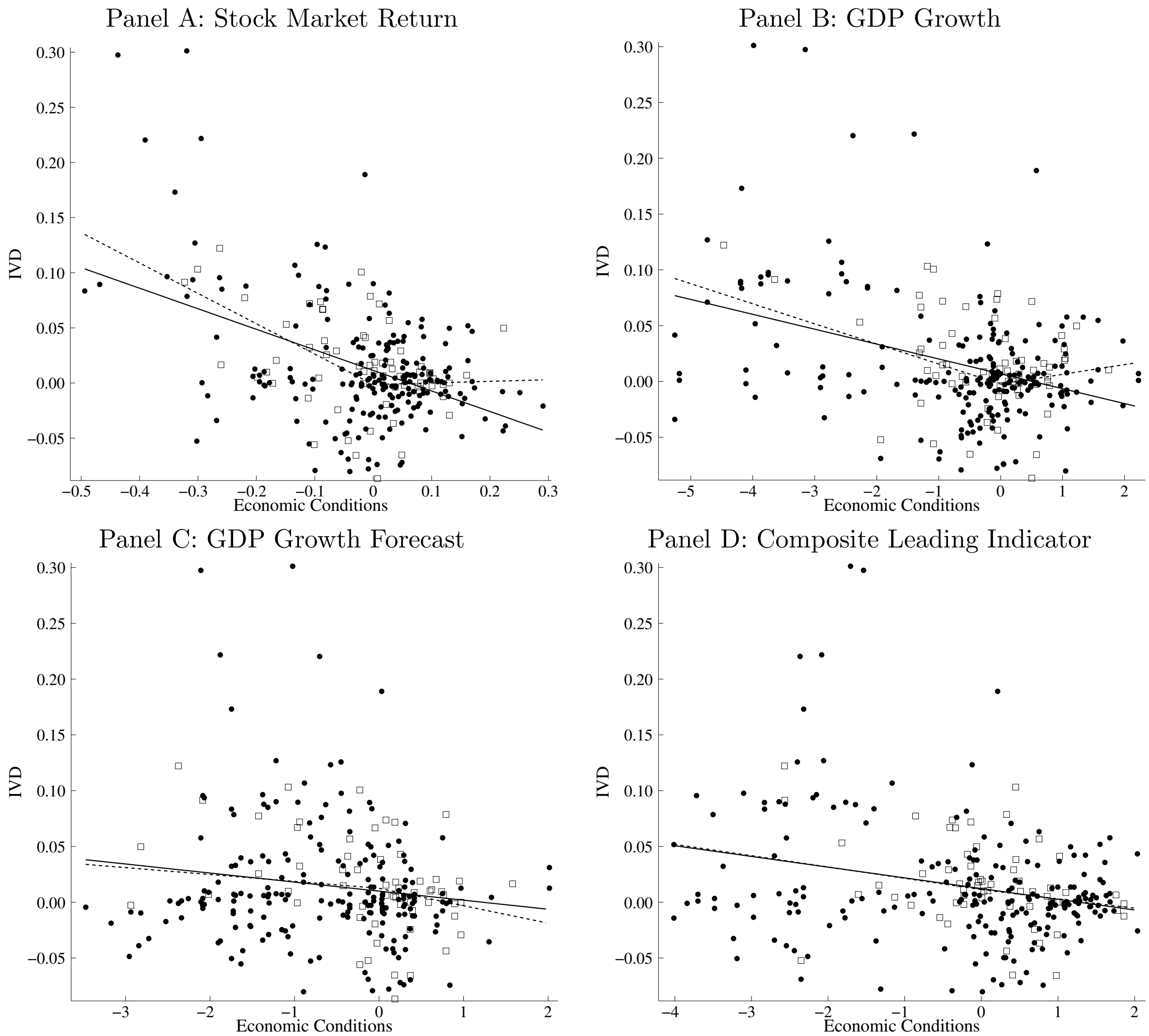

Figure 7. Implied volatility difference vs. economic conditions: Data. The figure plots IVD, the annualized implied volatility difference from equation (1), against four measures of economic conditions: the country's stock market index return (MKT; Panel A), real GDP growth (GDP; Panel B), the IMF's GDP growth forecast (FST; Panel C), and the OECD's Composite Leading Indicator (CLI; Panel D). We standardize GDP, FST, and CLI to zero mean and unit variance within each country by using data from 1990 through 2012. Election observations are marked as squares; summit observations as circles. The solid line is the line of best fit from a simple linear regression; the dashed line is from the piecewise linear regression with a kink at zero.

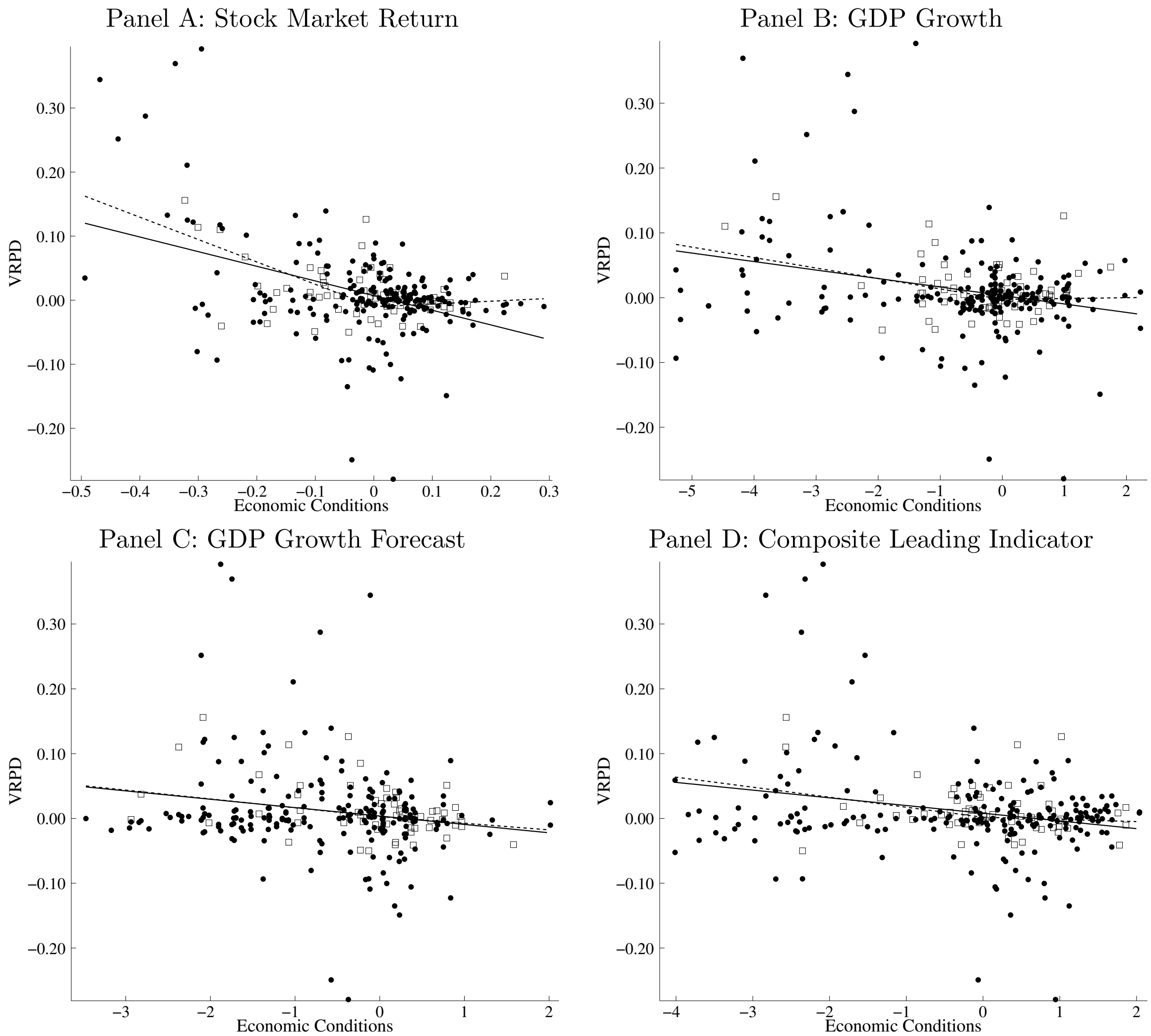

Figure 8. Variance risk premium difference vs. economic conditions: Data. The figure plots $VRPD$, the annualized variance risk premium difference from equation (4), against four measures of economic conditions: the country's stock market index return (MKT; Panel A), real GDP growth (GDP; Panel B), the IMF's GDP growth forecast (FST; Panel C), and the OECD's Composite Leading Indicator (CLI; Panel D). We standardize GDP, FST, and CLI to zero mean and unit variance within each country by using data from 1990 through 2012. Election observations are marked as squares; summit observations as circles. The solid line is the line of best fit from a simple linear regression; the dashed line is from the piecewise linear regression with a kink at zero.

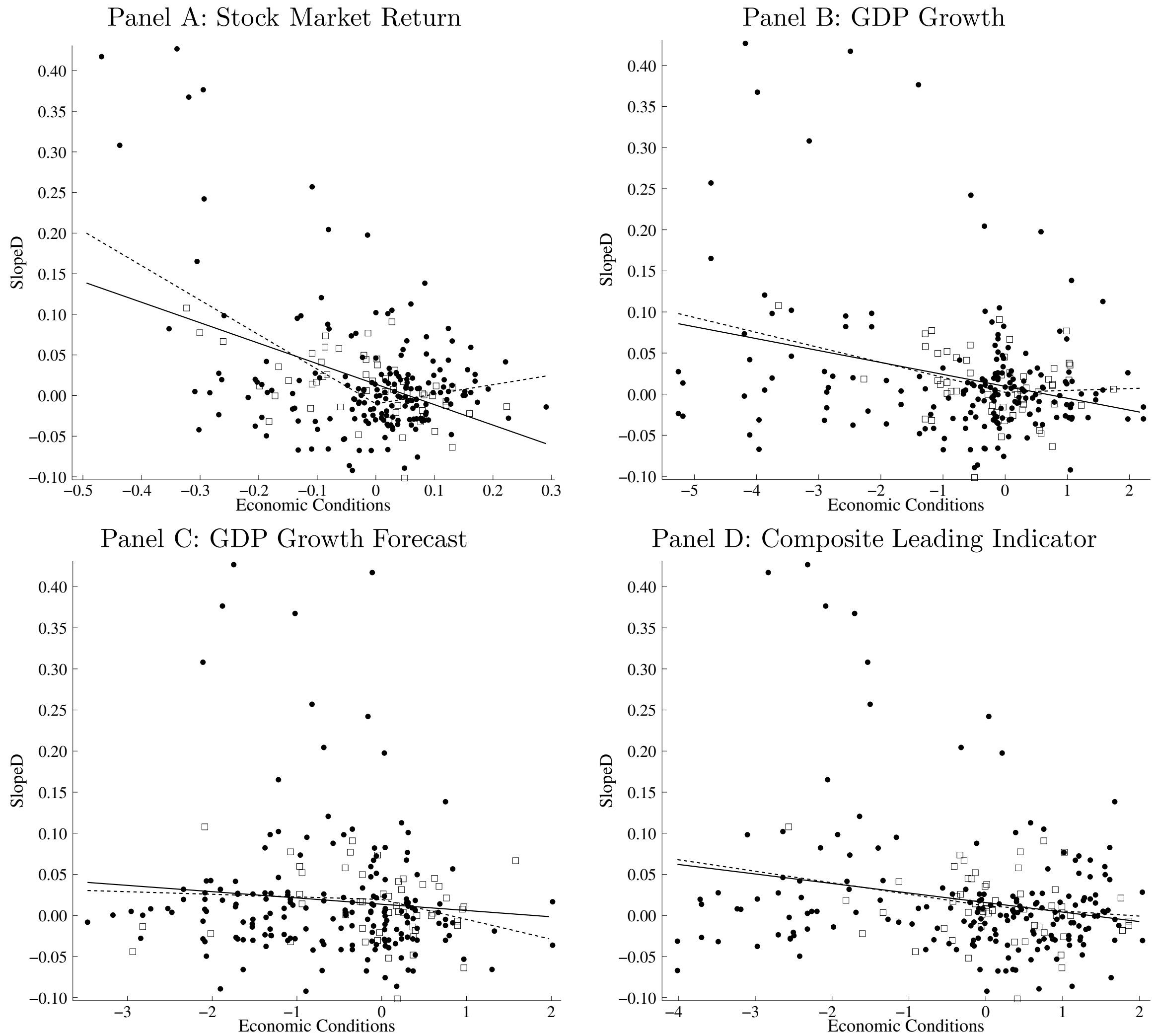

Figure 9. Implied volatility slope difference vs. economic conditions: Data. The figure plots *SlopeD*, the implied volatility slope difference from equation (6), against four measures of economic conditions: the country's stock market index return (MKT; Panel A), real GDP growth (GDP; Panel B), the IMF's GDP growth forecast (FST; Panel C), and the OECD's Composite Leading Indicator (CLI; Panel D). We standardize GDP, FST, and CLI to zero mean and unit variance within each country by using data from 1990 through 2012. Election observations are marked as squares; summit observations as circles. The solid line is the line of best fit from a simple linear regression; the dashed line is from the piecewise linear regression with a kink at zero.

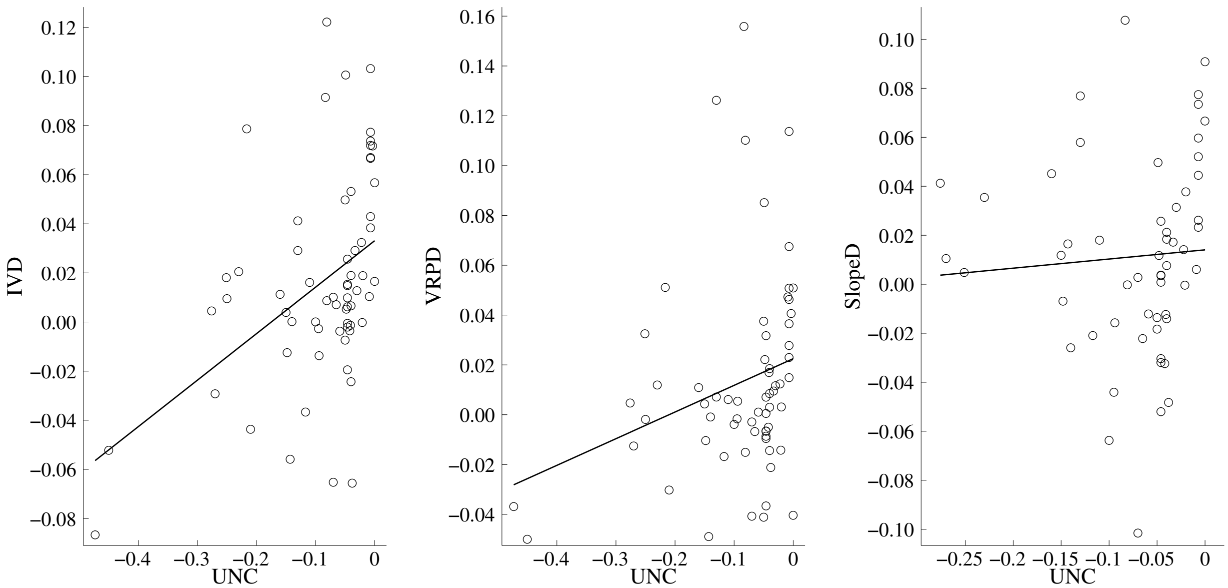

Figure 10. The role of political uncertainty: Data. The figure plots three option-market quantities against uncertainty about election outcome (UNC) for all election observations in our sample. UNC is the negative of the election poll spread. The three quantities are: IVD, the annualized implied volatility difference from equation (1), $VRPD$, the annualized variance risk premium difference from equation (4), and $SlopeD$, the implied volatility slope difference from equation (6). We also show the line of best fit from a simple linear regression.

Appendix

In Section A.1, we present the Pástor and Veronesi (2013) model. In Section A.2, we show the option pricing formula from Proposition 1. In Section A.3, we give the jump risk premium formula from Proposition 2. In Section A.4, we list all of our political events.

A.1. The Pástor and Veronesi (2013) model (PV)

This section is an abbreviated version of the exposition in PV. For additional detail and reasoning behind the model's assumptions, see the original work.

Consider an economy with a finite horizon $[0, T]$ and a continuum of all-equity firms $i \in [0, 1]$. Let B_t^i denote firm i's capital at time t. At time 0, all firms employ an equal amount of capital, $B_0^i = 1$. Firm i's capital is invested in a linear technology whose rate of return, or profitability, is denoted by $d\Pi_t^i$. All profits are reinvested, so that firm i's capital evolves according to $dB_t^i = B_t^i d\Pi_t^i$. For all $t \in [0, T]$, profitability follows the process

$$d\Pi_t^i = (\mu + g_t)\, dt + \sigma dZ_t + \sigma_1 dZ_t^i \ , \tag{A1}$$

where (μ, σ, σ_1) are observable constants, Z_t is a Brownian motion, and Z_t^i is an independent Brownian motion that is specific to firm i. The variable g_t denotes the impact of the prevailing government policy on the mean of the profitability process of each firm.

The government policy's impact, g_t, is constant while the same policy is in effect. The value of g_t can change only at a given time τ, $0 < \tau < T$, when the government makes an irreversible policy decision: whether to replace the current policy and, if so, which of N potential new policies to adopt. That is, the government chooses one of $N + 1$ policies, where policies $n = \{1, \dots, N\}$ are the potential new policies and policy 0 is the "old" policy prevailing since time 0. Let g^0 denote the impact of the old policy and g^n denote the impact of the n-th new policy, for $n = \{1, \dots, N\}$. The value of g_t is a simple step function of time:

$$g_t = \begin{cases} g^0 & \text{for} \quad t \leq \tau \\ g^0 & \text{for} \quad t > \tau \ \text{ if the old policy is retained (i.e., no policy change)} \\ g^n & \text{for} \quad t > \tau \ \text{ if the new policy } n \text{ is chosen, } n \in \{1, \dots, N\} \ . \end{cases} \tag{A2}$$

A policy change replaces g^0 by g^n, thereby inducing a permanent shift in average profitability.

The value of g_t is unknown to all agents for all $t \in [0, T]$. As of time 0, the prior distributions of all policy impacts are normal:

$$g^0 \sim N\left(0, \sigma_g^2\right) \tag{A3}$$
$$g^n \sim N\left(\mu_g^n, \sigma_{g,n}^2\right) \qquad \text{for } n = \{1, \dots, N\} \ . \tag{A4}$$

Between times 0 and τ, agents learn about g^0 in a Bayesian fashion by observing realized firm profitabilities. The posterior distribution of g^0 at any time $t \leq \tau$ is given by

$$g_t \sim N\left(\widehat{g}_t, \widehat{\sigma}_t^2\right) \ , \tag{A5}$$

where the posterior mean and variance evolve as

$$d\widehat{g}_t = \widehat{\sigma}_t^2 \sigma^{-1} d\widehat{Z}_t \tag{A6}$$
$$\widehat{\sigma}_t^2 = \frac{1}{\frac{1}{\sigma_g^2} + \frac{1}{\sigma^2} t} \ , \tag{A7}$$

Before time τ, there is no learning about $\{g^n\}_{n=1}^N$, so agents' beliefs about those values at any time $t \leq \tau$ are given by the prior distributions in equation (A4). If there is no policy change at time τ, then agents continue to learn about g^0 after time τ, and the processes (A6) and (A7) continue to hold also for $t > \tau$. If a new policy n is adopted at time τ, agents stop learning about g^0 and begin learning about g^n. As a result, a policy change resets agents' beliefs about g_t from the posterior $N\left(\widehat{g}_\tau, \widehat{\sigma}_\tau^2\right)$ to the prior $N\left(\mu_g^n, \sigma_{g,n}^2\right)$.

Firms are owned by a continuum of identical investors who maximize expected utility derived from terminal wealth. For all $j \in [0,1]$, investor j's utility function is given by

$$u\left(W_T^j\right) = \frac{\left(W_T^j\right)^{1-\gamma}}{1-\gamma} \ , \tag{A8}$$

where W_T^j is investor j's wealth at time T and $\gamma > 1$ is relative risk aversion. At time 0, all investors are equally endowed with firm stock. Stocks pay liquidating dividends at time T.

The government's preferences over policies $n = 0, \ldots, N$ are represented by a utility function that is identical to that of investors, except that the government also faces a nonpecuniary cost (or benefit) associated with any policy change. Specifically, at time τ, the government chooses the policy that maximizes

$$\max_{n \in \{0,\ldots,N\}} \left\{ \mathrm{E}_\tau \left[\frac{C^n W_T^{1-\gamma}}{1-\gamma} \mid \text{policy } n \right] \right\}, \tag{A9}$$

where $W_T = B_T = \int_0^1 B_T^i di$ is the final value of aggregate capital and C^n is the "political cost" incurred by the government if policy n is adopted. Values of $C^n > 1$ represent a cost (e.g., the government must exert effort or burn political capital to implement policy n), whereas $C^n < 1$ represents a benefit (e.g., policy n allows the government to make a transfer to a favored constituency). We normalize $C^0 = 1$, so that retaining the old policy is known with certainty to present no political costs or benefits to the government. The political costs of the new policies, $\{C^n\}_{n=1}^N$, are revealed to all agents at time τ. Immediately after the C^n values are revealed, the government makes its policy decision. As of time 0, the prior distribution of each C^n is lognormal and centered at $C^n = 1$:

$$c^n \equiv \log\left(C^n\right) \sim N\left(-\frac{1}{2}\sigma_c^2, \sigma_c^2\right) \qquad \text{for } n = \{1, \ldots, N\} \ , \tag{A10}$$

where the c^n values are uncorrelated across policies and independent of the Brownian motions in equation (A1). Uncertainty about $\{C^n\}_{n=1}^N$, which is given by σ_c as of time 0, is the source of *political uncertainty*, or uncertainty about the government's future policy choice. Any $\sigma_c > 0$ introduces an element of surprise into the policy decision. Given its objective function, the government is "quasi-benevolent": it maximizes the investors' welfare on average (because $\mathrm{E}_0\left[C^n\right] = 1$ for all n), but it also deviates from this objective in a random fashion.

The political costs $\{C^n\}_{n=1}^N$ are unknown to all agents until time τ. At time $t_0 < \tau$, agents begin learning about each c^n by observing unbiased signals:

$$ds_t^n = c^n \ dt + h \ dZ_{c,t}^n \ , \qquad n = 1, \ldots, N \ . \tag{A11}$$

The signals ds_t^n are uncorrelated across n and independent of all other shocks. We refer to ds_t^n as "political signals," and interpret them as capturing the steady flow of political news relevant to policy n. These signals help agents revise their beliefs about the government's future actions. Combining these signals with the prior distribution in equation (A10), we obtain the posterior distribution of c^n, for $n = 1, \ldots, N$, at any time $t \leq \tau$:

$$c^n \sim N\left(\widehat{c}_t^n, \widehat{\sigma}_{c,t}^2\right) \ , \tag{A12}$$

where the posterior mean and variance evolve as

$$d\widehat{c}_t^n = \widehat{\sigma}_{c,t}^2 h^{-1} d\widehat{Z}_{c,t}^n \tag{A13}$$

$$\widehat{\sigma}_{c,t}^2 = \frac{1}{\frac{1}{\sigma_c^2} + \frac{1}{h^2}(t - t_0)} \ . \tag{A14}$$

Assuming complete markets, the state price density in this economy is uniquely given by

$$\pi_t = \frac{1}{\lambda}\mathrm{E}_t\left[B_T^{-\gamma}\right], \tag{A15}$$

where λ is the Lagrange multiplier from the utility maximization problem of the representative investor. Before time τ, there are $N+2$ state variables in the model:

$$S_t \equiv \left(\widehat{g}_t, \widehat{c}_t^1, \ldots, \widehat{c}_t^N, t\right) . \tag{A16}$$

A.2. The option pricing formula

We now present the option pricing formula from Proposition 1. At time $t < \tau$, the price of a European put option expiring at time $m > \tau$ is given by

$$Put_t\left(\kappa\right) = B_t \frac{O\left(S_t, \kappa\right)}{\Omega\left(S_t\right)} \tag{A17}$$

where $\Omega\left(S_t\right)$ is in Equation (A.1) in PV, and

$$O\left(S_t, \kappa\right) = \sum_{n=0}^{N} e^{-\gamma\mu_{n,g}(T-\tau)+\frac{\gamma^2}{2}(T-\tau)^2\sigma_{g,n}^2} p_t^n V^n\left(S_t, \kappa\right)$$

where p_t^n is the probability of policy n as of time t, given in PV's Corollary 2, and

$$\begin{aligned}
V^n\left(S_t,\kappa\right) &= \int e^{-\gamma\Delta b_\tau} BSP_n\left(\Delta b_\tau, \kappa\right) f\left(\Delta b_\tau | n \text{ at } \tau\right) d\Delta b_\tau \quad \text{ for } n \geq 1 \\
V^0\left(S_t,\kappa\right) &= \int e^{-\gamma\left(E_t[\Delta b_\tau] + \left(\widehat{g}_\tau - \widehat{g}_t\right)\left[\frac{\sigma^2}{\widehat{\sigma}_t^2} + (\tau - t)\right]\right) - \gamma\left(\widehat{g}_\tau - \widehat{g}_t\right)(T-\tau)} BSP_0\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right) f\left(\widehat{g}_\tau | 0 \text{ at } \tau\right) d\widehat{g}_\tau
\end{aligned}$$

In the above expression, $b_\tau = \log(B_\tau)$, the probability densities $f\left(\Delta b_\tau | n \text{ at } \tau\right)$ and $f\left(\widehat{g}_\tau | 0 \text{ at } \tau\right)$ are given in the Appendix of PV, and $BSP_n\left(\Delta b_\tau, \kappa\right)$ and $BSP_0\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right)$ are the standard Black-Scholes formulas for put options with different inputs. Namely, denote

$$\begin{aligned}
\ell_n\left(\Delta b_\tau\right) &= \Delta b_\tau + \left(\mu - \gamma\sigma^2 + \mu_{g,n}\right)(T-\tau) + \frac{1-2\gamma}{2}(T-\tau)^2\sigma_{g,n}^2 \\
\ell_0\left(\widehat{g}_\tau; \widehat{g}_t\right) &= \left(\mu + \widehat{g}_t - \frac{1}{2}\sigma^2\right)(\tau - t) + \left(\widehat{g}_\tau - \widehat{g}_t\right)\left[\frac{\sigma^2}{\widehat{\sigma}_t^2} + (\tau - t)\right] \\
&\quad + \left(\mu - \gamma\sigma^2 + \widehat{g}_\tau\right)(T-\tau) + \frac{1-2\gamma}{2}(T-\tau)^2\widehat{\sigma}_\tau^2
\end{aligned}$$

Then, for $n \geq 1$

$$\begin{aligned}
BSP_n\left(\Delta b_\tau, \kappa\right) &= \kappa N\left[-d_{2,n}\left(\Delta b_\tau, \kappa\right)\right] - e^{\ell_n(\Delta b_\tau)} N\left[-d_{1,n}\left(\Delta b_\tau, \kappa\right)\right] \\
d_{1,n}\left(\Delta b_\tau, \kappa\right) &= \frac{\ell_n\left(\Delta b_\tau\right) - \log\left(\kappa\right)}{\sigma_{IV,n}} + \frac{1}{2}\sigma_{IV,n} \\
d_{2,n}\left(\Delta b_\tau, \kappa\right) &= d_1\left(\Delta b_\tau, \kappa\right) - \sigma_{IV,n}
\end{aligned}$$

and for $n = 0$

$$\begin{aligned}
BSP_0\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right) &= \kappa N\left[-d_2\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right)\right] - e^{\ell_0\left(\widehat{g}_\tau; \widehat{g}_t\right)} N\left[-d_1\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right)\right] \\
d_{1,0}\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right) &= \frac{\ell_0\left(\widehat{g}_\tau; \widehat{g}_t\right) - \log\left(\kappa\right)}{\sigma_{IV,0}} + \frac{1}{2}\sigma_{IV,0} \\
d_{2,0}\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right) &= d_{1,0}\left(\widehat{g}_\tau, \kappa; \widehat{g}_t\right) - \sigma_{IV,0}
\end{aligned}$$

Finally, in these expressions, we have for every $n \geq 0$:

$$\sigma_{IV,n}^2 = \int_{\tau}^{m} \sigma_{M,t}^2 dt \ ,$$

or expected average variance of stock returns. The square root of that variance after τ is $\sigma_{M,t} = \sigma + (T-t)\,\widehat{\sigma}_t^2 \sigma^{-1}$, where $\widehat{\sigma}_t^{-2} = \sigma_{g,n}^{-2} + \sigma^{-2}(t-\tau)$. In addition to proving the above option-pricing formula analytically, we have verified its validity by Monte Carlo simulations.

Corollary A.1: Let S_t in equation (A16) be such that the probability $p_t^n \to 1$ for some $n \geq 0$. Option prices are then given by the Black-Scholes formula with implied variance of

$$\sigma_{IV,n}^2 = \int_{t}^{m} \sigma_{M,0,s}^2 ds$$

where for $n \geq 1$ the stock return volatility $\sigma_{M,0,t}$ is given by

$$\begin{aligned} \sigma_{M,0,t} &= \sigma + (\tau - t)\,\widehat{\sigma}_t^2 \sigma^{-1} \quad \text{for } t \leq \tau \\ &= \sigma + (T-t)\,\widehat{\sigma}_t^2 \sigma^{-1} \quad \text{for } t > \tau \end{aligned}$$

with

$$\begin{aligned} \widehat{\sigma}_t^{-2} &= \widehat{\sigma}_{g,0}^{-2} + \sigma^{-2} t \qquad \text{for } t \leq \tau \\ \widehat{\sigma}_t^{-2} &= \sigma_{g,n}^{-2} + \sigma^{-2}(t-\tau) \quad \text{for } t > \tau \end{aligned}$$

while for $n = 0$, stock return volatility is

$$\sigma_{M,0,t} = \sigma + (T-t)\,\widehat{\sigma}_t^2 \sigma^{-1} \quad \text{for all } t$$

with

$$\widehat{\sigma}_t^{-2} = \widehat{\sigma}_{g,0}^{-2} + \sigma^{-2} t \quad \text{for all } t \ .$$

A.3. The jump risk premium formula

We now present the jump risk premium formula from Proposition 2. Immediately before time τ, the jump risk premium associated with the political event at time τ is given by

$$J(S_\tau) = \frac{\sum_{n=0}^{N} p_\tau^n e^{-\gamma(T-\tau)\left(\widetilde{\mu}^n - \widetilde{\mu}^0\right) + \frac{\gamma}{2}(T-\tau)^2\left(\sigma_{g,n}^2 - \widehat{\sigma}_\tau^2\right)} \sum_{n=0}^{N} p_\tau^n e^{\left(\widetilde{\mu}^n - \widetilde{\mu}^0\right)(T-\tau) - \frac{\gamma}{2}(T-\tau)^2\left(\sigma_{g,n}^2 - \widehat{\sigma}_\tau^2\right)}}{\sum_{n=0}^{N} p_\tau^n e^{(1-\gamma)(T-\tau)\left(\widetilde{\mu}^n - \widetilde{\mu}^0\right)}} - 1, \tag{A18}$$

where

$$\widetilde{\mu}^n = \mu_g^n - \frac{\sigma_{g,n}^2}{2}(T-\tau)(\gamma - 1) \qquad n = 1, \ldots, N \tag{A19}$$

$$\widetilde{\mu}^0 = \widehat{g}_\tau - \frac{\widehat{\sigma}_\tau^2}{2}(T-\tau)(\gamma - 1) \tag{A20}$$

and the probabilities $p_\tau^n \equiv p^n(S_\tau)$ are obtained in closed form in Corollary 2 of PV. The jump risk premium can also be computed as $J(S_\tau) = \sum_{n=0}^{N} p_\tau^n R^n(S_\tau)$, where $R^n(S_\tau)$ is the instantaneous stock return at time τ conditional on the announcement of policy n. These returns for all n are derived in PV's Proposition 6.

A.4. The full list of political events

Tables A.1 and A.2 provide the full lists of elections and summits, respectively, that took place during our sample period, along with brief descriptions of these events.

Table A.1
Elections

The table lists all national elections that took place in the period for which option data for the given country are available in Optionmetrics (see Table 1). There are three types of elections: parliamentary ('parl.'), presidential ('pres.'), and both parliamentary and presidential occurring at the same time ('both'). The 'use' variable is equal to one if the election is included in our sample and zero otherwise. We include all elections for which option data are available so that it is possible to calculate IVD in equation (1).

Country	Date	Type	Use	Country	Date	Type	Use
Australia	20041009	Parl.	0	Japan	20090830	Parl.	1
Australia	20071124	Parl.	0	Japan	20100711	Parl.	1
Australia	20100821	Parl.	1	Korea	20071219	Pres.	1
Belgium	20030518	Parl.	0	Korea	20080409	Parl.	1
Belgium	20070610	Parl.	1	Mexico	20090705	Parl.	1
Belgium	20100613	Parl.	1	Netherlands	20020515	Parl.	0
Brazil	20061001	Both	1	Netherlands	20030122	Parl.	0
Brazil	20061029	Pres.	1	Netherlands	20061122	Parl.	0
Brazil	20101003	Both	1	Netherlands	20100609	Parl.	1
Brazil	20101031	Pres.	1	Singapore	20110507	Parl.	1
Canada	20081014	Parl.	1	Singapore	20110827	Pres.	1
Canada	20110502	Parl.	1	South Africa	20090422	Parl.	1
Finland	20030316	Parl.	0	Spain	20080309	Parl.	1
Finland	20060115	Pres.	0	Spain	20111120	Parl.	1
Finland	20060129	Pres.	0	Sweden	20100919	Parl.	1
Finland	20070318	Parl.	0	Switzerland	20031019	Parl.	1
Finland	20110417	Parl.	0	Switzerland	20071021	Parl.	1
Finland	20120122	Pres.	0	Switzerland	20111023	Parl.	1
Finland	20120205	Pres.	0	Taiwan	20040320	Pres.	0
France	20070422	Pres.	1	Taiwan	20080112	Parl.	1
France	20070506	Pres.	1	Taiwan	20080322	Pres.	1
France	20070610	Parl.	1	Taiwan	20120114	Both	0
France	20070617	Parl.	1	UK	20050505	Parl.	1
France	20120422	Pres.	1	UK	20100506	Parl.	1
France	20120506	Pres.	1	USA	19901106	Parl.	1
France	20120610	Parl.	1	USA	19921103	Both	1
France	20120617	Parl.	1	USA	19941108	Parl.	1
Germany	20020922	Parl.	1	USA	19961105	Both	1
Germany	20050918	Parl.	1	USA	19981103	Parl.	1
Germany	20090927	Parl.	1	USA	20001107	Both	1
Greece	20120506	Parl.	1	USA	20021105	Parl.	1
Greece	20120617	Parl.	1	USA	20041102	Both	1
Italy	20080413	Parl.	1	USA	20061107	Parl.	1
Japan	20040711	Parl.	0	USA	20081104	Both	1
Japan	20050911	Parl.	1	USA	20101102	Parl.	1
Japan	20070729	Parl.	1				

Table A.2
Summits

The table lists all G8, G20, and European summits that took place between January 2007 and December 2011. We assign an economic relevance score to each summit, with "Yes" denoting the relevant ones (for which economic topics are the primary focus) and "No" denoting the rest. All summits rated "Yes" are included in our main sample. The robustness analysis in Table 9 includes all summits regardless of relevance. The topic list in the last column is constructed based on summit agendas, summit summaries, and press releases.

Type	Date	Economic Relevance	Topics
G8	20070606	No	Global warming; US missile defense system; Consortium for Africa
G8	20080707	No	Africa; Climate change; Intellectual property rights; Political issues; World Economy; Food crisis
G8	20090708	No	Climate change; Energy; Africa; Intellectual property; Afghan conflict; Nuclear security
G8	20100625	Yes	Recovery from global recession and European debt crisis; Nuclear programs of Iran and North Korea; Israel blockade
G8	20110526	No	Internet, innovation, green growth and sustainable economy; Nuclear safety; Arab spring; Africa
G20	20081114	Yes	Global financial crisis
G20	20090402	Yes	Stimulus; Regulation
G20	20090924	Yes	G20 to become premier forum for international economic cooperation; World economic recovery
G20	20100626	Yes	Recovery from global recession and European debt crisis
G20	20101111	Yes	Ensuring global economic recovery; Framework for growth; Financial regulation, institutions and safety nets; Risk of currency war; Development issues
G20	20111103	Yes	Recovery from global recession and European debt crisis
Euro	20070308	No	Lisbon strategy for growth; Regulation; Climate and energy policy; International relations
Euro	20070621	No	Treaty reform; Home affairs; Economic, social and environmental issues; External relations; Northern Ireland
Euro	20071018	No	Treaty reform; Climate change; US economic crisis
Euro	20071213	No	Treaty reform; Security; Economic, social and environmental issues; External relations
Euro	20080313	No	Lisbon strategy; Climate change and energy; Financial stability
Euro	20080619	No	Lisbon treaty; Security; Food and oil prices; Economic, social and environmental issues; Western Balkans; External relations
Euro	20080713	No	Strategy for the Mediterranean ("Barcelona Process")
Euro	20080901	No	Extraordinary summit on EU-Russia relations (Georgia crisis)
Euro	20081015	Yes	Economic and financial situations; Lisbon treaty; energy and climate change; Immigration
Euro	20081107	Yes	Global financial crisis
Euro	20081211	Yes	Lisbon treaty; Economic and financial questions; Energy and climate change; Agricultural policy; External relations; European security and defence
Euro	20090301	Yes	Global financial crisis
Euro	20090319	Yes	Economic, financial and social situation; Energy and climate change
Euro	20090405	Yes	US-EU summit; Economic, financial and social situation; Energy and climate change; Regional issues; Guantanamo
Euro	20090618	Yes	Institutional issues; Economic, financial and social situation; Climate change and sustainable development; Illegal immigration; external relations

Euro	20090917	No	Preparation for 2009 G20 Pittsburgh summit
Euro	20091029	No	Institutional issues; Climate change; Economic, financial and employment situation; Strategy for Baltic Region; External relations
Euro	20091119	No	Chose first President of the European Council and first High Representative of the Union for Foreign Affairs and Security Policy
Euro	20091210	Yes	Institutional issues; Economic, financial and employment situation; "Stockholm Program"; Climate change; Enlargement; External relations
Euro	20100211	Yes	Greek crisis
Euro	20100325	Yes	Greek crisis
Euro	20100507	Yes	Greek crisis
Euro	20100617	Yes	Strategy for jobs and growth; Millennium development goals, Climate change
Euro	20100916	Yes	Relations with strategic partners; Task force on economic governance; External policy
Euro	20101028	Yes	Task force on economic governance; Climate change
Euro	20101216	Yes	Economic policy
Euro	20110204	Yes	Energy; Innovation; Economic situation; External relations
Euro	20110311	Yes	Economic policy; Crisis response
Euro	20110324	Yes	Economic policy; Libya; Japan tsunami
Euro	20110623	Yes	Economic policy; Immigration; Croatia
Euro	20110721	Yes	Greek crisis
Euro	20111023	Yes	Economy policy; Organization of G20; Climate change; External relations
Euro	20111026	Yes	Crisis response
Euro	20111208	Yes	Economic policy; Energy; Enlargement

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