Political Uncertainty and Risk Premia

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Abstract

We develop a general equilibrium model of government policy choice in which stock prices respond to political news. The model implies that political uncertainty commands a risk premium whose magnitude is larger in weaker economic conditions. Political uncertainty reduces the value of the implicit put protection that the government provides to the market. It also makes stocks more volatile and more correlated, especially when the economy is weak. We find empirical evidence consistent with these predictions.

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1. Introduction

Political news has been dominating financial markets recently. Day after day, asset prices seem to react to news about what governments around the world have done or might do. As an example, consider the ongoing sovereign debt crisis in Europe. When European politicians announced a deal cutting Greece's debt in half on October 27, 2011, the S&P 500 index soared by 3.4%, while French and German stocks gained more than 5%. Early in the following week, stocks gave back all of those gains when Greece's prime minister announced his intention to hold a referendum on the deal. When other Greek politicians voiced their opposition to that initiative, stocks rose sharply again. It seems stunning that the pronouncements of politicians from a country whose GDP is smaller than that of Michigan can instantly create or destroy hundreds of billions of dollars of market value around the world.

Regrettably, our ability to interpret the impact of political news on financial markets is constrained by the lack of theoretical guidance. Models in which asset prices respond to political news are notably absent from mainstream finance theory. We try to fill this gap, and we use our model to study the asset pricing implications of political uncertainty.

Political uncertainty has become prominent not only in Europe but also in the United States. For example, the ratings firm Standard & Poor's cited political uncertainty among the chief reasons behind its unprecedented downgrade of the U.S. Treasury debt in August 2011.[1] Even prior to the political brinkmanship over the statutory debt ceiling in the summer of 2011, much uncertainty surrounded the U.S. government policy changes during and after the financial crisis of 2007-2008, such as the various bailout schemes, the Wall Street reform, and the health care reform. Yet, despite the apparent relevance of political uncertainty for global financial markets, we know little about its effects on asset prices.

How does uncertainty about future government actions affect market prices? On the one hand, this uncertainty could have a positive effect if the government responds properly to unanticipated shocks. For example, we generally do not insist on knowing in advance how exactly a doctor will perform a complex surgery; should unforeseeable circumstances arise, it is useful for a qualified surgeon to have the freedom to depart from the initial plan. In the same spirit, governments often intervene in times of trouble, which might lead investors to believe that governments provide put protection on asset prices (e.g., the "Greenspan

[1]The "debate this year has highlighted a degree of uncertainty over the political policymaking process which we think is incompatible with the AAA rating," said David Beers, managing director of sovereign credit ratings at Standard & Poor's, on a conference call with reporters on August 6, 2011.

put"). On the other hand, political uncertainty could have a negative effect because it is not fully diversifiable. Non-diversifiable risk generally depresses asset prices by raising discount rates.[2] Both of these effects arise endogenously in our theoretical model.

We analyze the effects of political uncertainty on stock prices in the context of a general equilibrium model. In our model, firm profitability follows a stochastic process whose mean is affected by the prevailing government policy. The policy's impact on the mean is uncertain. Both the government and the investors (firm owners) learn about this impact in a Bayesian fashion by observing realized profitability. At a given point in time, the government makes a policy decision—it decides whether to change its policy and if so, which of potential new policies to adopt. The potential new policies are viewed as heterogeneous a priori—agents expect different policies to have different impacts, with different degrees of prior uncertainty. 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 government is motivated by both economic and non-economic objectives: it maximizes the investors' welfare, as a social planner would, but it also takes into account the political costs (or benefits) associated with adopting any given policy. These costs are uncertain, as a result of which investors cannot fully anticipate which policy the government is going to choose. Uncertainty about political costs is the source of *political uncertainty* in the model. Agents learn about political costs by observing political signals that we interpret as outcomes of various political events.

Solving for the optimal government policy choice, we find that a policy is more likely to be adopted if its political cost is lower and if its impact on profitability is perceived to be higher or less uncertain. As a result of this decision rule, a policy change is more likely in weaker economic conditions, in which the current policy is typically perceived as harmful. By replacing poorly-performing policies in bad times, the government effectively provides put protection to the market. The value of this protection is reduced, though, by the ensuing uncertainty about which of the potential new policies will replace the outgoing policy.

We explore the asset pricing implications of our model. We show that stock prices are driven by three types of shocks, which we call capital shocks, impact shocks, and political shocks. The first two types of shocks are driven by shocks to aggregate capital. These fundamental economic shocks affect stock prices both directly, by affecting the amount of

[2]For example, some commentators argue that the risk premia in the eurozone have been inflated due to political uncertainty. According to Harald Uhlig, "The risk premium in the markets amounts to a premium on the uncertainty of what Merkel and Sarkozy will do." (Bloomberg Businessweek, July 28, 2011).

capital, and indirectly, by leading investors to revise their beliefs about the impact of the prevailing government policy. We refer to the direct effect as capital shocks and to the indirect effect as impact shocks. We also refer to both capital and impact shocks jointly as *economic shocks*. The third type of shocks, *political shocks*, are orthogonal to economic shocks. Political shocks arise due to learning about the political costs associated with the potential new policies. These shocks, which reflect the flow of political news, lead investors to revise their beliefs about the likelihood of the various government policy choices.

We decompose the equity risk premium into three components, which correspond to the three types of shocks introduced above. We find that all three components contribute substantially to the risk premium. Interestingly, political shocks command a risk premium despite being unrelated to economic shocks. Investors demand compensation for uncertainty about the outcomes of purely political events, such as debates and negotiations. Those events matter to investors because they affect the investors' beliefs about which policy the government might adopt in the future. We refer to the political-shock component of the equity premium as the *political risk premium*. Another component, that induced by impact shocks, compensates investors for a different aspect of uncertainty about government policy—uncertainty about the impact of the current policy on firm profitability.

We find that the composition of the equity risk premium is highly state-dependent. Importantly, the political risk premium is larger in weaker economic conditions. In fact, when the conditions are very weak, the political risk premium is the largest component of the equity premium in our baseline calibration. In a weaker economy, the government is more likely to adopt a new policy. Therefore, news about which new policy is likely to be adopted—political shocks—have a larger impact on stock prices in a weaker economy.

In strong economic conditions, the political risk premium is small, but the impact-shock component of the equity premium is large. When times are good, the current policy is likely to be retained, so news about the current policy's impact—impact shocks—have a large effect on stock prices. Impact shocks matter less when times are bad because the current policy is then likely to be replaced, so its impact is temporary. Interestingly, impact shocks often matter the most when times are neither good nor bad, but rather slightly below average. In such intermediate states, investors are the most uncertain about whether the current policy will be retained. Impact shocks then affect stock prices by revising not only the investors' perception of expected profitability, but also their perception of the probability of a policy change. As a result, investors demand extra compensation for holding stocks, and the equity premium exhibits a hump-shaped dependence on economic conditions.

The equity premium in weak economic conditions is affected by two opposing forces. On the one hand, the premium is pulled down by the government's implicit put protection—the fact that the government is likely to change its policy in a weak economy. This protection reduces the equity premium by making the effect of impact shocks temporary and thereby depressing the premium's impact-shock component. On the other hand, the premium is pushed up by political uncertainty, as explained earlier. In our baseline calibration, the two effects roughly cancel out. More generally, political uncertainty reduces the value of the implicit put protection that the government provides to the markets.

Political uncertainty pushes up not only the equity risk premium but also the volatilities and correlations of stock returns. As a result, stocks tend to be more volatile and more correlated when the economy is weak. The volatilities and correlations are also higher when the potential new government policies are perceived as more heterogeneous a priori.

The government's ability to change its policy has a substantial but ambiguous effect on stock prices. We compare the model-implied stock prices with their counterparts in a hypothetical scenario in which policy changes are precluded. We find that the ability to change policy generally makes stocks more volatile and more correlated in poor economic conditions. Interestingly, this ability can imply a higher or lower level of stock prices compared to the hypothetical scenario. Specifically, the government's ability to change policy is good for stock prices in dire economic conditions, but it depresses prices when the conditions are typical or only slightly below average.

When the government announces its policy decision, stock prices jump. The expected value of the jump represents the risk premium that compensates investors for holding stocks during this announcement. This jump risk premium can be fully attributed to political uncertainty. We find that this premium is generally higher when economic conditions are weaker as well as when there is more policy heterogeneity. These results support our prior conclusions about the pricing of political uncertainty.

We also show analytically that the announcement of a welfare-improving government policy decision need not produce a positive stock market reaction, nor does a positive market reaction imply that the newly adopted policy is welfare-improving. Among policies delivering the same welfare, the policies whose impact on profitability is more uncertain, such as deeper reforms, elicit less favorable stock market reactions. The broader lesson is that one cannot judge government policies solely by their announcement returns.

While our main contribution is theoretical, we also conduct some simple empirical analy-

sis. To proxy for political uncertainty, we use the recently developed policy uncertainty index of Baker, Bloom, and Davis (2011). We examine the following predictions of our model: political uncertainty should be higher in a weaker economy; stocks should be more volatile and more correlated when political uncertainty is higher; political uncertainty should command a risk premium; the effects of political uncertainty on volatility, correlation, and risk premia should be stronger when the economy is weaker. We find evidence consistent with all of these predictions, although the strength of the evidence varies across the predictions.

There is a small but growing amount of theoretical work on the effects of government-induced uncertainty on asset prices. Sialm (2006) analyzes the effect of stochastic taxes on asset prices, and finds that investors require a premium to compensate for the risk introduced by tax changes.[3] Tax uncertainty also features in Croce, Kung, Nguyen, and Schmid (2011), who explore its asset pricing implications in a production economy with recursive preferences. Croce, Nguyen, and Schmid (2011) examine the effects of fiscal uncertainty on long-term growth when agents facing model uncertainty care about the worst-case scenario. Finally, Ulrich (2011) analyzes the premium required by bond investors for Knightian uncertainty about both Ricardian equivalence and the size of the government multiplier. All of these studies are quite different from ours. They analyze fiscal policy, whereas we consider a broader set of government actions. They use very different modeling techniques, and they do not model the government's policy decision explicitly as we do. None of these studies feature Bayesian learning, which plays an important role here.

Our model is also different from the learning models that were recently proposed in the political economy literature, such as Callander (2011) and Strulovici (2010). In Callander's model, voters learn about the effects of government policies through repeated elections. In Strulovici's model, voters learn about their preferences through policy experimentation. Neither study analyzes the asset pricing implications of learning.

Pástor and Veronesi (2012) develop a related model of government policy choice that differs from ours in two key respects. First, in their model, all government policies are perceived as identical a priori, whereas we consider heterogeneous policies. Policy heterogeneity is crucial to our results; for example, it 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. In contrast, such uncertainty would be irrelevant if all potential

[3]Other studies, such as McGrattan and Prescott (2005), Sialm (2009), and Gomes, Michaelides, and Polkovnichenko (2009), relate stock prices to tax rates, without emphasizing tax-related uncertainty.

new policies were identical a priori, as in Pástor and Veronesi's model. We find that policy heterogeneity has a substantial effect on the equity risk premium, as well as on other properties of stock prices such as their level, volatility, and correlations. Second, in our model, agents learn about the political costs of the potential new policies. This learning introduces additional shocks to the economy, political shocks, which are the source of all of our main results, including the political risk premium. In addition, our study has a different focus. Pástor and Veronesi analyze the stock market reaction to the government's policy decision, whereas we focus on the risk premium induced by political uncertainty.

There is a modest amount of empirical work relating political uncertainty to the equity risk premium. Erb, Harvey, and Viskanta (1996) find a weak relation between political risk, measured by the International Country Risk Guide, and future stock returns. Pantzalis, Stangeland, and Turtle (2000) and Li and Born (2006) find abnormally high stock market returns in the weeks preceding major elections, especially for elections characterized by high degrees of uncertainty. This evidence is consistent with a positive relation between the equity premium and political uncertainty. Santa-Clara and Valkanov (2003) relate the equity risk premium to political cycles. Belo, Gala, and Li (2011) link the cross-section of stock returns to firms' exposures to the government sector. Bittlingmayer (1998), Voth (2002), and Boutchkova, Doshi, Durnev, and Molchanov (2010) find a positive relation between political uncertainty and stock volatility in a variety of settings. The literature has also related political uncertainty to private sector investment.[4] Finally, the literature has analyzed the effects of uncertainty about government policy on inflation, capital flows, and welfare.[5]

The paper is organized as follows. Section 2 presents the model. Section 3 analyzes the government's policy decision. Sections 4 and 5 present our results on the pricing of political uncertainty. Section 6 examines the risk premium associated with the policy decision. Section 7 shows our empirical analysis. Section 8 concludes. The Appendix contains some details as well as a reference to the Technical Appendix, which contains all the proofs.

[4]For example, Julio and Yook (2012) find that firms reduce their investment prior to major elections. Durnev (2011) finds that corporate investment is less sensitive to stock prices during election years. Baker, Bloom, and Davis (2011) find that policy uncertainty reduces investment and increases unemployment.

[5]For example, Drazen and Helpman (1990) study how uncertainty about a future fiscal adjustment affects the dynamics of inflation. Hermes and Lensink (2001) show that uncertainty about budget deficits, tax payments, government consumption, and inflation is positively related to capital outflows at the country level. Gomes, Kotlikoff, and Viceira (2012) calibrate a life-cycle model to measure the welfare losses resulting from uncertainty about government policies regarding taxes and Social Security. They find that policy uncertainty materially affects agents' consumption, saving, labor supply, and portfolio decisions.

2. The Model

Similar to Pástor and Veronesi (2012), we consider an economy with a finite horizon $[0, T]$ and a continuum of firms $i \in [0, 1]$. Let B_t^i denote firm i's capital at time t. Firms are financed entirely by equity, so B_t^i can also be viewed as book value of equity. At time 0, all firms employ an equal amount of capital, which we normalize to $B_0^i = 1$. Firm i's capital is invested in a linear technology whose rate of return is stochastic and denoted by $d\Pi_t^i$. All profits are reinvested, so that firm i's capital evolves according to $dB_t^i = B_t^i d\Pi_t^i$. Since $d\Pi_t^i$ equals profits over book value, we refer to it as the profitability of firm i. For all $t \in [0, T]$, profitability follows the process

$$d\Pi_t^i = (\mu + g_t)\, dt + \sigma dZ_t + \sigma_1 dZ_t^i \ , \tag{1}$$

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. If $g_t = 0$, the government policy is "neutral" in that it has no impact on profitability.

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.[6] At that time τ, the government decides 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 $n = \{1, \ldots, N\}$ 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 $n = \{1, \ldots, N\}$. The value of g_t is then a simple step function of time:

$$g_t = \begin{cases} g^0 & \text{for} \quad t \leq \tau \\ g^0 & \text{for} \quad t > \tau \quad \text{if the old policy is retained (i.e., no policy change)} \\ g^n & \text{for} \quad t > \tau \quad \text{if the new policy } n \text{ is chosen, } n \in \{1, \ldots, N\} \ . \end{cases} \tag{2}$$

A policy change replaces g^0 by g^n, thereby inducing a permanent shift in average profitability. A policy decision becomes effective immediately after its announcement at time τ.

The value of g_t is unknown for all $t \in [0, T]$. This key assumption captures the idea that government policies have an uncertain impact on firm profitability. As of time 0, the prior

[6] The assumption that τ is exogenous dramatically simplifies the analysis. If the government were allowed to choose the optimal τ, the double-learning problem analyzed in Sections 2.1 and 2.2 would become intractable. Conceptually, though, we do not see any reason why relaxing this assumption should affect our basic conclusions about the asset pricing effects of political uncertainty.

distributions of all policy impacts are normal:

$$g^0 \sim N\left(0, \sigma_g^2\right) \tag{3}$$

$$g^n \sim N\left(\mu_g^n, \sigma_{g,n}^2\right) \qquad \text{for } n = \{1, \ldots, N\} \ . \tag{4}$$

The old policy is expected to be neutral a priori, without loss of generality. The new policies are characterized by heterogeneous prior beliefs about g^n. The values of $\left\{g^0, g^1, \ldots, g^N\right\}$ are unknown to all agents—the government as well as the investors who own the firms.

The 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

$$u\left(W_T^j\right) = \frac{\left(W_T^j\right)^{1-\gamma}}{1-\gamma} \ , \tag{5}$$

where W_T^j is investor j's wealth at time T and $\gamma > 1$ is the coefficient of relative risk aversion. At time 0, all investors are equally endowed with shares of firm stock. Stocks pay liquidating dividends at time T.[7] Investors always know which government policy is in place.

When making its policy decision at time τ, the government maximizes the same objective function as the investors, except that it also faces a nonpecuniary cost (or benefit) associated with any policy change. The government chooses the policy that maximizes

$$\max_{n \in \{0, \ldots, N\}} \left\{ \mathrm{E}_\tau \left[\frac{C^n W_T^{1-\gamma}}{1-\gamma} \mid \text{policy } n \right] \right\}, \tag{6}$$

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).[8] 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 $C^n = 1$:

$$c^n \equiv \log\left(C^n\right) \sim N\left(-\frac{1}{2}\sigma_c^2, \sigma_c^2\right) \qquad \text{for } n = \{1, \ldots, N\} \ , \tag{7}$$

[7] No dividends are paid before time T because the investors' preferences (equation (5)) do not involve intermediate consumption. Firms in our model reinvest all of their earnings, as mentioned earlier.

[8] We refer to C^n as a cost because higher values of C^n translate into lower utility (as $W_T^{1-\gamma}/\left(1-\gamma\right) < 0$).

where the c^n values are uncorrelated across policies as well as independent of the Brownian motions in equation (1). Uncertainty about $\{C^n\}_{n=1}^N$, which is given by σ_c as of time 0, is the source of *political uncertainty* in our model. Due to this uncertainty, stock prices before time τ respond to political news, as explained later in Sections 2.2 and 4.2.

Given its objective function in equation (6), the government is "quasi-benevolent": it is expected to maximize the investors' welfare (because $\mathrm{E}_0[C^n] = 1$ for all n), but also to deviate from this objective in a random fashion. The assumption that governments do not behave as fully benevolent social planners is widely accepted in the political economy literature. This literature presents various reasons why governments might not maximize aggregate welfare. For example, governments care about the distribution of wealth.[9] Governments tend to be influenced by special interest groups.[10] They might also be susceptible to corruption.[11] Instead of modeling these political forces explicitly, we adopt a simple reduced-form approach to capturing departures from benevolence. In our model, all aspects of politics—redistribution, corruption, special interests, etc.—are bundled together in the political costs $\{C^n\}_{n=1}^N$. The randomness of these costs reflects the difficulty investors face in predicting the outcome of the political process, which can be complex and non-transparent. For example, it can be hard to predict the outcome of a battle between special interest groups. By modeling politics in such a reduced-form fashion, we are able to focus on the asset pricing implications of the uncertainty about government policy choice.

Government policies also merit more discussion. We interpret policy changes broadly as government actions that change the economic environment. Examples include major reforms, such as the recent Wall Street reform, health care reform, and the various ongoing structural changes in the eurozone. Deeper reforms, or more radical policy changes, tend to introduce a less familiar regulatory framework whose long-term impact on the private sector is often more difficult to assess in advance. Such policies might thus warrant relatively high values of $\sigma_{g,n}$ in equation (4). In contrast, a potential new policy that has already been tried in the past might merit a lower $\sigma_{g,n}$ if agents believe they have more prior information about that policy's impact. We abstract from the fact that government policies may affect some firms more than others, focusing on the aggregate effects.

[9] Redistribution of wealth is a major theme in political economy. Prominent studies of redistribution include Alesina and Rodrik (1994) and Persson and Tabellini (1994), among others. Our model is not well suited for analyzing redistribution effects because all of our investors are identical ex ante, for simplicity.

[10] See, for example, Grossman and Helpman (1994) and Coate and Morris (1995).

[11] See, for example, Shleifer and Vishny (1993) and Rose-Ackerman (1999).

2.1. Learning About Policy Impacts

As noted earlier, the values of the policy impacts $\{g^n\}_{n=0}^N$ are unknown to all agents, investors and the government alike. At time 0, all agents share the prior beliefs summarized in equations (3) and (4). Between times 0 and τ, all agents learn about g^0, the impact of the prevailing (old) policy, by observing the realized profitabilities of all firms. The Bayesian learning process is described in Proposition 1 of Pástor and Veronesi (2012). Specifically, the posterior distribution of g^0 at any time $t \leq \tau$ is given by

$$g_t \sim N\left(\widehat{g}_t, \widehat{\sigma}_t^2\right) \ , \tag{8}$$

where the posterior mean and variance evolve as

$$d\widehat{g}_t = \widehat{\sigma}_t^2 \sigma^{-1} d\widehat{Z}_t \tag{9}$$

$$\widehat{\sigma}_t^2 = \frac{1}{\frac{1}{\sigma_g^2} + \frac{1}{\sigma^2} t} \ . \tag{10}$$

Above, $d\widehat{Z}_t$ denotes the expectation errors, which reflect shocks to the average profitability across all firms.[12] When the average profitability is higher than expected, agents revise their beliefs about g^0 upward, and vice versa (see equation (9)). Uncertainty about g^0 declines deterministically over time due to learning (see equation (10)). Before time τ, there is no learning about the impacts of the new policies, so agents' beliefs about $\{g^n\}_{n=1}^N$ at any time $t \leq \tau$ are given by the prior distributions in equation (4).

If there is no policy change at time τ, then agents continue to learn about g^0 after time τ, and the processes (9) and (10) continue to hold also for $t > \tau$. If there is a policy change at time τ, agents stop learning about g^0 and begin learning about g^n, the impact of the new policy n adopted by the government. 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 $N\left(\mu_g^n, \sigma_{g,n}^2\right)$. Agents continue to learn about g^n in a Bayesian fashion until time T.

2.2. Learning About Political Costs

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. We model these signals as "signal = true value plus noise," which takes the following form in continuous time:

$$ds_t^n = c^n dt + h dZ_{c,t}^n \ , \qquad n = 1, \ldots, N, \tag{11}$$

[12] The $d\widehat{Z}_t$ shocks are related to the dZ_t shocks from equation (1) as follows: $d\widehat{Z}_t = dZ_t + \left[(g^0 - \widehat{g}_t)/\sigma\right] dt$.

where $1/h$ denotes signal precision. The signals ds_t^n are uncorrelated across n and independent of any other shocks in the economy. We refer to these signals as "political signals," and interpret them as capturing the steady flow of political news relevant to policy n. Real-world agents observe numerous political speeches, debates, and negotiations on a daily basis. The outcomes of these events help agents revise their beliefs about the political costs and benefits associated with the policies being debated.

Combining the signals in equation (11) with the prior distribution in equation (7), we obtain the posterior distribution of c^n, for $n = 1, \ldots, N$, at any time $t \leq \tau$:

$$c^n \sim N\left(\widehat{c}_t^n, \widehat{\sigma}_{c,t}^2\right) \ , \tag{12}$$

where the posterior mean and variance evolve as

$$d\widehat{c}_t^n = \widehat{\sigma}_{c,t}^2 h^{-1} d\widehat{Z}_{c,t}^n \tag{13}$$

$$\widehat{\sigma}_{c,t}^2 = \frac{1}{\frac{1}{\sigma_c^2} + \frac{1}{h^2}(t - t_0)} \ . \tag{14}$$

Equation (13) shows that agents' beliefs about c^n are driven by the Brownian shocks $d\widehat{Z}_{c,t}^n$, which reflect the differences between the political signals ds_t^n and their expectations ($d\widehat{Z}_{c,t}^n = h^{-1}\left(ds_t^n - \mathrm{E}_t\left[ds_t^n\right]\right)$). Since the political signals are independent of all "fundamental" shocks in the economy (i.e., dZ_t and dZ_t^i), the innovations $d\widehat{Z}_{c,t}^n$ represent pure *political shocks*. These shocks shape agents' beliefs about which government policy is likely to be adopted in the future, above and beyond the effect of fundamental economic shocks. In reality, political shocks might potentially be related to economic shocks in a complicated way. Our assumption of independence allows us to emphasize later that even when political shocks are orthogonal to economic shocks, they command a risk premium in equilibrium.

Our model exhibits two major differences from the model of Pástor and Veronesi (2012). First, we allow the government to choose from a set of policies that are perceived as heterogeneous a priori. Pástor and Veronesi assume that the prior beliefs about the impacts of all government policies are identical, which corresponds to $\mu_g^n = 0$ and $\sigma_{g,n}^2 = \sigma_g^2$ for all n in our setting. In contrast, we allow μ_g^n and $\sigma_{g,n}^2$ to vary across policies, as a result of which uncertainty about which of the new policies the government might adopt becomes important. Due to this uncertainty, policy heterogeneity generates an endogenous increase in political uncertainty when economic conditions get worse and the probability of a policy change rises. We also allow the political costs C^n to differ across policies. Second, we allow agents to learn about C^n before time τ. There is no such learning in Pástor and Veronesi's model; their political cost is drawn at time τ from the prior distribution in equation (7).

Learning about C^n introduces additional "political" shocks to the economy, which play a crucial role in our paper. Finally, our focus differs from that of Pástor and Veronesi. They emphasize the announcement returns associated with policy changes, whereas our objects of interest are the risk premium, volatility, and correlation induced by political uncertainty. They concentrate on the instantaneous price response at time τ, whereas we emphasize the asset pricing effects of a continuous stream of political shocks before time τ.

3. Optimal Government Policy Choice

In this section, we analyze how the government chooses its policy at time τ. After a period of learning about g^0 and $\{C^n\}_{n=1}^N$, the government chooses one of $N+1$ policies, $\{0, 1, \ldots, N\}$, at time τ. Recall that if the government replaces policy 0 by policy n, the value of g_t changes from g^0 to g^n and the perceived distribution of g_t changes from the posterior in equation (8) to the prior in equation (4). It is useful to introduce the following notation:

$$\widetilde{\mu}^n = \mu_g^n - \frac{\sigma_{g,n}^2}{2}(T-\tau)(\gamma-1) \qquad n = 1, \ldots, N \tag{15}$$

$$\widetilde{\mu}^0 = \widehat{g}_\tau - \frac{\widehat{\sigma}_\tau^2}{2}(T-\tau)(\gamma-1) \ . \tag{16}$$

To align the notation for the old policy with the notation for the new policies, we also define

$$\mu_g^0 = \widehat{g}_\tau \tag{17}$$

$$\sigma_{g,0} = \widehat{\sigma}_\tau \ , \tag{18}$$

keeping in mind that μ_g^0 as well as $\widetilde{\mu}^0$ are stochastic, unlike their counterparts for the new policies (for which there is no learning before time τ). Under this notation, at time τ, agents' beliefs about each policy n are given by $N\left(\mu_g^n, \sigma_{g,n}^2\right)$, where this distribution is a prior for $n = 1, \ldots, N$ but a posterior for $n = 0$.

We refer to $\widetilde{\mu}^n$ in equations (15) and (16) as the "utility score" of policy n, for $n = 0, 1, \ldots, N$. This label can be easily understood in the context of the following lemma.

Lemma 1: *Given any two policies m and n in the set $\{0, 1, \ldots, N\}$, we have*

$$\mathrm{E}_\tau\left[\frac{W_T^{1-\gamma}}{1-\gamma} \mid \text{policy } n\right] > \mathrm{E}_\tau\left[\frac{W_T^{1-\gamma}}{1-\gamma} \mid \text{policy } m\right] \tag{19}$$

if and only if

$$\widetilde{\mu}^n > \widetilde{\mu}^m \ . \tag{20}$$

Lemma 1 shows that the policy with the highest utility score delivers the highest utility to investors at time τ. It follows immediately from the definition of the utility score that investors prefer policies whose impacts are perceived to have high means and/or low variances, analogous to the popular mean-variance preferences in portfolio theory.

The government's preferences differ from the investors' preferences due to political costs, as shown in equation (6). The government chooses policy n at time τ if and only if the following condition is satisfied for all policies $m \neq n, m \in \{0, \ldots, N\}$:

$$\mathrm{E}_\tau\left[\frac{C^n W_T^{1-\gamma}}{1-\gamma} \mid \text{policy } n\right] \;>\; \mathrm{E}_\tau\left[\frac{C^m W_T^{1-\gamma}}{1-\gamma} \mid \text{policy } m\right] \qquad \forall m \neq n \ .$$

The above condition yields our first proposition.

Proposition 1: *The government chooses policy n at time τ if and only if the following condition holds for all policies $m \neq n,\ m \in \{0, 1, \ldots, N\}$:*

$$\widetilde{\mu}^n - \widetilde{c}^n > \widetilde{\mu}^m - \widetilde{c}^m \ , \tag{21}$$

where we define

$$\widetilde{c}^n = \frac{c^n}{(\gamma-1)\,(T-\tau)} \qquad\qquad n = 0, 1, \ldots, N \ . \tag{22}$$

Proposition 1 shows that the government chooses the policy with the highest value of $\widetilde{\mu}^n - \widetilde{c}^n$ across all $n \in \{0, \ldots, N\}$. Recall that $\widetilde{c}^0 = 0$ and that policy 0's utility score $\widetilde{\mu}^0$ is a simple function of $\widehat{g}_\tau$ (see equation (16)). We thus obtain the following corollary.

Corollary 1: *The government changes its policy at time τ if and only if*

$$\widehat{g}_\tau \;<\; \max_{n \in \{1,\ldots,N\}} \{\widetilde{\mu}^n - \widetilde{c}^n\} + \frac{\widehat{\sigma}_\tau^2}{2}\,(T-\tau)\,(\gamma-1) \ . \tag{23}$$

The government finds it optimal to change its policy if $\widehat{g}_\tau$, the posterior mean of g^0, is sufficiently low. That is, the old policy is replaced if its impact on firm profitability is perceived as sufficiently unfavorable. This result is the basis for our interpretation later on that the government effectively provides put protection to the market.

Before time τ, agents face uncertainty about the government's action at time τ because they know neither $\widehat{g}_\tau$ nor the political costs. From Proposition 1, we derive the probabilities of all potential government actions as perceived at any time $t \leq \tau$.

Corollary 2: *The probability that the government chooses policy n at time τ, evaluated at any time $t \leq \tau$ for any policy $n \in \{1, \ldots, N\}$, is given by*

$$p_t^n = \int_{-\infty}^{\infty} \Pi_{m \neq n, m \in \{1,\ldots,N\}} \left[1 - \Phi_{\widetilde{c}^m}\left(\widetilde{c}^n + \widetilde{\mu}^m - \widetilde{\mu}^n\right)\right] \Phi_{\widetilde{\mu}^0}\left(\widetilde{\mu}^n - \widetilde{c}^n | \widehat{g}_t\right) \phi_{\widetilde{c}^n}\left(\widetilde{c}^n\right) d\widetilde{c}^n \ . \tag{24}$$

Above, $\phi_{\widetilde{c}^n}(.)$ and $\Phi_{\widetilde{c}^n}(.)$ are the normal pdf and cdf of $\widetilde{c}^n$, respectively, and $\Phi_{\widetilde{\mu}^0}$ is the normal cdf of $\widetilde{\mu}^0$.[13] *The probability that the old policy will be retained is $p_t^0 = 1 - \sum_{n=1}^{N} p_t^n$.*

4. Stock Prices

In this section, we derive the asset pricing implications of political uncertainty. First, we analyze the effect of this uncertainty on the state price density. Next, we study how stock prices depend on economic and political shocks. Finally, we examine the stock price response to the resolution of political uncertainty when the government makes its policy decision.

Firm i's stock is a claim on the firm's liquidating dividend at time T, which is equal to B_T^i. The market value of stock i is given by the standard pricing formula

$$M_t^i = \mathrm{E}_t\left[\frac{\pi_T}{\pi_t} B_T^i\right] \ , \tag{25}$$

where π_t denotes the state price density. The investors' total wealth at time T is equal to $W_T = B_T = \int_0^1 B_T^i di$. Since investors consume only at time T, there is no intertemporal consumption choice that would pin down the risk-free interest rate, so this rate is indeterminate. We set it equal to zero, for simplicity.[14] Our choice to model consumption from final wealth ensures that our asset pricing results are not driven by fluctuations in the risk-free rate but rather by risk premia, which are the focus of this paper. Assuming complete markets, standard arguments imply that the state price density is uniquely given by

$$\pi_t = \frac{1}{\lambda} \mathrm{E}_t\left[B_T^{-\gamma}\right], \tag{26}$$

where λ is the Lagrange multiplier from the utility maximization problem of the representative investor. This state price density is further characterized below.

[13] As of time t, $\widetilde{c}^n \sim \mathcal{N}(\frac{\widehat{c}_t^n}{(\gamma-1)(T-\tau)}, \frac{\widehat{\sigma}_{c,t}^2}{(\gamma-1)^2(T-\tau)^2})$ and $\widetilde{\mu}^0 \sim \mathcal{N}(\widehat{g}_t - \frac{\widehat{\sigma}_\tau^2}{2}(T-\tau)(\gamma-1), \widehat{\sigma}_t^2 - \widehat{\sigma}_\tau^2)$.

[14] This assumption is equivalent to assuming that a riskless zero-coupon bond with maturity T is chosen as the numeraire in all stock price calculations. Both assumptions are commonly made when utility is defined over final wealth; e.g., Kogan, Ross, Wang, and Westerfield (2006) and Cuoco and Kaniel (2011).

4.1. The State Price Density

Our main focus is on the behavior of stock prices before political uncertainty is resolved at time τ. Before time τ, agents learn about the impact of the old policy as well as the political costs of the new policies. This learning generates stochastic variation in the posterior means of g^0 and $\{c^n\}_{n=1}^N$, as shown in equations (9) and (13). The $N+1$ posterior means, $\left(\widehat{g}_t, \widehat{c}_t^1, \ldots, \widehat{c}_t^N\right)$, represent stochastic state variables that affect asset prices before time τ. The posterior variances of g^0 and $\{c^n\}_{n=1}^N$ vary deterministically over time (see equations (10) and (14)). We denote the full set of $N+2$ state variables, including time t, by

$$S_t \equiv \left(\widehat{g}_t, \widehat{c}_t^1, \ldots, \widehat{c}_t^N, t\right) \ . \tag{27}$$

The following proposition presents an analytical expression for the state price density.

Proposition 2: *The state price density at time $t \leq \tau$ is given by*

$$\pi_t = \lambda^{-1} B_t^{-\gamma} e^{\left(-\gamma\mu + \frac{1}{2}\gamma(\gamma+1)\sigma^2\right)(T-\tau)} \Omega\left(S_t\right) \ , \tag{28}$$

where the function $\Omega\left(S_t\right)$ is given in equation (A1) in the Appendix.

The dynamics of π_t, which are key for understanding the sources of risk in this economy, are given in the following proposition, which follows from Proposition 2 by Ito's lemma.

Proposition 3: *The stochastic discount factor (SDF) follows the diffusion process*

$$\frac{d\pi_t}{\pi_t} = \left(-\gamma\sigma + \sigma_{\pi,0}\right) d\widehat{Z}_t + \sum_{n=1}^{N} \sigma_{\pi,n} d\widehat{Z}_{c,t}^n \ , \tag{29}$$

where

$$\sigma_{\pi,0} = \frac{1}{\Omega}\frac{\partial\Omega}{\partial\widehat{g}_t}\widehat{\sigma}_t^2\sigma^{-1} \tag{30}$$

$$\sigma_{\pi,n} = \frac{1}{\Omega}\frac{\partial\Omega}{\partial\widehat{c}_t^n}\widehat{\sigma}_{c,t}^2 h^{-1} \ . \tag{31}$$

Equation (29) shows that the SDF is driven by three types of shocks, which we refer to as capital shocks, impact shocks, and political shocks.

Capital shocks, measured by $-\gamma\sigma d\widehat{Z}_t$, are due to stochastic variation in total capital B_t. In the filtered probability space, B_t follows the process

$$\frac{dB_t}{B_t} = (\mu + \widehat{g}_t)dt + \sigma d\widehat{Z}_t \ , \tag{32}$$

which shows that the shocks to total capital are perfectly correlated with $d\widehat{Z}_t$. Capital shocks would affect the SDF in the same way even if all the parameters were known.

Impact shocks, measured by $\sigma_{\pi,0}d\widehat{Z}_t$, are also perfectly correlated with $d\widehat{Z}_t$, but they are induced by learning about the impact of the old policy (g^0). Recall from equation (9) that the revisions in agents' beliefs about g^0, denoted by $d\widehat{g}_t$, are perfectly correlated with $d\widehat{Z}_t$. It follows from equation (30) that impact shocks affect the SDF more when the sensitivity of marginal utility to variation in $\widehat{g}_t$ is larger (i.e., when $\partial\Omega/\partial\widehat{g}_t$ is larger), when the uncertainty about g^0 is larger (i.e., when $\widehat{\sigma}_t$ is larger), as well as when the precision of the $\widehat{g}_t$ shocks is larger (i.e., when σ^{-1} is larger). Impact shocks capture the unexpected variation in marginal utility resulting from learning about the old policy's impact.

As noted above, both capital shocks and impact shocks are driven by the same underlying shocks $d\widehat{Z}_t$. Since the $d\widehat{Z}_t$ shocks represent perceived shocks to aggregate capital (see equation (32)), they affect the aggregate fundamentals of the economy. Therefore, we refer to both capital shocks and impact shocks jointly as *economic shocks*.

The third and final type of shocks, *political shocks*, are orthogonal to economic shocks. Political shocks, measured by $\sum_{n=1}^{N}\sigma_{\pi,n}d\widehat{Z}^n_{c,t}$, arise due to learning about political costs $\{C^n\}_{n=1}^N$ (see equation (13)). The $d\widehat{Z}^n_{c,t}$ shocks are independent of the $d\widehat{Z}_t$ shocks; hence the orthogonality between political and economic shocks. It follows from equation (31) that political shocks have a bigger effect on the SDF when the sensitivity of marginal utility to $\widehat{c}^n_t$ ($\partial\Omega/\partial\widehat{c}^n_t$) is larger, when the uncertainty about political costs ($\widehat{\sigma}_{c,t}$) is larger, as well as when the precision of the political signals (h^{-1}) is larger.

Interestingly, the importance of political shocks for the SDF is state-dependent as a result of the dependence of the sensitivity $\partial\Omega/\partial\widehat{c}^n_t$ on $\widehat{g}_t$. When $\widehat{g}_t$ is large, this sensitivity is close to zero, and so is $\sigma_{\pi,n}$. In fact, we can prove the following corollary.

Corollary 3: *As* $\widehat{g}_t \to \infty$, $\sigma_{\pi,n} \to 0$ *for all* $n = 1, \ldots, N$.

This corollary shows that the number of priced factors is effectively endogenous. There are $N+1$ shocks in equation (29) but as $\widehat{g}_t$ grows, the influence of the N political shocks diminishes, and in the limit as $\widehat{g}_t \to \infty$, the SDF depends only on economic shocks $d\widehat{Z}_t$.

The logic behind this corollary is simple. As $\widehat{g}_t$ increases, the old policy becomes increasingly likely to be retained by the government at time τ (Corollary 1). In the limit, the old policy is certain to be retained. Since the new policies are certain not to be adopted, news about their political costs does not matter. More generally, learning about the politicians'

preferences for the various potential new policies matters more if the old policy is more likely to be replaced, which happens when $\widehat{g}_t$ is lower. We return to this key point later on.

4.2. Stock Prices and Risk Premia

First, we derive the level of stock prices in closed form.

Proposition 4: *The market value of firm i at time $t \leq \tau$ is given by*

$$M_t^i = B_t^i e^{(\mu-\gamma\sigma^2)(T-\tau)} \frac{H\left(S_t\right)}{\Omega\left(S_t\right)} \ , \tag{33}$$

where $\Omega\left(S_t\right)$ and $H\left(S_t\right)$ are given in equations (A1) and (A2) in the Appendix.

The dynamics of stock prices are presented in the following proposition.

Proposition 5: *Stock returns of firm i at time $t \leq \tau$ follow the process*

$$\frac{dM_t^i}{M_t^i} = \mu_M^i dt + \left(\sigma + \sigma_{M,0}\right) d\widehat{Z}_t + \sum_{n=1}^{N} \sigma_{M,n} d\widehat{Z}_{c,t}^n + \sigma_1 dZ_t^i \ , \tag{34}$$

where

$$\begin{aligned} \sigma_{M,0} &= \left(\frac{1}{H}\frac{\partial H}{\partial \widehat{g}_t} - \frac{1}{\Omega}\frac{\partial \Omega}{\partial \widehat{g}_t}\right) \widehat{\sigma}_t^2 \sigma^{-1} \\ \sigma_{M,n} &= \left(\frac{1}{H}\frac{\partial H}{\partial \widehat{c}_t^n} - \frac{1}{\Omega}\frac{\partial \Omega}{\partial \widehat{c}_t^n}\right) \widehat{\sigma}_{c,t}^2 h^{-1} \end{aligned}$$

and

$$\mu_M^i = \left(\gamma\sigma - \sigma_{\pi,0}\right)\left(\sigma + \sigma_{M,0}\right) - \sum_{n=1}^{N} \sigma_{\pi,n}\sigma_{M,n} \ . \tag{35}$$

Equation (34) shows that individual stock returns are driven by both economic shocks ($d\widehat{Z}_t$) and political shocks ($d\widehat{Z}_{c,t}^n$), as well as by the firm-specific dZ_t^i shocks. The latter shocks do not command a risk premium because they are diversifiable across firms. The risk premium of stock i is equal to the expected rate of return μ_M^i since the risk-free rate is zero.[15] This risk premium, given in equation (35), does not depend on i, so it also represents the market-wide equity risk premium. The premium can be further decomposed as follows:

$$\mu_M^i = \underbrace{\underbrace{\underbrace{\gamma\sigma^2}_{\text{Capital shocks}} + \underbrace{\left(\gamma\sigma\sigma_{M,0} - \sigma\sigma_{\pi,0} - \sigma_{M,0}\sigma_{\pi,0}\right)}_{\text{Impact shocks}}}_{\text{Economic shocks}} - \underbrace{\sum_{n=1}^{N} \sigma_{\pi,n}\sigma_{M,n}}_{\text{Political shocks}}}_{} \ . \tag{36}$$

[15] Alternatively, μ_M^i can be interpreted as the equity risk premium relative to the zero-coupon risk-free bond that we use as the numeraire. Recall the discussion at the beginning of Section 4.

Equation (36) shows that the risk premium has three components corresponding to the three types of shocks introduced earlier in the discussion of Proposition 3. Recall that impact shocks are induced by learning about g^0 (i.e., by time variation in $\widehat{g}_t$), whereas political shocks are induced by learning about C^n (i.e., by $d\widehat{Z}^n_{c,t}, n = 1, \ldots, N$). Also recall that both capital shocks and impact shocks are driven by the same economic shocks $d\widehat{Z}_t$. A positive shock $d\widehat{Z}_t$ increases not only current capital B_t (equation (32), a capital shock) but also expected future capital via $\widehat{g}_t$ (equation (9), an impact shock).

The last term in equation (36) represents the risk premium induced by political shocks, which are orthogonal to economic shocks. It is interesting that political shocks command a risk premium despite being unrelated to fundamental economic shocks. We refer to this premium as the *political risk premium*, to emphasize its difference from the more traditional economic risk premia that are driven by economic shocks. The political risk premium compensates investors for political uncertainty, which makes investors uncertain about which policy the government might adopt in the future.

The second term in (36), the risk premium induced by impact shocks, represents compensation for a different aspect of uncertainty about government policy—uncertainty about the impact of the prevailing policy on profitability (g^0). If g^0 were known with certainty, this component of the risk premium would be zero. Learning about g^0 affects agents' expectations of future capital growth, as well as their assessment of the probability that the government will change its policy. Since the signals about g^0 are perfectly correlated with economic shocks ($d\widehat{Z}_t$), the second term in (36) represents an economic risk premium.

The risk premium induced by capital shocks, $\gamma\sigma^2$, is independent of any state variables. In contrast, the risk premia induced by both impact shocks and political shocks are state-dependent because $\sigma_{M,n}$ and $\sigma_{\pi,n}$ depend on S_t for all $n = 0, \ldots, N$. For example, we already know that the political risk premium goes to zero as $\widehat{g}_t \to \infty$ (Corollary 3). More generally, we show below that the political risk premium is larger in poorer economic conditions (i.e., when $\widehat{g}_t$ is low). We also show that the risk premium induced by impact shocks varies with economic conditions in an interesting non-monotonic fashion.

4.3. Stock Price Reaction to the Policy Decision

When the government announces its policy decision at time τ, stock prices jump. To evaluate this jump, we solve for stock prices immediately before and immediately after the policy announcement. Let M^i_τ denote the market value of firm i immediately before the announce-

ment, and $M_{\tau+}^{i,n}$ denote the firm's value immediately after the announcement of policy n. Closed-form expressions for M_τ^i and $M_{\tau+}^{i,n}$ are given in the Appendix in Lemmas A1 and A2, respectively. We then define each firm's "announcement return" as the instantaneous stock return at time τ conditional on the announcement of policy n:

$$R^n\left(\widehat{g}_\tau\right) = \frac{M_{\tau+}^{i,n}}{M_\tau^i} - 1 \ . \tag{37}$$

The announcement return depends on $\widehat{g}_\tau$ but not on i: all firms experience the same announcement return as they are equally exposed to changes in government policy. Therefore, R^n also represents the aggregate stock market reaction to the announcement of policy n.

Proposition 6: *If the government retains the old policy, the announcement return is*

$$R^0\left(\widehat{g}_\tau\right) = \frac{\sum_{n=0}^N p_\tau^n e^{-\gamma(T-\tau)\left(\widetilde{\mu}^n-\widetilde{\mu}^0\right)+\frac{\gamma}{2}(T-\tau)^2\left(\sigma_{g,n}^2-\widehat{\sigma}_\tau^2\right)}}{\sum_{n=0}^N p_\tau^n e^{(1-\gamma)(T-\tau)(\widetilde{\mu}^n-\widetilde{\mu}^0)}} - 1 \ . \tag{38}$$

If the government replaces the old policy by the new policy n, for any $n \in \{1,\ldots,N\}$, the announcement return is equal to

$$R^n\left(\widehat{g}_\tau\right) = \left[1 + R^0\left(\widehat{g}_\tau\right)\right] e^{\left(\widetilde{\mu}^n-\widetilde{\mu}^0\right)(T-\tau)-\frac{\gamma}{2}(T-\tau)^2\left(\sigma_{g,n}^2-\widehat{\sigma}_\tau^2\right)} - 1 \ . \tag{39}$$

Proposition 6 provides a closed-form expression for the announcement return associated with any government policy choice. The proposition implies the following corollary.

Corollary 4: *The ratio of the gross announcement returns for any pair of policies m and n in the set $\{0,1,\ldots,N\}$ is given by*

$$\frac{1 + R^m\left(\widehat{g}_\tau\right)}{1 + R^n\left(\widehat{g}_\tau\right)} = e^{(\widetilde{\mu}^m-\widetilde{\mu}^n)(T-\tau)-\frac{\gamma}{2}(T-\tau)^2\left(\sigma_{g,m}^2-\sigma_{g,n}^2\right)} \ . \tag{40}$$

The corollary relates the announcement returns to the utility scores for any policy pair. Interestingly, a given policy choice can increase investor welfare while decreasing stock prices, and vice versa. Consider two policies m and n for which the following condition holds:

$$0 < \mu_g^m - \mu_g^n - \frac{1}{2}(T-\tau)(\gamma-1)\left(\sigma_{g,m}^2 - \sigma_{g,n}^2\right) < \frac{\gamma}{2}(T-\tau)\left(\sigma_{g,m}^2 - \sigma_{g,n}^2\right) \ . \tag{41}$$

Even though policy m yields higher utility (because $\widetilde{\mu}^m > \widetilde{\mu}^n$), policy n yields a higher announcement return ($R^m < R^n$). Utility is maximized by the policy with the highest utility score $\widetilde{\mu}^n$, whereas stock market value is maximized by the policy with the highest value of $\widetilde{\mu}^n - \frac{\gamma}{2}(T-\tau)\sigma_{g,n}^2$. To understand this difference, recall from equation (4) that $\sigma_{g,n}$

measures the uncertainty about the impact of policy n on firm profitability. This uncertainty cannot be diversified away because it affects all firms. As a result, this uncertainty increases discount rates and pushes down asset prices. Adopting a policy with a high value of $\sigma_{g,n}$ can thus depress stock prices even if this policy is welfare-improving. Overall, Corollary 4 shows that one cannot judge government policies solely by their announcements returns.

The result that stock prices and welfare can move in opposite directions is not unique to our setting. For example, this result obtains also in a standard Lucas economy with intermediate consumption, time-separable CRRA utility with risk aversion greater than one, and stock prices defined in terms of the consumption good. In that economy, an increase in consumption growth improves welfare but decreases stock prices, due to consumption smoothing: higher consumption growth leads investors to sell stocks and bonds to consume more today, pushing interest rates up and stock prices down. There is no such intertemporal smoothing in our model. We identify a new mechanism that can drive a wedge between prices and welfare, namely, policy risk. Corollary 4 shows that if policies m and n are equally risky, so that $\sigma_{g,m} = \sigma_{g,n}$, then prices and welfare coincide (i.e., $R^m = R^n$ if and only if $\widetilde{\mu}^m = \widetilde{\mu}^n$). It is differences in policy risk that separate prices from welfare in our model.

Corollary 5: *Holding the utility score $\widetilde{\mu}^n$ constant, policies with higher uncertainty $\sigma_{g,n}$ elicit lower announcement returns.*

Corollary 5 follows immediately from Corollary 4. Among policies delivering the same utility, the policies with higher values of $\sigma_{g,n}$ elicit less favorable stock market reactions.

5. A Two-Policy Example

In this section, we use a simple setting to illustrate our results on the risk premium, volatility, and correlation induced by political uncertainty. We consider a special case of $N = 2$, allowing the government to choose from two new policies, L and H, in addition to the old one. We assume that both new policies are expected to provide the same level of utility a priori, $\widetilde{\mu}^L = \widetilde{\mu}^H$. This simplifying iso-utility assumption can be motivated by appealing to the government's presumed good intentions—it would be reasonable for the government to eliminate from consideration any policies that are perceived by all agents as inferior in terms of utility. We also assume, without loss of generality, that policy H is perceived to have a more uncertain impact on firm profitability, so that $\sigma_{g,L} < \sigma_{g,H}$. As argued earlier, policy H can then be viewed as the deeper reform. To ensure that both new policies yield the same

utility, policy H must also have a more favorable expected impact, so that $\mu_g^L < \mu_g^H$. It follows immediately from equation (15) that to ensure $\widetilde{\mu}^L = \widetilde{\mu}^H$, we must have

$$\mu_g^H - \mu_g^L = \frac{1}{2}\left(\sigma_{g,H}^2 - \sigma_{g,L}^2\right)(T-\tau)(\gamma-1) \ . \tag{42}$$

That is, the higher uncertainty of policy H must be compensated by a higher expectation.

Table 1 reports the parameter values used to calibrate the model. For the first eight parameters (σ_g, σ_c, μ, σ, σ_1, T, τ, and γ), we choose the same annual values (2%, 10%, 10%, 5%, 10%, 20, 10, 5) as do Pástor and Veronesi (2012). The remaining three parameters (h, $\sigma_{g,L}$, and $\sigma_{g,H}$) do not appear in Pástor and Veronesi's model. We choose $h = 5\%$, equal to the value of σ, so that the speed of learning about each C^n is the same as the speed of learning about g^n. We choose $\sigma_{g,L} = 1\%$ and $\sigma_{g,H} = 3\%$, so that the prior uncertainties about the new policies are symmetric around the old policy's $\sigma_g = 2\%$. In addition, we require that the new-policy means be symmetric around the old-policy mean of zero, that is, $\mu_{g,L} = -\mu_{g,H}$. It then follows from equation (42) that $\mu_{g,L} = -0.8\%$ and $\mu_{g,H} = 0.8\%$. Finally, we assume that learning about C^n begins at time $t_0 = \tau - 1$, which means that political debates about the new policies begin one year before the policy decision. All of these parameter choices strike us as reasonable, but we also perform some sensitivity analysis.

Figure 1 plots the adoption probabilities of the three government policy choices: the old policy 0 and the new policies H and L. The probabilities are computed as of time $t = \tau - 1$ when the political debates begin.[16] They are plotted as a function of $\hat{g}_t$, the posterior mean of g^0 at time t, which is the key state variable summarizing *economic conditions*. High values of $\widehat{g}_t$ indicate that the prevailing government policy is helping make firms highly profitable, which is generally indicative of strong economic conditions. Similarly, low values of $\widehat{g}_t$ tend to indicate low profitability and thus weak economic conditions.[17] We set the values of $\widehat{c}_\tau^L$ and $\widehat{c}_\tau^H$ equal to their initial values at time 0 ($\widehat{c}_\tau^L = \widehat{c}_\tau^H = -\sigma_c^2/2$) to make both new policies equally likely; as a result, the solid and dotted lines coincide. We label policy H as the "new risky policy" and policy L as the "new safe policy" (since $\sigma_{g,H} > \sigma_{g,L}$).

Figure 1 shows that when $\widehat{g}_t$ is very low, the probability that the old policy will be retained is close to zero. A low $\widehat{g}_t$ indicates that the old policy is "not working," so the government

[16] As of time 0, the probabilities of policies 0, L, and H are 63.4%, 18.3%, and 18.3%, respectively.

[17] The value of $\widehat{g}_t$ is determined by the cumulative effect of all aggregate profitability shocks before time t (see equation (9)). A high value of $\widehat{g}_t$ implies high average realized profitability, and vice versa. Plotting a quantity against $\widehat{g}_t$ is equivalent to plotting it against the average realized profitability computed across many paths of shocks simulated from our model. To the extent that strong (weak) economic conditions are characterized by high (low) aggregate profitability, $\widehat{g}_t$ is a natural measure of economic conditions. Furthermore, $\widehat{g}_t$ is the only economic state variable in the model, as noted earlier.

is likely to replace it (Corollary 1). Both new policies receive equal probabilities of almost 50% when $\widehat{g}_t$ is very low. In contrast, when $\widehat{g}_t$ is very high, the old policy is almost certain to be retained because a high $\widehat{g}_t$ boosts the old policy's utility score. It is possible for the government to replace the old 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. Interestingly, when $\widehat{g}_t = 0$, the old policy has about 90% probability of being retained. This result is driven by learning about g^0. By time t, agents have learned a lot about the old policy's impact, and the resulting decrease in uncertainty improves the old policy's utility score relative to the new policies (about which there is no learning before τ). Therefore, the old policy is likely to be replaced only if its perceived impact $\widehat{g}_t$ is sufficiently negative.

Figure 1 implies that the amount of political uncertainty in the economy is endogenous and dependent on economic conditions. In good conditions (i.e., when $\widehat{g}_t$ is high), there is little political uncertainty because the government is expected to retain its current policy. In bad conditions, though, political uncertainty is high because a policy change is expected and it is uncertain which of the new policies will be adopted.

5.1. The Level of Stock Prices

We now analyze how the level of stock prices depends on economic and political shocks. We measure the stock price level by the market-to-book ratio (M_t^i/B_t^i, or M/B).

Figure 2 plots M/B as a function of $\widehat{g}_t$ for three different combinations of $\widehat{c}_t^L$ and $\widehat{c}_t^H$. In the baseline scenario (solid line), we set $\widehat{c}_t^L = \widehat{c}_t^H = -\frac{1}{2}\sigma_c^2$, which is the prior mean from equation (7).[18] In this scenario, policies H and L are perceived as equally likely to be adopted at time τ. In the other two scenarios, we maintain $\widehat{c}_t^L = -\frac{1}{2}\sigma_c^2$ but vary $\widehat{c}_t^H$ so that one policy is more likely than the other. In the first scenario (dashed line), $\widehat{c}_t^H$ is two standard deviations below $\widehat{c}_t^L$, so that policy H is more likely. In the second scenario (dotted line), $\widehat{c}_t^H$ is two standard deviations above $\widehat{c}_t^L$, and policy L is more likely. All quantities are computed at time $t = \tau - 1$ when the political debates begin.

Figure 2 highlights the effects of both economic and political shocks on stock prices. First, consider economic shocks. These shocks are perfectly correlated with shocks to $\widehat{g}_t$ (see equations (9) and (32)), so they represent horizontal movements in Figure 2. The figure

[18]Note that the prior mean represents the initial values of $\widehat{c}_t^L$ and $\widehat{c}_t^H$ at time 0, in that $\widehat{c}_0^L = \widehat{c}_0^H = -\frac{1}{2}\sigma_c^2$.

shows that the relation between M/B and $\widehat{g}_t$ is monotonically increasing. Higher values of $\widehat{g}_t$ increase stock prices because they raise agents' expectations of future profits.

More interesting, the relation between M/B and $\widehat{g}_t$ is highly nonlinear. This relation is nearly flat when $\widehat{g}_t$ is low, steeper when $\widehat{g}_t$ is high, and steeper yet when $\widehat{g}_t$ takes on intermediate below-average values. To understand this nonlinear pattern, recall from Figure 1 that the probability of retaining the old policy, p_t^0, depends on $\widehat{g}_t$. When $\widehat{g}_t$ is very low, the old policy is likely to be replaced at time τ (i.e., $p_t^0 \approx 0$). Therefore, shocks to $\widehat{g}_t$ are temporary, lasting for one year only. As a result, shocks to $\widehat{g}_t$ have a small effect on M/B, and the relation between M/B and $\widehat{g}_t$ is relatively flat. This result is indicative of the put protection that the government implicitly provides to the stock market. Indeed, the pattern in Figure 2 looks roughly like the payoff of a call option. Loosely invoking the logic of put-call parity, stockholders own a call because the government wrote a put.

In contrast, when $\widehat{g}_t$ is high, the old policy is likely to be retained (i.e., $p_t^0 \approx 1$). Therefore, shocks to $\widehat{g}_t$ are permanent and the relation between M/B and $\widehat{g}_t$ is steep. The relation is even steeper for intermediate values of $\widehat{g}_t$ that are mostly below the unconditional mean of zero (for the solid line, these are values between -0.8% and 0.3% or so). For those intermediate values, p_t^0 is highly sensitive to $\widehat{g}_t$—a positive shock to $\widehat{g}_t$ substantially increases p_t^0 (see Figure 1). Therefore, a positive shock to $\widehat{g}_t$ gives a "double kick" to stock prices—in addition to raising expected profitability, it also reduces the probability of a policy change. The latter effect lifts stock prices because retaining the old policy, whose uncertainty has been reduced through learning, tends to be good news for stocks for those intermediate values of $\widehat{g}_t$.

Political shocks also exert a strong and state-dependent effect on stock prices. These shocks are due to revisions in $\widehat{c}_t^L$ and $\widehat{c}_t^H$ (see equation (13)), so they represent vertical movements in Figure 2. These shocks matter especially when $\widehat{g}_t$ is very low, i.e., in poor economic conditions. For example, when $\widehat{g}_t = -2\%$, increasing $\widehat{c}_t^H$ by two standard deviations pushes M/B up by 8% (dashed line vs. solid line), and then by another 9% (solid line vs. dotted line). M/B rises because a higher value of $\widehat{c}_t^H$ makes policy H less likely relative to policy L, and policy H has a more adverse effect on stock prices (Corollary 5). In contrast, political shocks do not matter in strong economic conditions—when $\widehat{g}_t$ is above 1% or so, the three lines in Figure 2 coincide. When $\widehat{g}_t$ is very high, the old policy is almost certain to be retained, so news about the political costs of the new policies is irrelevant.

To summarize, Figure 2 shows that economic and political shocks, which are orthogonal to each other, exert important independent influences on stock prices. Political shocks matter especially in poor economic conditions (i.e., when $\widehat{g}_t$ is low), whereas economic shocks matter

at all times but especially in slightly-below-average conditions.

5.2. The Risk Premium and Its Components

We now examine the equity risk premium and its three components from equation (36). Figure 3 plots the three components as a function of $\widehat{g}_t$. The component due to capital shocks is plotted in blue at the bottom, the component due to impact shocks is plotted in green in the middle, and the component due to political shocks is plotted in red at the top. As before, $\widehat{c}_t^L$ and $\widehat{c}_t^H$ are set equal to their prior mean, so that policies L and H are equally likely, and all quantities are computed at time $t = \tau - 1$.

Figure 3 shows a hump-shaped pattern in the risk premium. The premium is about 4% per year when $\widehat{g}_t$ is either high or low, but it is 5.5% for intermediate values of $\widehat{g}_t$. This hump-shape is not induced by the capital-shock component, which contributes a constant 1.25% regardless of $\widehat{g}_t$. Instead, this pattern results from the state dependence of the political-shock and impact-shock components, which are discussed next.

The political risk premium is the largest component of the total risk premium when $\widehat{g}_t$ is low. This component accounts for almost two thirds of the total premium when $\widehat{g}_t$ is below -1.5% or so, contributing about 2.5% per year. This contribution shrinks as $\widehat{g}_t$ increases, and for $\widehat{g}_t > 0.3\%$ or so, the political risk premium is essentially zero. The non-linear dependence of the political risk premium on $\widehat{g}_t$ is closely related to the non-linear probability patterns in Figure 1. When $\widehat{g}_t$ is below -1.5% or so, the probability of a policy change one year later is essentially one, so the uncertainty about which new policy will be adopted has a large impact on the risk premium. In contrast, when $\widehat{g}_t > 0.3\%$, the probability of a policy change is very close to zero. Since it is virtually certain that the potential new policies will not be adopted, news about their political costs does not merit a risk premium.

The impact-shock component is the largest component of the risk premium when $\widehat{g}_t$ is high. When $\widehat{g}_t$ is above 0.5% or so, this component contributes about 2.5% per year to the total premium. Its contribution is even higher, about 3.5%, when $\widehat{g}_t$ is close to zero, but it is much lower, only about 0.2%, when $\widehat{g}_t$ is very low. This interesting non-monotonicity is also related to policy probabilities, as discussed earlier in Figure 2. When $\widehat{g}_t$ is low, the probability of a policy change is high; as a result, shocks to $\widehat{g}_t$ are temporary and they have a small effect on the risk premium. This result reflects the quasi-benevolent nature of the government—by essentially guaranteeing a policy change if economic conditions turn bad, the government effectively provides a put option to the market.

This put option is worth little when $\widehat{g}_t$ is high because a policy change is then unlikely. Given the longer-lasting nature of the shocks to $\widehat{g}_t$, the risk premium induced by impact shocks is higher when $\widehat{g}_t$ is high. The premium is even higher for intermediate values of $\widehat{g}_t$ for which the probability of a policy change is highly sensitive to $\widehat{g}_t$. A negative shock to $\widehat{g}_t$ then depresses stock prices not only directly, by reducing expected profitability, but also indirectly, by increasing the probability of a policy change. The indirect effect is negative because a higher likelihood of a policy change is bad news for stocks for intermediate values of $\widehat{g}_t$. Given the double effect of the $\widehat{g}_t$ shocks, investors demand extra compensation for holding stocks in intermediate economic conditions. For example, when $\widehat{g}_t = 0$, impact shocks account for about two thirds of the 5% total risk premium.

Overall, Figure 3 shows that the composition of the equity risk premium depends on economic conditions. In strong conditions, the equity premium is driven by economic shocks, whereas in weak conditions, it is driven mostly by political shocks. In those weak conditions, the risk premium is affected by two opposing forces. On the one hand, the premium is reduced by the implicit put option provided by the government. On the other hand, the premium is boosted by the uncertainty about which new policy the government might adopt. The two forces roughly cancel out for the parameter values used here. An additional force, which operates in intermediate economic conditions, is the uncertainty about whether the current policy will be replaced. Due to that uncertainty, the largest values of the equity premium in Figure 3 obtain in slightly-below-average economic conditions.

5.3. Comparative Statics

Figures 4 and 5 examine the robustness of the results from Figure 3 to other parameter choices. In Panels A and B of Figure 4, we replace the baseline value $\sigma_g = 2\%$ by 1% and 3%, while keeping all remaining parameters at their values from Table 1. We see that σ_g affects primarily the impact-shock component of the risk premium, which is larger for higher values of σ_g. This is intuitive because when σ_g is higher, the old policy's impact is more uncertain, and the $\widehat{g}_t$ shocks are more volatile (see equations (9) and (10)). In Panels C and D, we replace the baseline value $\sigma_c = 10\%$ by 5% and 20%. We see that σ_c affects mostly the political-shock component of the risk premium, which is higher when σ_c is higher. This makes sense because larger values of σ_c make political costs more uncertain, thereby increasing the volatility of political shocks (see equations (13) and (14)). In Panels A and B of Figure 5, we replace the baseline value $h = 5\%$ by 2.5% and 10%. Similar to σ_c, h affects primarily the political risk premium. This premium is lower when h is higher because the

signals about political costs are then less precise. As a result, learning about these costs is slower and political shocks are less volatile (see equations (13) and (14)). In Panels C and D, we replace the baseline value $\tau - t = 1$ year by 1.5 and 0.5 years. This change affects mostly the impact-shock component. When time τ is closer, two things happen. First, the posterior uncertainty about g^0 is smaller, which pushes the impact-shock component down. Second, the probability of a policy change is more sensitive to the $\widehat{g}_t$ shocks for intermediate values of $\widehat{g}_t$, which pushes the impact-shock component up for such values of $\widehat{g}_t$. Overall, Figures 4 and 5 lead to the same qualitative conclusions as Figure 3 about the relative importance of economic and political shocks in different economic conditions.

Figure 6 provides another perspective by varying the properties of the new policies. This figure is analogous to Figure 3, except that the new policies no longer yield the same level of utility a priori. In Panels A and C, we replace the baseline values $(\sigma_{g,L}, \sigma_{g,H}) = (1\%, 3\%)$ by $(0.9\%, 3.1\%)$, thereby making policy H riskier and policy L safer. We keep all remaining parameters at their baseline values, including $\mu_g^L = -0.8\%$ and $\mu_g^H = 0.8\%$. Since policy H now yields less utility than policy L, its prior probability is smaller than that of policy L. Indeed, in Panel C, policy L is about twice as likely as policy H at any level of $\widehat{g}_t$. In Panels B and D of Figure 6, we replace the baseline values of $\sigma_{g,L}$ and $\sigma_{g,H}$ by $(1.1\%, 2.9\%)$, making policy H safer and policy L riskier. Policy H then yields more utility, and it is about twice as likely as policy L. We keep $\widehat{c}_t^L$ and $\widehat{c}_t^H$ equal to their initial values, as before.

The main difference between Panels A and B of Figure 6 on one side and Figure 3 on the other is in the magnitude of the political risk premium. In Panel A, this premium is substantially larger than in Figure 3, whereas in Panel B it is smaller. For example, at large negative values of $\widehat{g}_t$, the political risk premium is about 4% in Panel A and 1% in Panel B, compared to 2.5% in Figure 3. The premium is larger in Panel A because the two new policies are more different from each other, making the choice between them more important. In contrast, the two policies are more similar in Panel B, reducing the importance of uncertainty about which of them will be chosen. The total risk premium remains a hump-shaped function of $\widehat{g}_t$ in Panel B but not in Panel A. Apart from these quantitative differences, Figure 6 reaches the same broad conclusions as Figure 3.

5.4. The Effects of Policy Heterogeneity

In Figure 7, we examine how the risk premium depends on the degree to which the potential new policies differ from each other while providing the same level of welfare. Unlike in Figure

6, we put both policies H and L back on the iso-utility curve. We define policy *heterogeneity* as $\mathcal{H} = \sigma_{g,H} - \sigma_{g,L}$. To vary $\mathcal{H}$, we vary $\sigma_{g,L}$ and $\sigma_{g,H}$ while keeping all other parameters fixed at their values from Table 1. In the baseline case examined in Figure 3, we have $\sigma_{g,L} = 1\%$ and $\sigma_{g,H} = 3\%$, so that $\mathcal{H} = 2\%$. In Figure 7, we consider three levels of $\mathcal{H}$: 1%, 2%, and 3%, by choosing $(\sigma_{g,L}, \sigma_{g,H}) = (1.5\%, 2.5\%), (1\%, 3\%)$, and $(0.5\%, 3.5\%)$, respectively. For each of the three pairs of $(\sigma_{g,L}, \sigma_{g,H})$, we choose μ_g^H and $\mu_g^L = -\mu_g^H$ such that both new policies yield the same level of utility. Panel A plots the probability of retaining the old policy, as perceived at time $t = \tau - 1$. The new policies are equally likely as we set $\widehat{c}_\tau^L = \widehat{c}_\tau^H = -\sigma_c^2/2$, as before. Panel B plots the total equity premium, whereas Panels C and D plot its components due to economic and political shocks, respectively.

Figure 7 shows that the risk premium is generally higher when the new policies are more heterogeneous, except in strong economic conditions. This relation is driven mostly by the premium's political shock component in poor economic conditions. At large negative values of $\widehat{g}_t$, the political risk premium is 0.7% when $\mathcal{H} = 1\%$ and 5.7% when $\mathcal{H} = 3\%$, compared to 2.5% in the baseline case. Not surprisingly, when the new policies are more heterogeneous, uncertainty about which of them will be chosen is more important. In addition, more heterogeneity increases the importance of the decision whether to retain the old policy, resulting in a higher impact shock component. Adding up the two effects across Panels C and D, the total risk premium in Panel B strongly depends on the menu of policies considered by the government, except in good economic conditions when no policy change is expected.

Figure 8 describes the same setting as Figure 7, but it focuses on the stock price level (M/B), the volatility of individual stock returns, and the correlation between each pair of stocks. First, consider the baseline case of $\mathcal{H} = 2\%$ (solid line). The stock price level in Panel B exhibits the same hockey-stick-like pattern as it does in Figure 2, for the same reason—the government's implicit put option supports stock prices in poor economic conditions. Panels C and D show that stocks are more volatile and more highly correlated when economic conditions are poor. Comparing very good conditions ($\widehat{g}_t = 2\%$) with very bad ones ($\widehat{g}_t = -2\%$), volatility is almost 50% higher in bad conditions (19.5% versus 13.4%) and the pairwise correlation is over 70% higher (74% versus 43%). The reason is that political uncertainty is higher in bad economic conditions, as discussed earlier. This uncertainty affects all firms, so it cannot be fully diversified away.

Departing from the baseline case and looking across the three values of $\mathcal{H}$ in Panel B of Figure 8, we see that higher heterogeneity generally implies lower stock prices, but only in weak economic conditions. This result is easy to understand. More policy heterogeneity

means more political uncertainty, especially in weak conditions, as discussed earlier. The higher political uncertainty translates into higher risk premia (see Panel A), which push stock prices down. Higher heterogeneity also generally implies higher volatilities and correlations, as shown in Panels C and D. For example, in poor economic conditions, the correlation is 86% when $\mathcal{H} = 3\%$ but only 48% when $\mathcal{H} = 1\%$. Again, more heterogeneity means more political uncertainty, and political shocks affect all firms. Finally, note that in the special case of $\mathcal{H} = 0$ (not plotted), the political risk premium in Panel D of Figure 7 is zero, and both volatility and correlation in Figure 8 are independent of economic conditions.

5.5. Policy Changes Allowed Versus Precluded

In this subsection, we compare the model-implied stock prices with their counterparts in the hypothetical scenario in which policy changes are precluded. This scenario matches our model in all respects except that the government cannot change its policy at time τ. The key pricing quantities—the equity risk premium, M/B, stock volatility, and correlation—in this hypothetical scenario are plotted by the dash-dot line in each panel of Figure 8.

At high positive values of $\widehat{g}_t$, the dash-dot line coincides with the other lines plotted in Figure 8. The reason is that when $\widehat{g}_t$ is high, the government finds it optimal not to change its policy, so the constraint precluding it from changing policy is not binding.

The dash-dot line is flat in three of the four panels. Eliminating the government's ability to change its policy eliminates both political uncertainty and the put option discussed earlier. As a result, the risk premium, volatility, and correlation are all independent of $\widehat{g}_t$ when the policy cannot be changed. Precluding policy changes can increase or decrease the risk premium, depending on policy heterogeneity. When $\mathcal{H}$ is low, the put option affects the risk premium more than political uncertainty does, and so precluding policy changes raises the risk premium. The opposite happens when $\mathcal{H}$ is medium or high. In contrast, precluding policy changes always reduces the volatility and correlation, for all three levels of $\mathcal{H}$. The reason is that uncertainty about the political costs of the potential new policies is irrelevant when the government cannot change its policy. Due to political uncertainty, the government's ability to change its policy makes stocks more volatile and more highly correlated.

Interestingly, Panel B of Figure 8 shows that precluding policy changes can increase or decrease the level of stock prices. Precluding policy changes decreases M/B when $\widehat{g}_t$ is highly negative, but it increases M/B when $\widehat{g}_t$ is only slightly negative (it makes little difference when $\widehat{g}_t$ is positive, as noted earlier). When $\widehat{g}_t$ is highly negative—in dire economic conditions—the

government's ability to change policy is valuable because the positive effect of the put option is stronger than the negative effect of political uncertainty. In contrast, political uncertainty is stronger in slightly-below-average conditions. Since political uncertainty increases with policy heterogeneity, higher values of $\mathcal{H}$ make it more likely that precluding policy changes increases M/B. Overall, we see that the government's ability to change its policy has a substantial but ambiguous effect on stock prices.

6. The Jump Risk Premium

In this section, we study the risk premium at a different point in time. Instead of quantifying the premium before time τ as in Sections 4 and 5, we measure it at time τ, immediately before the policy decision. Before time τ, the political risk premium is induced by a continuous stream of political shocks, which lead investors to revise their beliefs about the probabilities of the various policy choices. At time τ, the ultimate political shock occurs when the C^n's are revealed and the government announces its decision. Stock prices jump at the announcement, as shown in Section 4.3, so the risk premium at time τ is a jump risk premium.

This jump risk premium is due to political uncertainty. Before time τ, investors face uncertainty about two events: whether the current policy will be replaced, and if so, which new policy will be adopted. Whereas the probability of the second event depends on political shocks only, the first event's probability is driven by both political and economic shocks. Therefore, the political risk premium defined as compensation for political shocks captures only some of the uncertainty associated with government policy choice. In contrast, immediately before the policy decision at time τ, all remaining uncertainty is political. Investors observe $\widehat{g}_\tau$ and the only uncertainty they face pertains to the revelation of political costs. As a result, the jump risk premium can be fully attributed to political uncertainty.

The jump risk premium is the expected announcement return at time τ, conditional on all the information available to investors immediately before the government's decision:

$$J\left(S_\tau\right) = \sum_{n=0}^{N} p_\tau^n R^n\left(\widehat{g}_\tau\right) \ , \tag{43}$$

where the probabilities p_τ^n come from Corollary 2 and the announcement returns R^n come from Proposition 6. In equilibrium, this premium is also equal to the negative of the covariance between the announcement return and the jump in SDF at time τ. The jump risk premium compensates investors for holding stocks during the announcement of the govern-

ment's policy decision. We derive a closed-form expression for $J(S_\tau)$.

Proposition 7: *The conditional jump risk premium is given by*

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

The jump risk premium tends to be large when political costs C^n remain highly uncertain just before time τ. Interestingly, if we increase the speed of learning about C^n (i.e., if we reduce h), then the political risk premium before time τ goes up (because political signals become more precise) but the jump risk premium at time τ goes down (because more of the uncertainty about C^n is resolved before time τ). In the limiting case in which all uncertainty about C^n is resolved by time τ, one of the p_τ^n's is equal to one while the others are zero, and Proposition 7 immediately implies that the jump risk premium is zero.

To shed more light on the jump risk premium, Panel A of Figure 9 plots $J(S_\tau)$ as a function of $\hat{g}_\tau$ for three different levels of heterogeneity $\mathcal{H}$. We use the baseline parameter values from Table 1, while varying $\mathcal{H}$ in the same way as in Figures 7 and 8. Panel B plots the probability of retaining the old policy, as perceived immediately before the policy decision. We choose $\widehat{c}_\tau^L$ and $\widehat{c}_\tau^H$ that make both new policies equally likely, as before.

Figure 9 shows that the jump risk premium strongly depends on both $\hat{g}_\tau$ and $\mathcal{H}$. First, the premium is generally higher in weaker economic conditions. For example, for the baseline case of medium $\mathcal{H}$, the premium is 1% when $\hat{g}_\tau$ is sufficiently low, but it is negligible when $\hat{g}_\tau$ is sufficiently large. The reason is that when $\hat{g}_\tau$ is large, the current policy is virtually certain to be retained, so that investors face essentially no uncertainty related to the policy announcement. In contrast, when $\hat{g}_\tau$ is low, 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 economic conditions.

Figure 9 also shows that the jump risk premium increases with heterogeneity, as long as economic conditions are sufficiently weak. When $\mathcal{H}$ is low, the premium is only 27 basis points, but when $\mathcal{H}$ is high, the premium rises to almost 2.3%. A larger value of $\mathcal{H}$ means a larger difference between the two new policies; as a result, uncertainty about which of them will be adopted becomes more important. Overall, Figure 9 lends further support to our conclusions from Section 5 about the pricing of political uncertainty.

7. Empirical Analysis

In this section, we conduct some simple exploratory empirical analysis to examine the seven main testable predictions of our model. First, the model predicts that political uncertainty should be higher when economic conditions are worse. Second and third, stocks should be more volatile and more correlated when political uncertainty is higher. Fourth, political uncertainty should command a risk premium. Finally, the effects of political uncertainty on volatility, correlation, and risk premia should be stronger in a weaker economy. To preview our results, the empirical evidence is consistent with all of these predictions, although the degree of statistical significance varies across the predictions.

All of the above predictions are illustrated in Section 5 for several sets of parameter values. Let us briefly remind the reader why the model makes these general predictions. Political uncertainty is higher in weaker economic conditions because in such conditions, the government is more likely to change its policy, and it is uncertain which of the potential new policies will be adopted. Political uncertainty makes stocks more volatile because a given political signal has more influence on learning about political costs when these costs are more uncertain. The uncertainty also makes stocks more correlated because political shocks affect all firms. It commands a risk premium because it is non-diversifiable. Finally, the effects of political uncertainty on stock prices are stronger in a weaker economy because investors are then more uncertain about which policy will be chosen by the government, which leads them to respond more strongly to political shocks.

7.1. Data

In our empirical analysis, we interpret political uncertainty broadly as uncertainty about future government actions. An important source of this uncertainty in the model is uncertainty about political costs—when investors are less certain about these costs, they are also less certain about which policy the government might adopt in the future.

To proxy for political uncertainty, we use the policy uncertainty (PU) index of Baker, Bloom, and Davis (2011). The PU index is constructed as a weighted average of three components. The first component, which receives the largest weight, captures news coverage of policy-related uncertainty. Beginning in January 1985, this component is obtained by month-by-month searches of Google News for newspaper articles that refer to uncertainty and the role of policy. The second component is the number of federal tax code provisions

set to expire in coming years, obtained from the congressional Joint Committee on Taxation. The third component, the extent of disagreement among forecasters of future inflation and government spending, is intended to capture elements of uncertainty about future U.S. monetary and fiscal policies. Figure 10 plots the monthly time series of the PU index for January 1985 through December 2010.[19] Baker et al. note that their index "spikes around consequential presidential elections and major political shocks like the Gulf Wars and 9/11. Recently, it rose to historical highs after the Lehman bankruptcy and TARP legislation, the 2010 midterm elections, the Eurozone crisis, and the U.S. debt-ceiling dispute." The PU index seems to represent a plausible way of measuring uncertainty about what the government might do in the future. Moreover, there are no obvious alternatives.

We use two monthly measures of aggregate stock market volatility: realized and implied. Realized volatility is computed from daily returns of the S&P 500 index within the given month. Implied volatility is the average daily value of the CBOE VIX index within the month. We also use two measures of stock correlation, representing equal- and value-weighted averages of pairwise correlations for all stocks that comprise the S&P 500 index. The underlying correlations for all pairs of stocks are computed from daily returns within the month. Since both pairs of measures are highly correlated, we only plot one of each in Figure 10: equal-weighted correlation in Panel A and realized volatility in Panel B. For aesthetic purposes, we smooth both variables by plotting their six-month moving averages (we use the unsmoothed raw values in subsequent regressions). The figure shows strong comovement between both variables and PU, especially since year 2000.

We use five monthly measures of economic conditions. Three of these are macroeconomic variables: the Chicago Fed National Activity Index (CFI), constructed by the Federal Reserve from 85 monthly indicators of economic activity; the NBER recession dummy (REC), equal to one during recession months and zero otherwise; and month-to-month industrial production growth (IPG), obtained from the Board of Governors. The other two measures are financial market variables. Our stock market measure of economic conditions is the cyclically adjusted price-to-earnings ratio for the aggregate stock market (P/E), downloaded from Robert Shiller's website. Our bond market measure is the default spread (DEF), the difference between the yields of AAA and BBB corporate bonds, from Federal Reserve. All five variables represent natural choices at the monthly data frequency.

[19] We downloaded the PU index data from Nick Bloom's website on October 17, 2011. The index data are regularly updated on www.policyuncertainty.com. In both panels of Figure 10, PU is scaled to have the same mean and volatility as the other variable plotted in the same panel.

7.2. Political Uncertainty and Economic Conditions

The model predicts that uncertainty about the government's future policy choice is generally larger in weaker economic conditions, because that is when the government is more likely to change its policy.[20] Indeed, Figure 10 shows that the PU index tends to be higher during recessions. To examine the prediction more formally, we first run a simple regression of the PU index on a measure of economic conditions:

$$PU_t \;\; = \;\; a + b\; E_t + e_t \;, \tag{44}$$

where E_t is one of the five measures of economic conditions: CFI, -REC, IPG, P/E, or -DEF. We flip the signs on REC and DEF so that higher values of each of the five measures indicate better economic conditions; as a result, the model predicts $b < 0$ for each measure of E_t. In addition, we run the regression

$$PU_t \;\; = \;\; a + b\; E_t + c\; PU_{t-1} + e_t \;, \tag{45}$$

adding a lag of PU to soak up the serial correlation in the PU index. The autocorrelation of the residuals from the regression of PU_t on PU_{t-1} is essentially zero (-0.01). As a further precaution against autocorrelated residuals, we compute Newey-West standard errors with three lags, and verify that using one or six lags leads to identical conclusions regarding the statistical significance of b in each of the 10 regressions (two regressions times five measures of E_t). The sample period is January 1985 through December 2010.

Table 2 reports the OLS estimates of the slope coefficients b, together with their Newey-West t-statistics. Consistent with the model's prediction, all 10 point estimates of b are negative. Eight of the 10 estimates are statistically significant at the 5% level, and one other estimate is significant at the 10% level. This evidence suggests that political uncertainty indeed tends to be higher when economic conditions are worse.

7.3. Stock Market Volatility and Correlations

According to the model, stocks should be more volatile and more correlated at times of higher political uncertainty. Indeed, Figure 10 reveals a strong association between PU and

[20]There is some independent empirical support for the model's prediction that governments are more likely to change their policies in weak economic conditions. For example, Bruno and Easterly (1996) find that inflation crises tend to be followed by reforms. Drazen and Easterly (2001) and Alesina, Ardagna, and Trebbi (2006) also find evidence supporting the hypothesis that crises induce reforms, although the former study finds this evidence only for a subset of the crisis indicators.

both volatility and correlation, especially in the second half of the sample. To assess the significance of this association, we consider the following regressions:

$$VC_t = a + b\ PU_t + e_t \tag{46}$$

$$VC_t = a + b\ PU_t + c\ VC_{t-1} + e_t\ , \tag{47}$$

where VC stands for either volatility or correlation. Adding VC_{t-1} in the second specification removes most of the serial correlation in VC; the autocorrelation of the residuals from the regression of VC_t on VC_{t-1} is always within 0.17 of zero, for all four measures of VC (two volatilities, two correlations). As before, we compute Newey-West standard errors with three lags, and verify that using one or six lags leads to identical conclusions.

Table 3 reports the OLS estimates of b and their t-statistics. We find $b > 0$ in all eight regressions (four measures of VC, two specifications), as the model predicts. All eight coefficients are highly statistically significant. This evidence suggests that stocks are indeed more volatile and more correlated when there is more political uncertainty.

The model also predicts that the associations between political uncertainty and VC should be more positive when economic conditions are worse. The reason is that political shocks exert a larger influence on stock prices in a weaker economy (see Figures 2 and 8). To evaluate this prediction, we run the following regressions with interaction terms:

$$VC_t = a + b\ PU_t\ E_t + c\ PU_t + d\ E_t + e_t \tag{48}$$

$$VC_t = a + b\ PU_t\ E_t + c\ PU_t + d\ E_t + e\ VC_{t-1} + e_t\ . \tag{49}$$

The model predicts $b < 0$. Table 4 shows strong support for this prediction when VC denotes volatility, but only weak support when it stands for correlation. For correlation, the point estimate of b is negative in 17 of the 20 specifications (two measures of correlation times five measures of E_t times two regressions), but only five estimates are significantly negative at the 5% level. For volatility, all 20 point estimates are negative, and 18 of them are significant.

7.4. The Equity Risk Premium

The model predicts that political uncertainty commands a risk premium, especially in weak economic conditions. However, the model also predicts that an opposing force, the government's put protection, reduces risk premia in weak conditions. In Figure 3, the two forces roughly cancel out, but either can prevail for other parameter values (Figures 4, 5, and 6). The two forces seem difficult to separate empirically because, according to the model, they

operate in similar states of the world—we tend to be more uncertain about future government actions when the government's put protection is more valuable. The PU index may thus reflect not only political uncertainty, which it was designed to capture, but also some degree of put protection. If the put's influence on the PU index is small, then the model predicts a positive PU risk premium, but if it is large, the prediction is unclear.

To proxy for the equity risk premium, we use realized future excess market returns, denoted by $R_{t+1,t+h}$. We construct $R_{t+1,t+h}$ by computing the cumulative return on the CRSP value-weighted market portfolio over months $t+1$ through $t+h$ and subtracting the cumulative return on the one-month T-bill. We consider $h = 3$, 6, and 12 months.

In a simple regression of $R_{t+1,t+h}$ on PU_t, the estimate of the slope coefficient is positive at all three horizons, but it is never statistically significant. Even when we add the five measures of economic conditions on the right-hand side of the regression, all three estimates of the slope on PU_t remain positive but insignificant. There might be no unconditional risk premium associated with the PU index. It is also possible, though, that 26 years of monthly returns is simply not enough to ensure decent power for this test. Stock returns are notoriously noisy, making realized returns a rough proxy for expected returns.

We then look for a conditional political risk premium, motivated by the model's implication that political shocks have a larger effect on stock prices in weaker economic conditions (see Figures 2 through 7). To see whether the PU index indeed commands a higher risk premium when the economy is weaker, we run the regression

$$R_{t+1,t+h} \;=\; a + b\; PU_t\; E_t + c\; PU_t + d\; E_t + e_t\;. \tag{50}$$

Table 5 reports the OLS estimates of b for 15 specifications (five measures of E_t times three h's). The t-statistics are computed based on Newey-West standard errors with h lags. The evidence suggests that $b < 0$, though not overwhelmingly: while all 15 point estimates are negative, only six of them are significant at the 5% level. The evidence is strongest for $h = 12$ months, when b is significantly negative at the 10% level under all five measures of E_t. We conclude that, despite the relatively short sample, there seems to be some evidence of a political risk premium that is higher in weaker economic conditions.

Finally, we emphasize that our simple empirical analysis is only illustrative. Despite the commendable effort of its authors, the PU index is not a perfectly clean measure of uncertainty about future government policy. For example, the index might also reflect broader economic uncertainty to some extent. Its shortcomings notwithstanding, we view this index as adequate for our purposes because it is the only index of its kind, to our knowledge, and

because constructing a purer index is well beyond the scope of this paper. This paper's main contribution is theoretical—to develop and analyze an equilibrium model in which stock prices respond to political shocks. The model makes a rich set of predictions, and the purpose of our empirical analysis is to provide a quick first look at the empirical validity of these predictions. We do not go beyond our brief examination in an effort to keep the paper focused and reasonably short. But since our first look indicates preliminary success, we hope that future research will examine the model's predictions in more detail.

8. Conclusions

We examine the effects of political uncertainty on stock prices through the lens of a general equilibrium model of government policy choice. In the model, the government tends to change its policy when the economy is weak, effectively providing put protection to the market. However, the value of this implicit put protection is reduced by political uncertainty. This uncertainty commands a risk premium even though political shocks are orthogonal to fundamental economic shocks. The risk premium induced by political uncertainty is larger in a weaker economy. Political uncertainty also makes stocks more volatile and more highly correlated, especially when the economy is weak. Larger heterogeneity among the potential new government policies increases risk premia as well as volatilities and correlations of stock returns. We find some empirical support for the model's key predictions.

Our analysis opens several paths for future research. For example, it would be useful to extend our model by endogenizing the political costs of government policies, relying on the insights from the political economy literature. Such an extension could link asset prices to various political economy variables. Other extensions could shift the focus from stocks to other assets, such as bonds or currencies. We empirically examine one time-series proxy for political uncertainty in the U.S.; future work could construct other proxies and look across countries. More work on the government's role in asset pricing is clearly warranted.

Appendix

The Appendix contains selected formulas that are mentioned in the text but omitted for the sake of brevity. The proofs of all results are available in the companion Technical Appendix, which is downloadable from the authors' websites.

Definition of Omega in Propositions 2, 3, 4, and 5.

$$\Omega\left(S_t\right) = \sum_{n=0}^{N} p_t^n F^n\left(S_t\right) e^{-\gamma\mu_g^n(T-\tau)+\frac{\gamma^2}{2}(T-\tau)^2\sigma_{g,n}^2} \ . \tag{A1}$$

In equation (A1), we have

$$\begin{aligned} F^n\left(S_t\right) &= \int e^{-\gamma\Delta b_\tau} f\left(\Delta b_\tau | S_t, n \text{ at } \tau\right) d\ \Delta b_\tau \qquad\qquad n = 1, \ldots, N \\ F^0\left(S_t\right) &= \int e^{-\gamma\left(E[\Delta b_\tau]+(\widehat{g}_\tau-\widehat{g}_t)\sqrt{\frac{V_{b_\tau}}{V_{\widehat{g}_\tau}}}\right)-\gamma(T-\tau)(\widehat{g}_\tau-\widehat{g}_t)} f\left(\widehat{g}_\tau | S_t, 0 \text{ at } \tau\right) d\widehat{g}_\tau \ , \end{aligned}$$

where $V_{b_\tau} \equiv \mathrm{Var}(b_\tau|S_t) = \widehat{\sigma}_t^2\left(\tau-t\right)^2 + \sigma^2\left(\tau-t\right)$, $V_{\widehat{g}_\tau} \equiv \mathrm{Var}(\widehat{g}_\tau|S_t) = \widehat{\sigma}_t^2 - \widehat{\sigma}_\tau^2$, and the conditional densities $f\left(\Delta b_\tau|S_t, n \text{ at } \tau\right)$ and $f\left(\widehat{g}_\tau|S_t, 0 \text{ at } \tau\right)$ are defined below. The density of $\Delta b_\tau = b_\tau - b_t = \log\left(B_\tau/B_t\right)$ conditional on S_t and policy n being chosen at time τ is

$$\begin{aligned} & f\left(\Delta b_\tau | S_t, n \text{ at } \tau\right) \\ = \ & \frac{\phi_{\Delta b_\tau}\left(\Delta b_\tau\right)}{p_t^n} \int_{-\infty}^{\widetilde{\mu}^n - E_t\left[\widetilde{\mu}^0\right] - \left(\Delta b_\tau - E_t[\Delta b_\tau]\right)\frac{\widehat{\sigma}_t^2}{(\tau-t)\widehat{\sigma}_t^2+\sigma^2}} \Pi_{j\neq n}\left(1-\Phi_{\widetilde{c}^j}\left(\widetilde{c}^n - \widetilde{\mu}^n + \widetilde{\mu}^j\right)\right)\phi_{\widetilde{c}^n}\left(\widetilde{c}^n\right) d\widetilde{c}^n \ , \end{aligned}$$

where $\phi_{\Delta b_\tau}\left(\Delta b_\tau\right)$ is the normal density with mean $E_t\left[\Delta b_\tau\right] = \left(\mu + \widehat{g}_t - \frac{1}{2}\sigma^2\right)(\tau-t)$ and variance V_{b_τ}. In addition, $E_t\left[\widetilde{\mu}^0\right] = \widehat{g}_t - \frac{\widehat{\sigma}_\tau^2}{2}\left(T-\tau\right)(\gamma-1)$.

The density of $\widehat{g}_\tau$ conditional on S_t and the old policy being retained at time τ is

$$f\left(\widehat{g}_\tau|S_t, 0 \text{ at } \tau\right) = \phi_{\widehat{g}}\left(\widehat{g}_\tau\right) \frac{\Pi_{n=1}^N\left(1-\Phi_{\widetilde{c}^n}\left(\widetilde{\mu}^n - \widehat{g}_\tau + \frac{\widehat{\sigma}_\tau^2}{2}\left(T-\tau\right)(\gamma-1)\right)\right)}{1-\sum_{n=1}^N p_t^n}$$

where $\phi_{\widehat{g}}\left(\widehat{g}_\tau\right)$ is the conditional normal density of $\widehat{g}_\tau$, with mean $\widehat{g}_t$ and variance $\widehat{\sigma}_t^2 - \widehat{\sigma}_\tau^2$.

Definition of H in Propositions 4 and 5.

$$H\left(S_t\right) = \sum_{n=0}^{N} p_t^n G^n\left(S_t\right) e^{(1-\gamma)\mu_g^n(T-\tau)+\frac{(1-\gamma)^2}{2}(T-\tau)^2\sigma_{g,n}^2} \ , \tag{A2}$$

where

$$\begin{aligned} G^n\left(S_t\right) &= \int e^{(1-\gamma)\Delta b_\tau} f\left(\Delta b_\tau|\widehat{g}_t, n \text{ at } \tau\right) d\ \Delta b_\tau \qquad\qquad n = 1, \ldots, N \\ G^0\left(S_t\right) &= \int e^{(1-\gamma)\left(E[\Delta b_\tau]+(\widehat{g}_\tau-\widehat{g}_t)\sqrt{\frac{V_{b_\tau}}{V_{\widehat{g}_\tau}}}\right)+(1-\gamma)(T-\tau)(\widehat{g}_\tau-\widehat{g}_t)} f\left(\widehat{g}_\tau|\widehat{g}_t, 0 \text{ at } \tau\right) d\widehat{g}_\tau \end{aligned}$$

Lemma A1: *Immediately before the policy announcement at time τ, the market value of any firm i is given by*

$$\begin{aligned} M_\tau^i &= B_\tau^i e^{(\mu-\gamma\sigma^2)(T-\tau)+\widehat{g}_\tau(T-\tau)+\frac{(1-2\gamma)}{2}(T-\tau)^2\widehat{\sigma}_\tau^2} \times \\ &\quad \times \frac{\left(1+\sum_{n=1}^N p_\tau^n \left(e^{(1-\gamma)\left(\mu_g^n-\widehat{g}_\tau\right)(T-\tau)+\frac{(1-\gamma)^2}{2}(T-\tau)^2\left(\sigma_{g,n}^2-\widehat{\sigma}_\tau^2\right)}-1\right)\right)}{\left(1+\sum_{n=1}^N p_\tau^n \left(e^{-\gamma\left(\mu_g^n-\widehat{g}_\tau\right)(T-\tau)+\frac{\gamma^2}{2}(T-\tau)^2\left(\sigma_{g,n}^2-\widehat{\sigma}_\tau^2\right)}-1\right)\right)} . \end{aligned} \tag{A3}$$

Lemma A2: *Immediately after the announcement of policy n at time τ, for any $n \in \{0,1,\ldots,N\}$, the market value of any firm i is given by*

$$M_{\tau+}^{i,n} = B_{\tau+}^i e^{(\mu-\gamma\sigma^2+\mu_g^n)(T-\tau)+\frac{1-2\gamma}{2}(T-\tau)^2\sigma_{g,n}^2} . \tag{A4}$$

Table 1
Parameter Choices

This table reports the baseline parameter values used to produce the subsequent theory figures. All variables are reported on an annual basis (except for γ, which denotes risk aversion). The parameter choices for the first 8 parameters are identical to those in Pástor and Veronesi (2012). The value of $h = 5\%$ is chosen equal to the value of σ, to equate the speeds of learning about the policy impacts and political costs. The prior uncertainties about the new policies, $\sigma_{g,L} = 1\%$ and $\sigma_{g,H} = 3\%$, are chosen to be symmetric around the old policy's $\sigma_g = 2\%$.

σ_g	σ_c	μ	σ	σ_1	T	τ	γ	h	$\sigma_{g,L}$	$\sigma_{g,H}$
2%	10%	10%	5%	10%	20	10	5	5%	1%	3%

Table 2
Political Uncertainty and Economic Conditions

This table addresses the question "Is there more political uncertainty when economic conditions are worse?" The table reports the estimated slope coefficients b and their t-statistics from the following two regressions:

$$\text{Specification 1:} \qquad PU_t = a + bE_t + e_t$$
$$\text{Specification 2:} \qquad PU_t = a + bE_t + cPU_{t-1} + e_t \ .$$

Political uncertainty PU_t is proxied by the policy uncertainty index of Baker, Bloom, and Davis (2011), which we scale down by 100. We use five different monthly proxies for economic conditions E_t: the Chicago Fed National Activity Index (CFI), minus the NBER recession dummy (-REC), industrial production growth (IPG), Shiller's price-to-earnings ratio for the aggregate stock market (P/E), and minus the AAA-BBB corporate bond default spread (-DEF). Since higher values of each proxy indicate better economic conditions, our theory predicts $b < 0$. The t-statistics, reported in parentheses, are computed based on Newey-West standard errors with three lags. The sample period is January 1985 through December 2010.

	Measure of Economic Conditions				
	CFI	-REC	IPG	P/E	-DEF
Specification 1	-0.31	-0.69	-20.95	-0.02	-0.75
	(-7.24)	(-5.12)	(-4.10)	(-3.38)	(-8.61)
Specification 2	-0.05	-0.09	-2.90	-0.00	-0.09
	(-3.90)	(-2.75)	(-1.85)	(-1.58)	(-3.06)

Table 3
Political Uncertainty, Volatility, and Correlation

This table asks: "Are stocks more volatile and more correlated when there is more political uncertainty?" The table reports the estimated slope coefficients b and their t-statistics from the following two regressions:

$$\text{Specification 1:} \qquad VC_t = a + bPU_t + e_t$$
$$\text{Specification 2:} \qquad VC_t = a + bPU_t + cVC_{t-1} + e_t \ .$$

PU_t is the policy uncertainty index of Baker, Bloom, and Davis (2011), divided by 100. VC_t stands for either volatility or correlation. We use two correlation measures, which represent equal-weighted (EW) and value-weighted (VW) averages of pairwise correlations for all stocks that comprise the S&P 500 index. We use two market volatility measures: realized volatility of the S&P 500 index, computed from daily index returns within the month, and implied volatility, measured by the average daily value of the CBOE VIX index within the month. The t-statistics are computed based on Newey-West standard errors with three lags. The sample period is January 1985 through December 2010, except for the regressions that involve VIX, for which the sample begins in January 1990 due to limited data availability.

	Correlation		Volatility	
	EW	VW	Realized	Implied
Specification 1	0.17	0.15	0.01	0.08
	(9.81)	(7.25)	(4.81)	(5.27)
Specification 2	0.09	0.07	0.00	0.01
	(6.43)	(5.14)	(3.45)	(2.53)

Table 4
Political Uncertainty, Volatility, Correlation, and Economic Conditions

This table addresses the question: "Are stock volatilities and correlations more positively associated with political uncertainty when economic conditions are weaker?" The table reports the estimated slope coefficients b and their t-statistics from the following two regression specifications:

$$\text{Specification 1:} \qquad VC_t = a + bPU_tE_t + cPU_t + dE_t + e_t$$
$$\text{Specification 2:} \qquad VC_t = a + bPU_tE_t + cPU_t + dE_t + eVC_{t-1} + e_t \ .$$

PU_t is the policy uncertainty index of Baker, Bloom, and Davis (2011), divided by 100. VC_t stands for either volatility or correlation. We use two correlation measures, which represent equal-weighted (EW) and value-weighted (VW) averages of pairwise correlations for all stocks that comprise the S&P 500 index. We use two market volatility measures: realized volatility of the S&P 500 index, computed from daily index returns within the month, and implied volatility, measured by the average daily value of the CBOE VIX index within the month. We use five proxies for economic conditions E_t: the Chicago Fed National Activity Index (CFI), minus the NBER recession dummy (-REC), industrial production growth (IPG), Shiller's price-to-earnings ratio for the aggregate stock market (P/E), and minus the AAA-BBB corporate bond default spread (-DEF). Since higher values of each proxy indicate better economic conditions, our theory predicts $b < 0$. The t-statistics are computed based on Newey-West standard errors with three lags. The sample period is January 1985 through December 2010, except for the regressions that involve VIX, for which the sample begins in January 1990 due to limited data availability.

	Measure of Economic Conditions				
	CFI	-REC	IPG	P/E	-DEF
			Panel A. Specification 1		
Correlation: EW	-0.03	-0.04	-3.53	-0.00	-0.00
	(-2.41)	(-0.96)	(-2.36)	(-0.00)	(-0.08)
Correlation: VW	-0.03	-0.03	-3.54	-0.00	0.04
	(-1.92)	(-0.60)	(-2.03)	(-0.26)	(1.28)
Volatility: Realized	-0.00	-0.01	-0.39	-0.00	-0.00
	(-5.46)	(-4.39)	(-4.52)	(-3.74)	(-3.17)
Volatility: Implied	-0.04	-0.12	-3.48	-0.01	-0.05
	(-4.50)	(-3.69)	(-3.18)	(-5.48)	(-1.91)
			Panel B. Specification 2		
Correlation: EW	-0.02	-0.03	-2.35	0.00	-0.00
	(-2.04)	(-1.07)	(-1.97)	(0.05)	(-0.05)
Correlation: VW	-0.02	-0.03	-2.04	-0.00	0.02
	(-1.48)	(-0.79)	(-1.54)	(-0.10)	(1.13)
Volatility: Realized	-0.00	-0.01	-0.21	-0.00	-0.00
	(-4.11)	(-3.86)	(-3.11)	(-2.77)	(-2.58)
Volatility: Implied	-0.01	-0.05	-0.19	-0.00	-0.03
	(-2.81)	(-3.71)	(-0.36)	(-2.76)	(-2.70)

Table 5
Political Uncertainty and the Equity Risk Premium

This table asks: "Does political uncertainty command a risk premium that is higher in weaker economic conditions?" The table reports the estimated slope coefficients b and their t-statistics from the regression

$$R_{t+1,t+h} \quad = \quad a + bPU_tE_t + cPU_t + dE_t + e_t \ .$$

$R_{t+1,t+h}$ is the aggregate stock market return in excess of the one-month T-bill rate over $h = 3$, 6, and 12 months following month t. PU_t is the policy uncertainty index of Baker, Bloom, and Davis (2011), divided by 100. We use five proxies for economic conditions E_t: the Chicago Fed National Activity Index (CFI), minus the NBER recession dummy (-REC), industrial production growth (IPG), Shiller's price-to-earnings ratio for the aggregate stock market (P/E), and minus the AAA-BBB corporate bond default spread (-DEF). Since higher values of each proxy indicate better economic conditions, our theory predicts $b < 0$. The t-statistics, reported in parentheses, are computed based on Newey-West standard errors with the number of lags equal to h. The sample period is January 1985 through December 2010.

	Measure of Economic Conditions				
Horizon	CFI	-REC	IPG	P/E	-DEF
3 months	-0.02	-0.05	-0.89	-0.01	-0.03
	(-1.30)	(-1.24)	(-0.71)	(-2.17)	(-1.19)
6 months	-0.04	-0.11	-2.50	-0.01	-0.09
	(-2.09)	(-1.53)	(-1.17)	(-3.18)	(-1.97)
12 months	-0.09	-0.21	-6.48	-0.02	-0.15
	(-2.41)	(-1.78)	(-1.76)	(-2.85)	(-1.69)

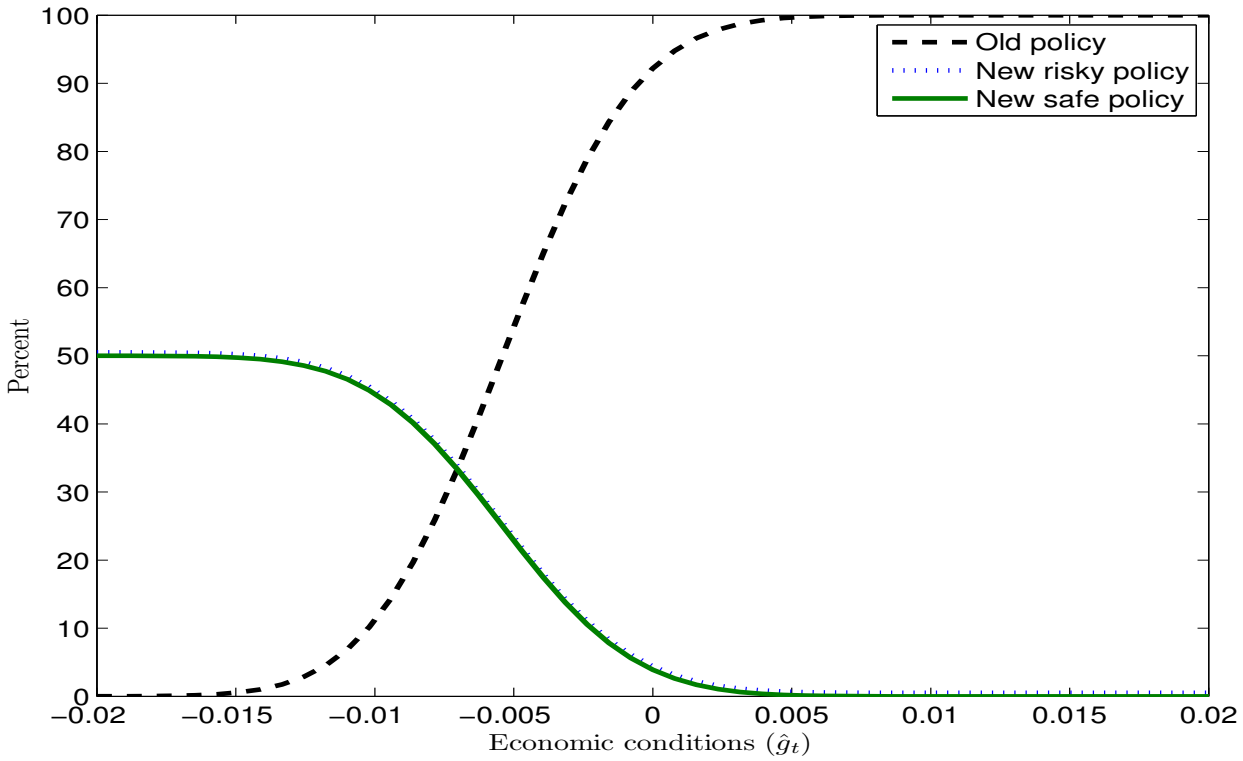


Figure 1. Probability of adopting the given government policy. This figure plots the probabilities of the three government policy choices—the old policy, the new risky policy (H), and the new safe policy (L)—as a function of $\hat{g}_t$, which is the posterior mean of the old policy's impact g^0 as of time t. High values of $\hat{g}_t$ indicate strong economic conditions; low values indicate weak conditions. All quantities are computed at time $t = \tau - 1$ when the political debates begin. The values of $\widehat{c}_t^L$ and $\widehat{c}_t^H$ are set equal to their initial value at time 0 ($\widehat{c}_t^L = \widehat{c}_t^H = -\sigma_c^2/2$), so that both new policies are equally likely; as a result, the solid and dotted lines coincide. The parameters are from Table 1.

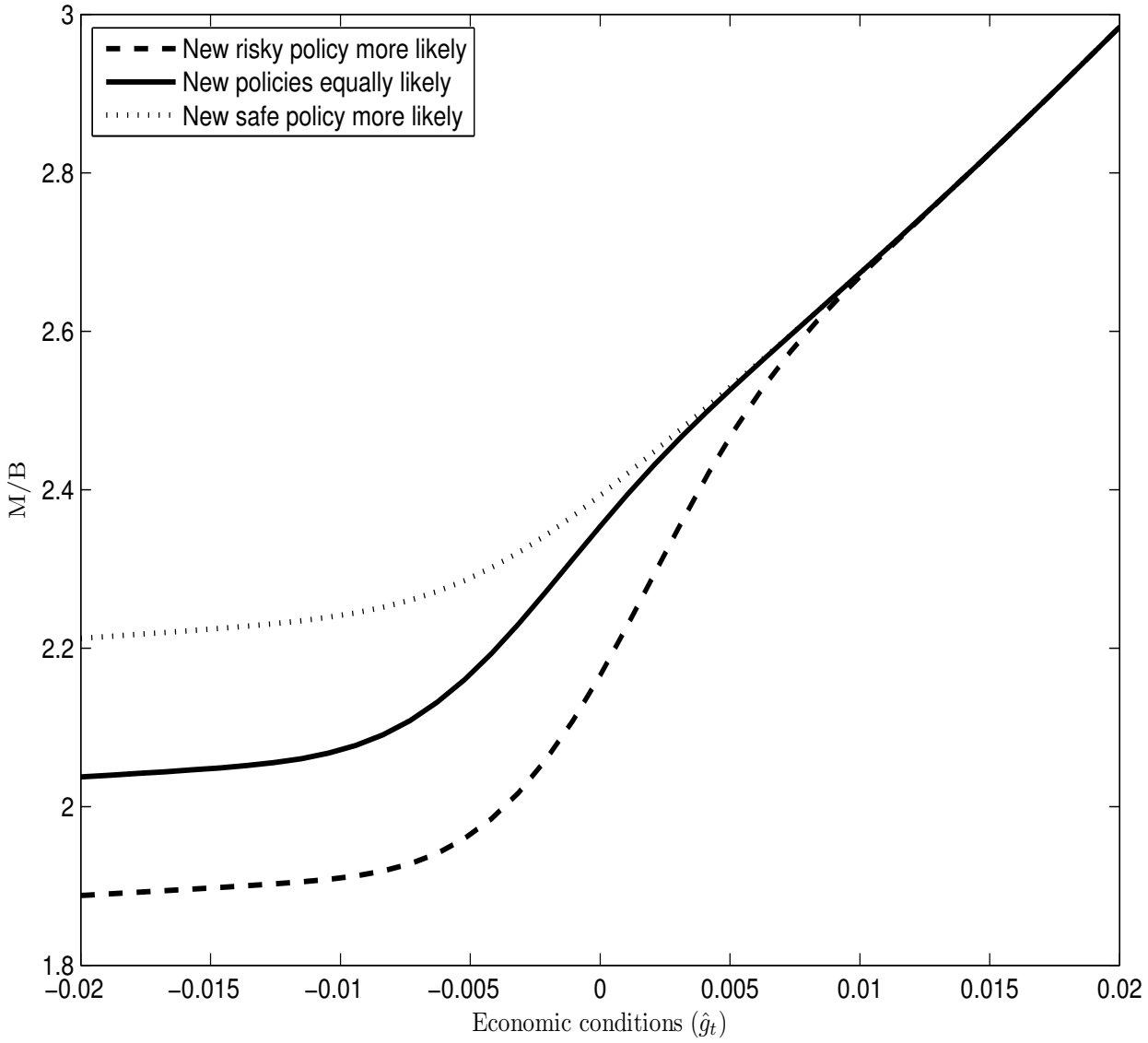


Figure 2. The level of stock prices: The effects of economic and political shocks. This figure plots the aggregate stock price level, measured by the market-to-book ratio M/B, as a function of $\hat{g}_t$, which is the posterior mean of the old policy's impact g^0 as of time t. High values of $\hat{g}_t$ indicate strong economic conditions; low values indicate weak conditions. The solid line corresponds to the scenario in which $\widehat{c}_t^L = \widehat{c}_t^H$ are both equal to their initial value, so that both new policies are equally likely to be adopted at time τ. The dashed (dotted) line corresponds to the scenario in which $\widehat{c}_t^L$ is equal to its initial value but $\widehat{c}_t^H$ is two standard deviations below (above) the same initial value, so that the new risky (safe) policy is more likely. Shocks to $\hat{g}_t$ represent economic shocks, whereas shocks to $\widehat{c}_t^L$ and $\widehat{c}_t^H$ are pure political shocks. All quantities are computed at time $t = \tau - 1$ when the political debates begin. The parameter values are in Table 1.

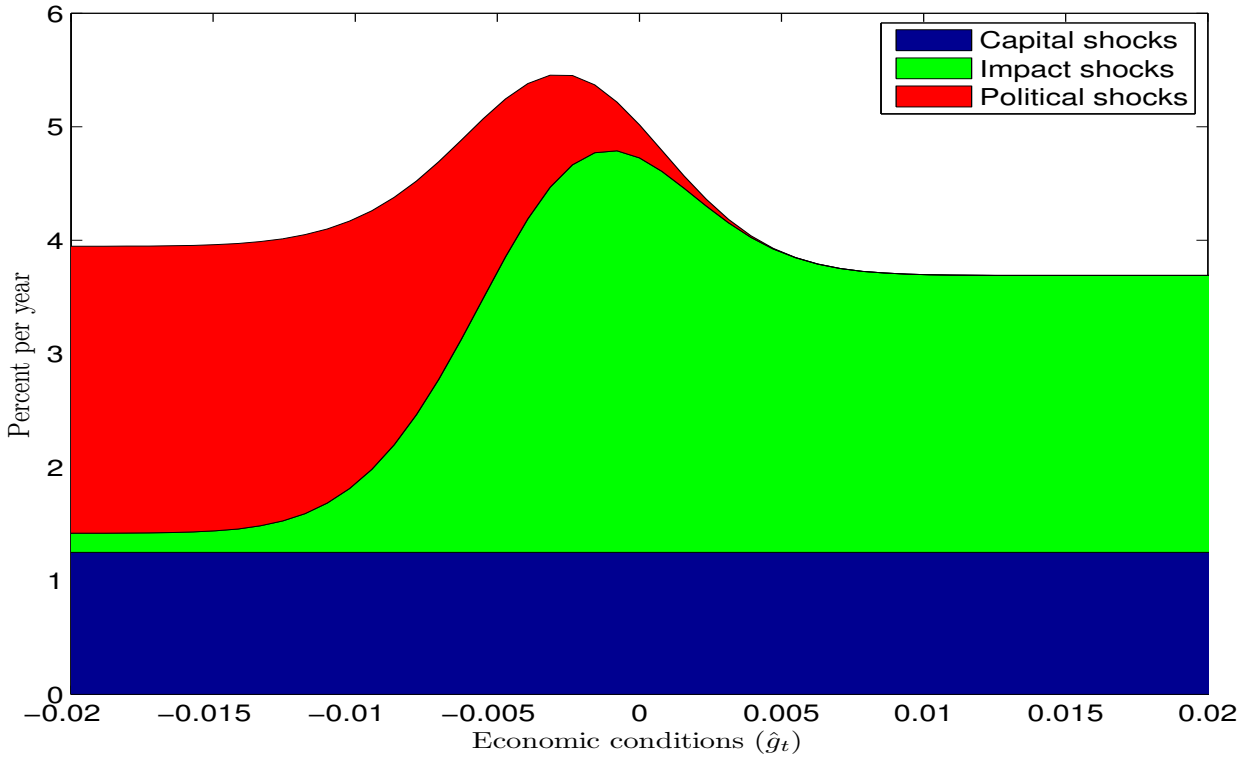


Figure 3. The equity risk premium and its components. This figure plots the equity risk premium and its components as a function of $\hat{g}_t$, which is the posterior mean of the old policy's impact g^0 as of time t. High values of $\hat{g}_t$ indicate strong economic conditions; low values indicate weak conditions. The flat blue area at the bottom represents the component of the risk premium that is due to "capital shocks," i.e. shocks to capital B_t in the absence of any updating of beliefs about g^0. The middle green area represents the component of the risk premium that is due to "impact shocks," which reflect learning about the old policy's impact g^0. The top red area represents the component of the risk premium that is due to "political shocks," which reflect learning about C^L and C^H. The three areas add up to the total equity risk premium. The values of $\widehat{c}_t^L$ and $\widehat{c}_t^H$ are set equal to their initial value at time 0, so that both new policies are equally likely. All quantities are computed at time $t = \tau - 1$ when the political debates begin. The parameter values are in Table 1.

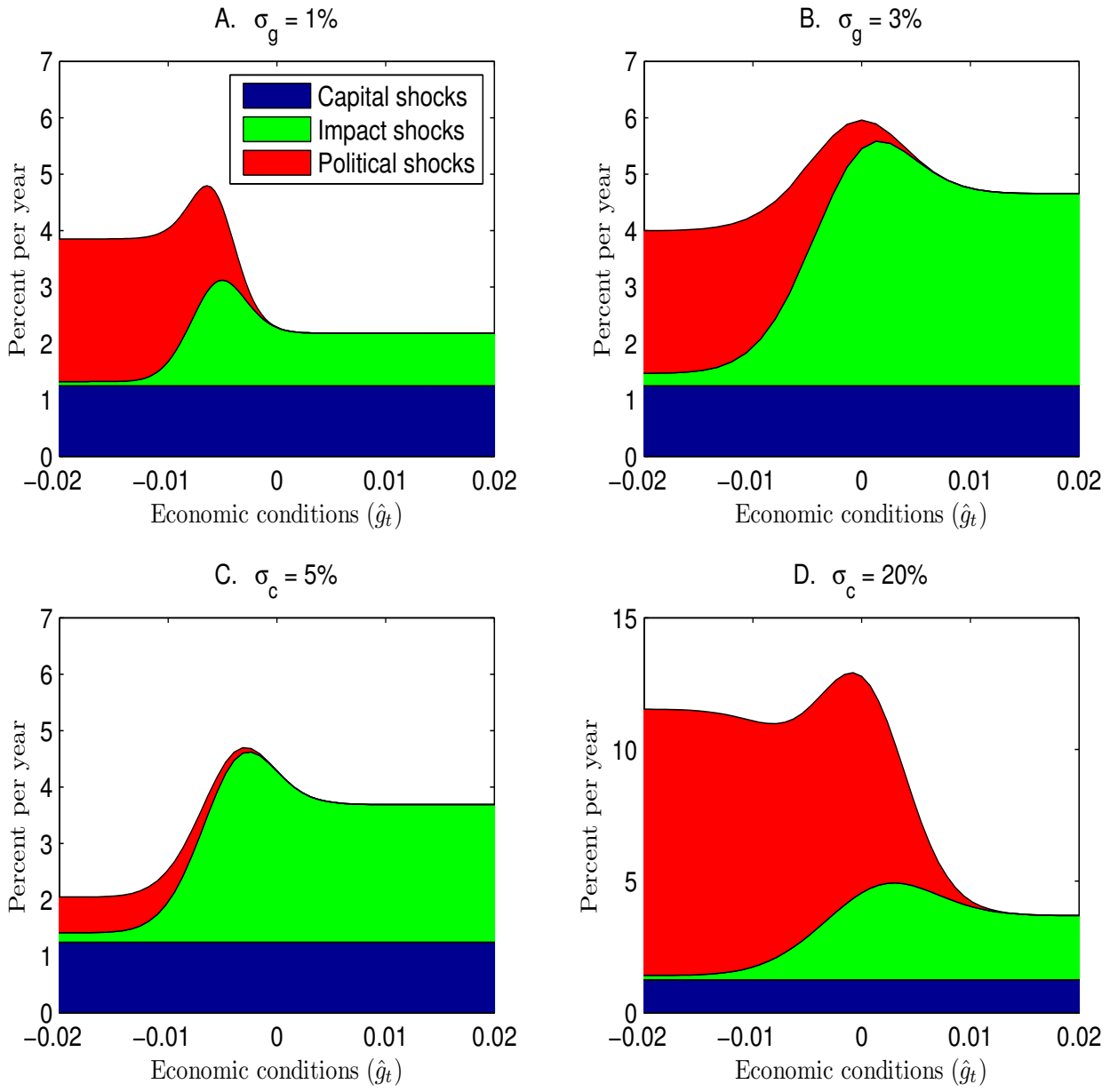


Figure 4. The equity risk premium and its components: The effects of σ_g and σ_c. Each of the four panels is analogous to Figure 3—the flat blue area at the bottom represents the risk premium due to capital shocks, the middle green area represents the risk premium due to impact shocks, and the top red area represents the risk premium due to political shocks. The three areas add up to the total equity risk premium. The parameter values are in Table 1, except for σ_g and σ_c, which vary across the four panels.

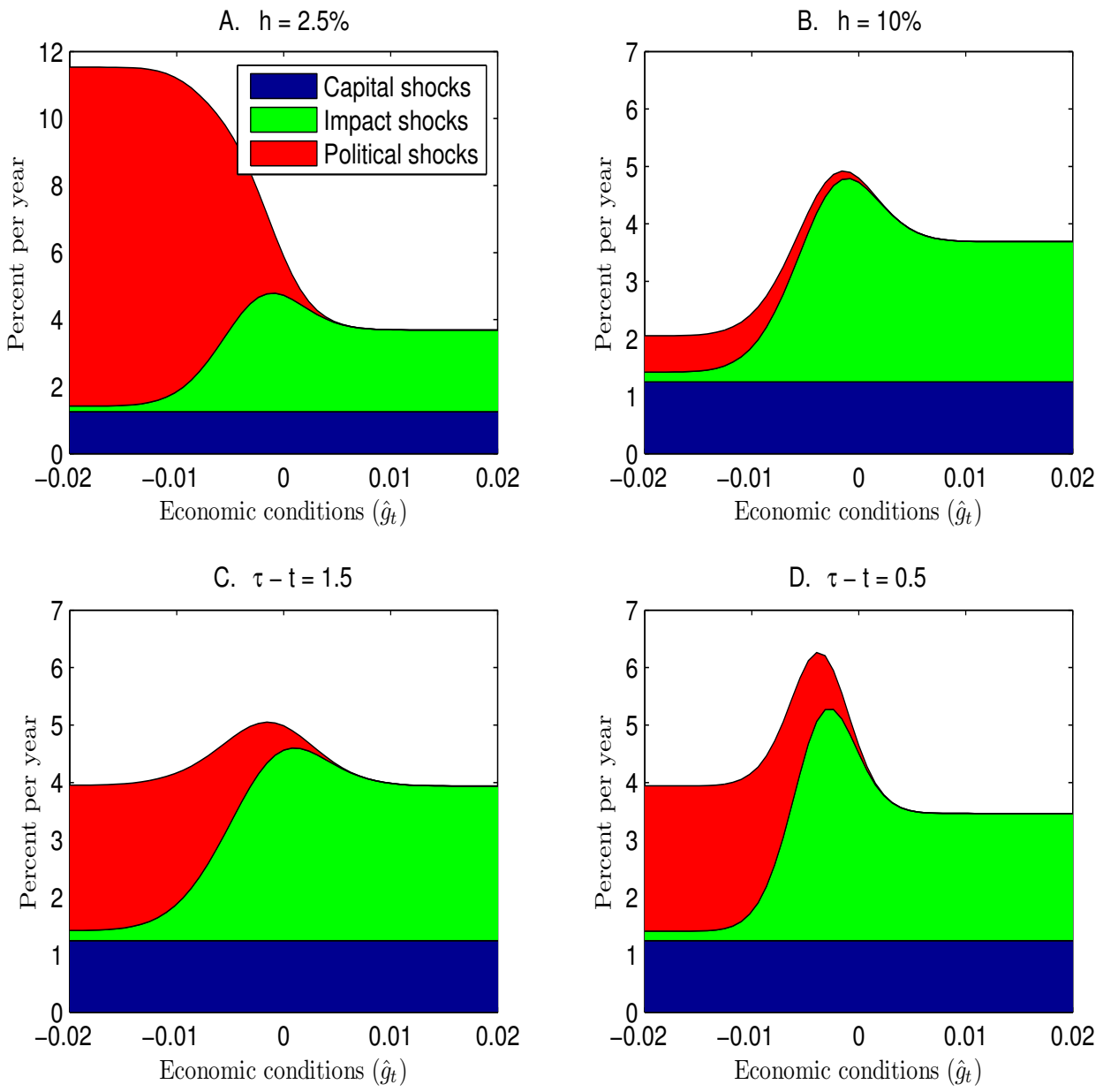


Figure 5. The equity risk premium and its components: The effects of h and t. Each of the four panels is analogous to Figure 3—the flat blue area at the bottom represents the risk premium due to capital shocks, the middle green area represents the risk premium due to impact shocks, and the top red area represents the risk premium due to political shocks. The three areas add up to the total equity risk premium. The parameter values are in Table 1, except for h and $\tau - t$, which vary across the four panels.

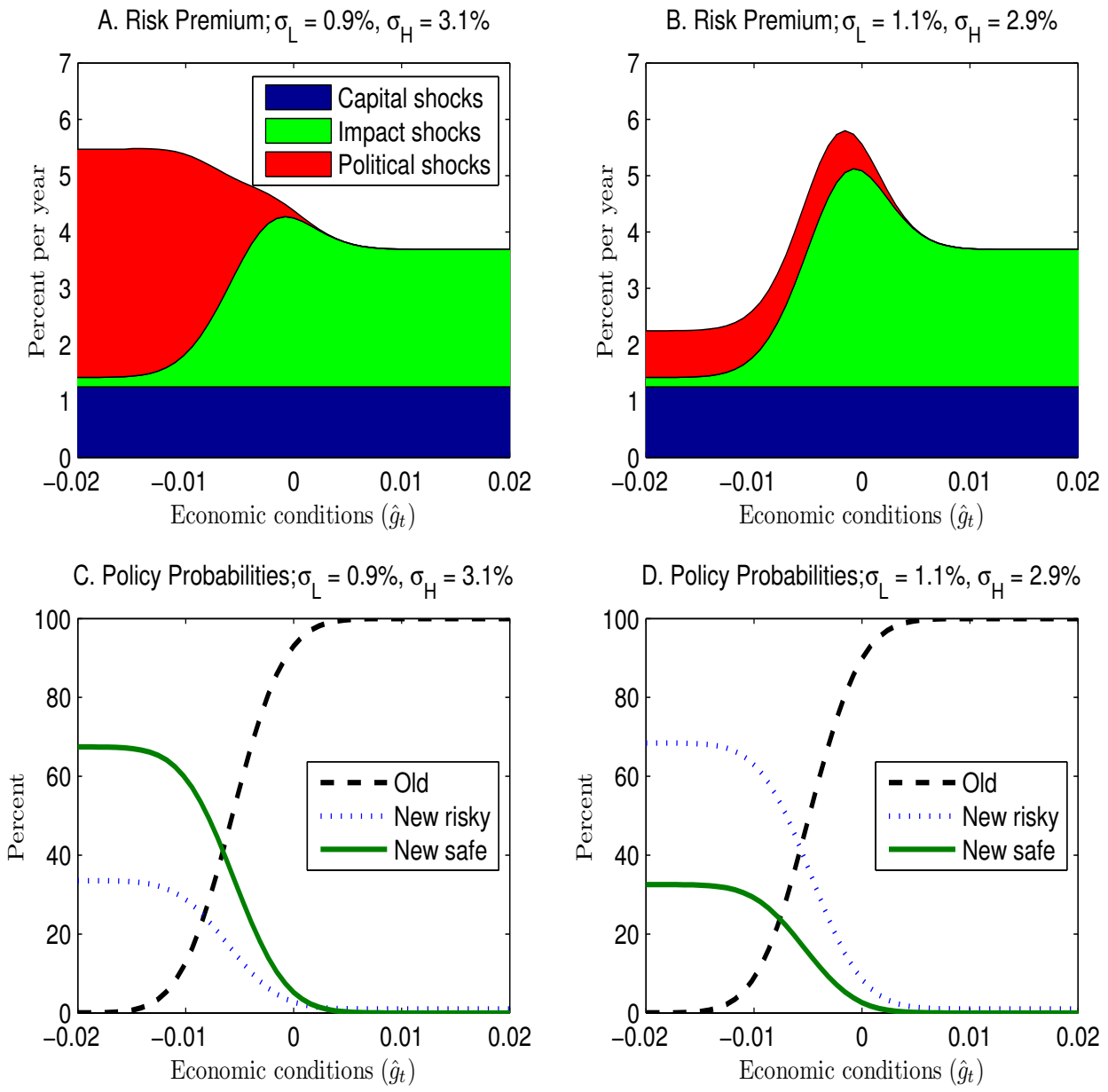


Figure 6. The equity risk premium and its components when new policies are at different utility levels. This figure is analogous to Figures 1 and 3, except that the new policies no longer yield the same level of utility a priori. In Panels A and C, the new risky policy yields less utility than the new safe policy, whereas it yields more utility in Panels B and D. In Panels A and C, the new risky policy is riskier and the new safe policy is safer compared to the benchmark case (because $\sigma_{g,L} = 0.9\% < 1\%$ and $\sigma_{g,H} = 3.1\% > 3\%$), whereas it is the other way round in Panels B and D. With the exception of $\sigma_{g,L}$ and $\sigma_{g,H}$, all other parameters, including μ_g^L and μ_g^H, are the same as in Table 1.

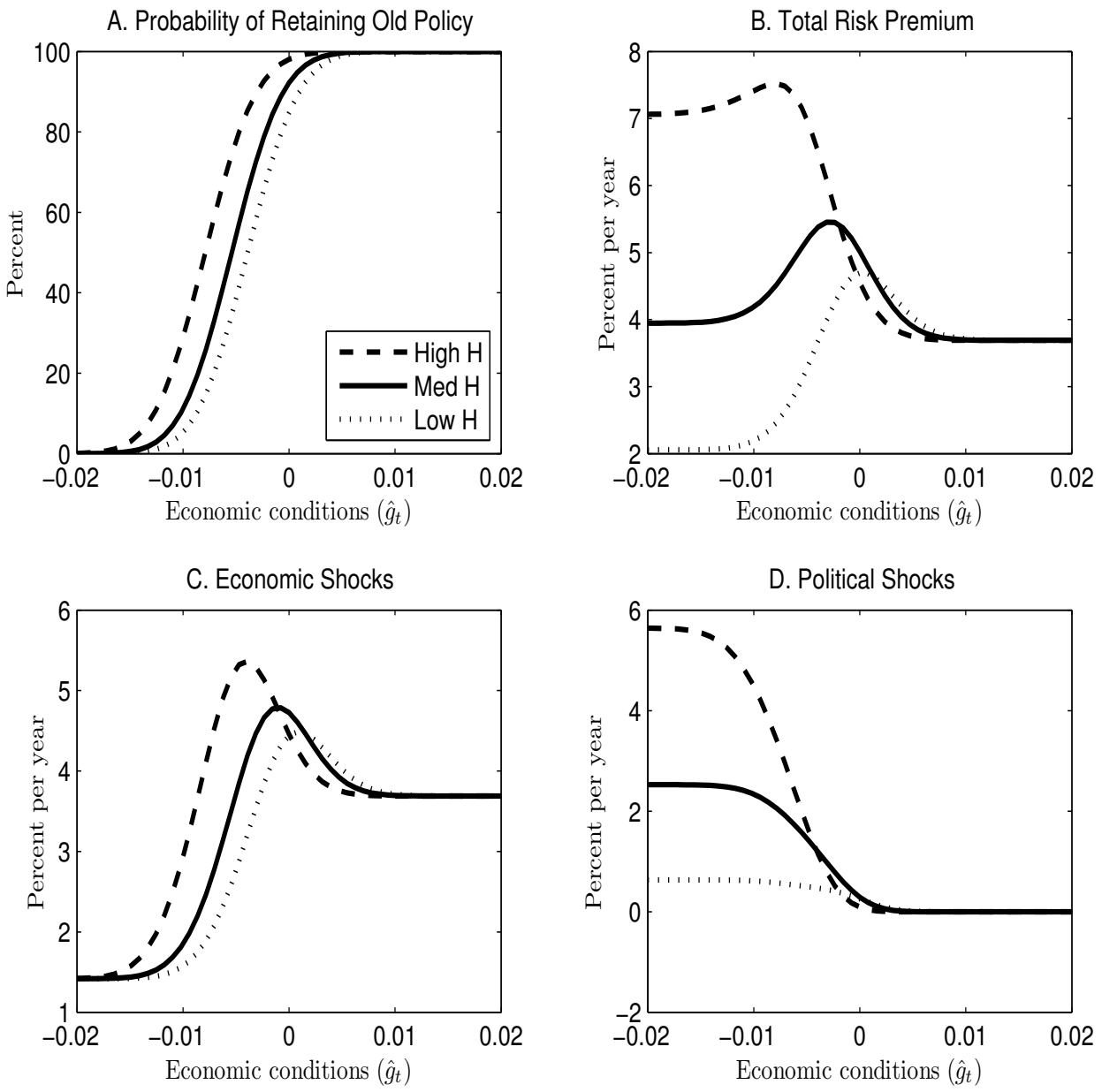


Figure 7. The equity risk premium and its components: The effect of policy heterogeneity. Panel A plots the probability of retaining the old policy, as perceived at time $t = \tau - 1$, for different values of $\hat{g}_t$ and three different levels of heterogeneity among the new policies. Heterogeneity $\mathcal{H}$ is defined as $\mathcal{H} = \sigma_{g,H} - \sigma_{g,L}$. The solid line corresponds to $\mathcal{H} = 0.02$, which is the benchmark case from Table 1. The dashed line corresponds to $\mathcal{H} = 0.03$, whereas the dotted line corresponds to $\mathcal{H} = 0.01$. For each of the three pairs of $(\sigma_{g,L}, \sigma_{g,H})$, we choose μ_g^H and $\mu_g^L = -\mu_g^H$ such that both new policies yield the same level of utility. All other parameter values are in Table 1. The values of $\widehat{c}_t^L$ and $\widehat{c}_t^H$ are set equal to their initial value at time 0, so that both new policies are equally likely to be adopted at time τ. Panel B plots the total equity risk premium as a function of $\hat{g}_t$ for the same three values of $\mathcal{H}$. Panel C plots the component of the total risk premium that is due to economic shocks, which include both capital shocks (i.e., shocks to B_t in the absence of learning about g^0) and impact shocks (i.e., learning about g^0). Panel D plots the component of the risk premium that is due to political shocks (i.e., learning about C^L and C^H).

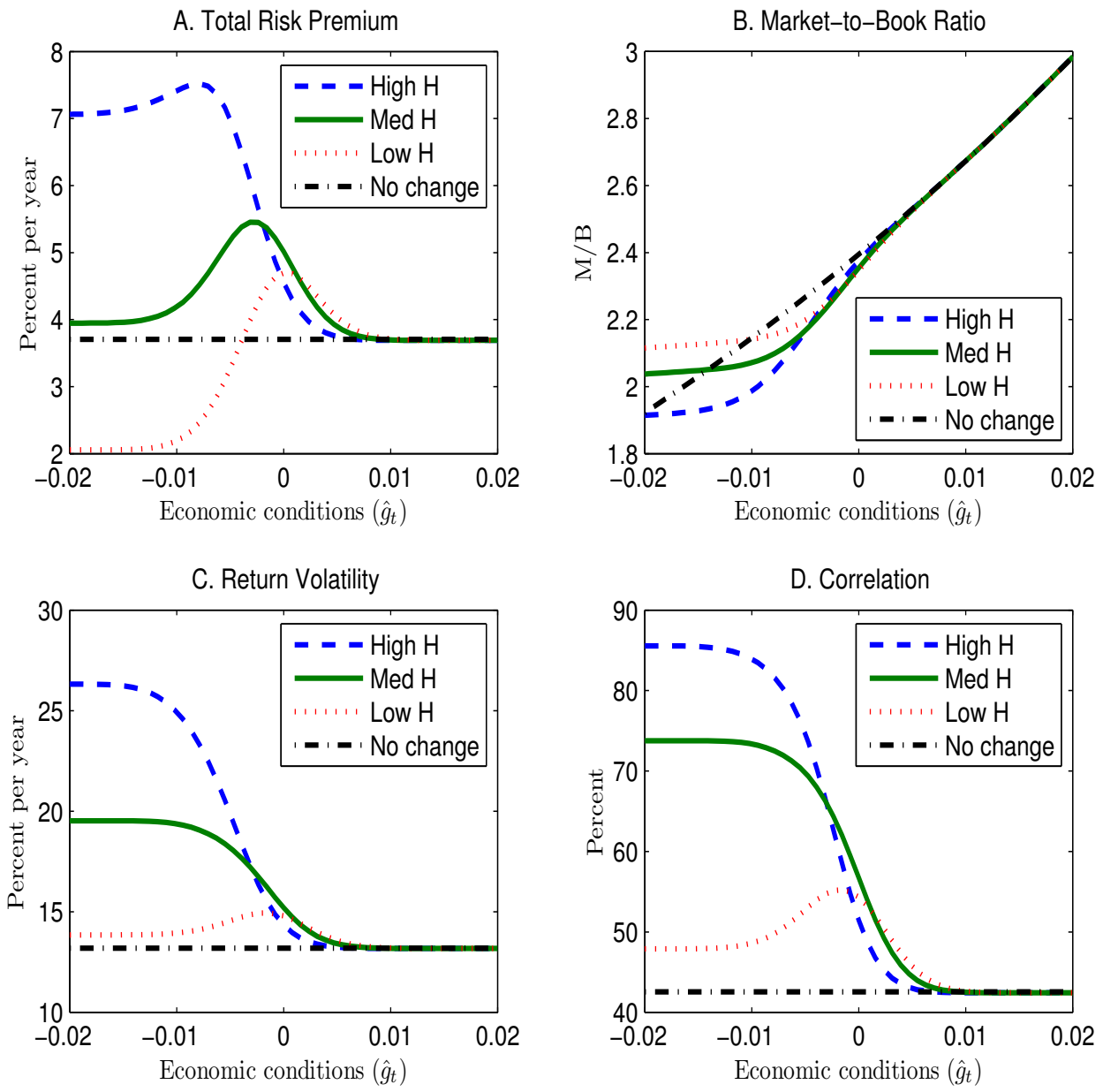


Figure 8. Stock price level, volatility, and correlation: The effect of policy heterogeneity. This figure is constructed in the same way as Figure 7 except that it plots additional quantities of interest—the stock price level, measured by the market-to-book ratio, the volatility of each stock's return, and the correlation between each pair of stocks. All quantities are plotted at time $t = \tau - 1$ for different values of $\hat{g}_t$ and three different levels of heterogeneity among the new policies, defined as $\mathcal{H} = \sigma_{g,H} - \sigma_{g,L}$. In addition, the dash-dot line in each panel represents the value of the given variable in the hypothetical scenario in which the government cannot change its policy at time τ. Comparing the dash-dot line to the other three lines thus highlights the effect of precluding the government from changing its policy.

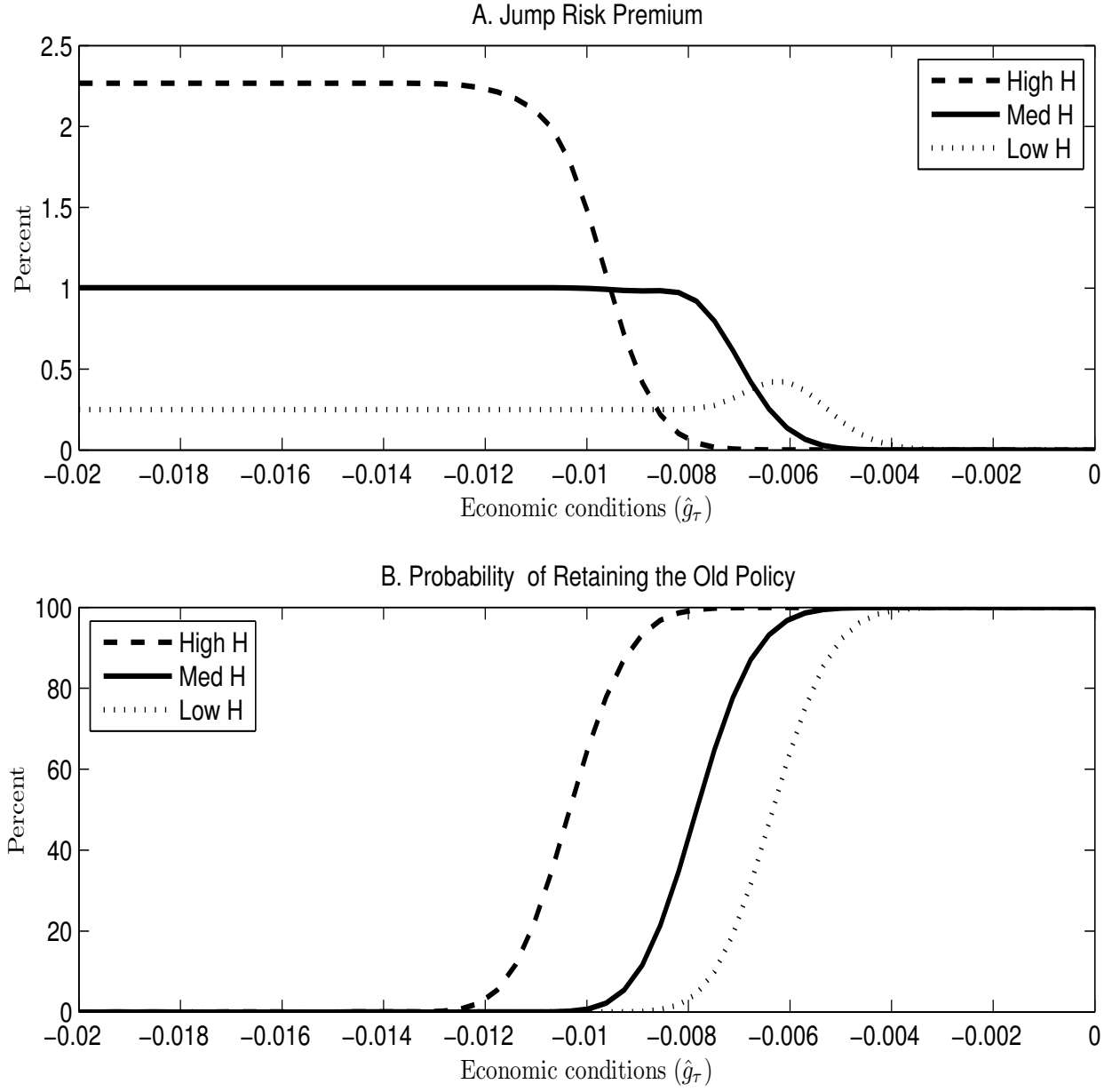


Figure 9. The jump risk premium. Panel A plots the conditional expected stock return immediately before the government's policy decision at time τ. This jump risk premium compensates investors for the uncertainty associated with the government's policy decision. Panel B plots the probability of retaining the old policy, as perceived immediately before the government's policy decision. Both the jump risk premia and the policy probabilities are plotted for different values of $\hat{g}_\tau$ and three different levels of heterogeneity among the new policies, defined as $\mathcal{H} = \sigma_{g,H} - \sigma_{g,L}$. The values of $\widehat{c}_t^L$ and $\widehat{c}_t^H$ are set equal to their initial values at time 0, so that both new policies are equally likely to be adopted at time τ. All parameter values, except for those we need to vary in order to vary $\mathcal{H}$ (in the same way as in Figures 7 and 8), are in Table 1.

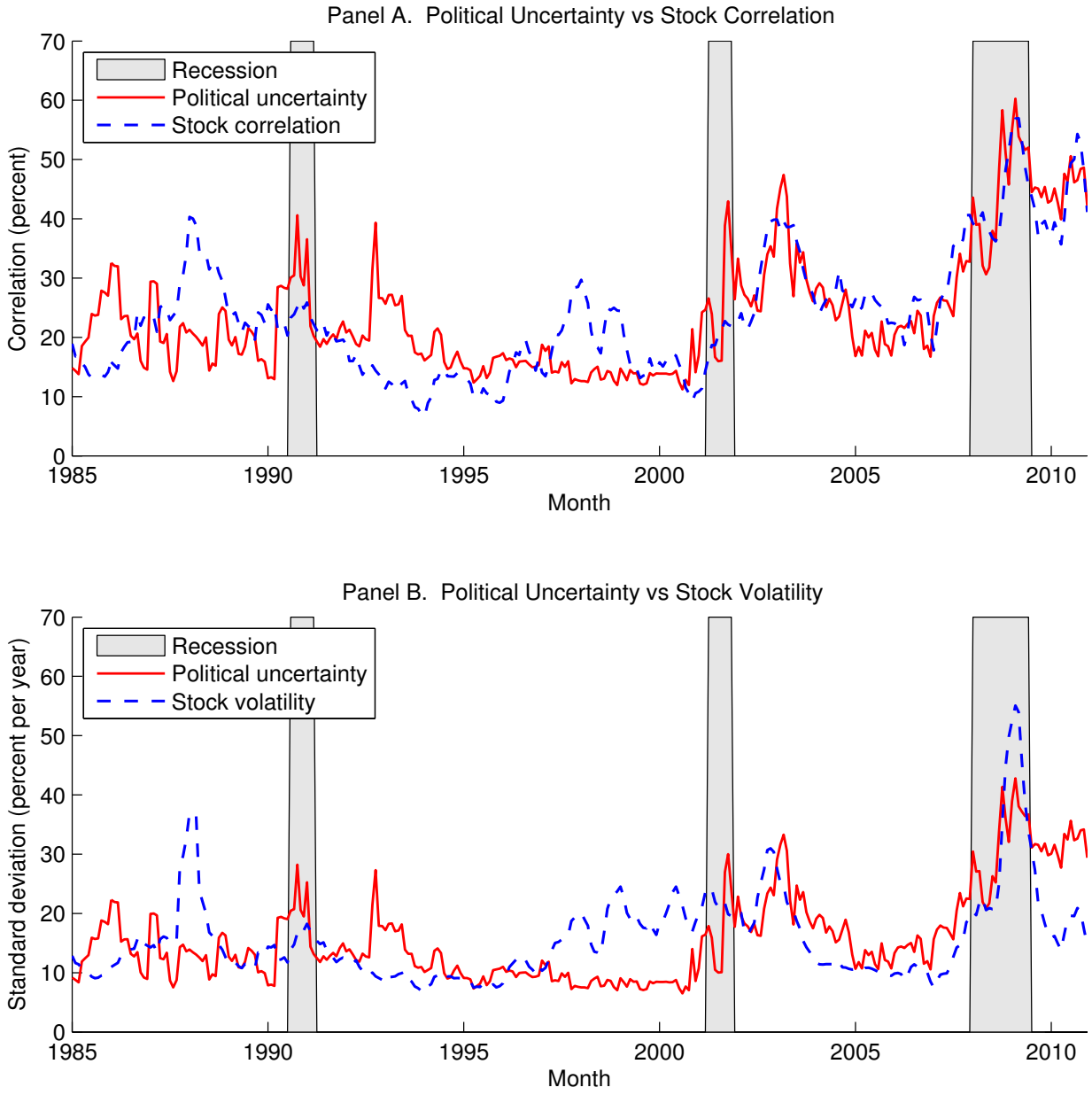


Figure 10. Political uncertainty versus stock market correlation and volatility. The solid line in each panel plots the policy uncertainty (PU) index of Baker, Bloom, and Davis (2011), which is our proxy for political uncertainty. In each panel, PU is scaled to have the same mean and volatility as the other variable plotted in the same panel. In Panel A, the other variable is the equal-weighted average of pairwise correlations for all stocks that comprise the S&P 500 index. In Panel B, the other variable is the realized volatility of the S&P 500 index. Both correlation and volatility are computed monthly from daily returns within the month. The dashed lines plot both variables' six-month moving averages between January 1985 and December 2010. The shaded areas represent NBER recessions.

REFERENCES

Alesina, Alberto, Silvia Ardagna, and Francesco Trebbi, 2006, Who adjusts and when? The political economy of reforms, *IMF Staff Papers* 53, 1–29.

Alesina, Alberto, and Dani Rodrik, 1994, Distributive politics and economic growth, *Quarterly Journal of Economics* 109, 465–490.

Baker, Scott R., Nicholas Bloom, and Steven J. Davis, 2011, Measuring economic policy uncertainty, Working paper, Stanford University.

Belo, Frederico, Vito D. Gala, and Jun Li, 2011, Government spending, political cycles, and the cross-section of stock returns, *Journal of Financial Economics*, forthcoming.

Bittlingmayer, George, 1998, Output, stock volatility, and political uncertainty in a natural experiment: Germany, 1880–1940, *Journal of Finance* 53, 2243–2257.

Boutchkova, Maria, Hitesh Doshi, Art Durnev, and Alexander Molchanov, 2010, Precarious politics and return volatility, *Review of Financial Studies*, forthcoming.

Bruno, Michael, and William Easterly, 1996, Inflation's children: Tales of crises that beget reforms, *American Economic Review P&P* 86, 213–217.

Callander, Steven, 2011, Searching for good policies, *American Political Science Review* 105, 643–662.

Coate, Stephen, and Stephen Morris, 1995, On the form of transfers to special interests, *Journal of Political Economy* 103, 1210–1235.

Croce, Maximiliano M., Howard Kung, Thien T. Nguyen, and Lukas Schmid, 2011, Fiscal policies and asset prices, *Review of Financial Studies*, forthcoming.

Croce, Maximiliano M., Thien T. Nguyen, and Lukas Schmid, 2011, The market price of fiscal uncertainty, Working paper, UNC.

Cuoco, Domenico, and Ron Kaniel, 2011, Equilibrium prices in the presence of delegated portfolio management, *Journal of Financial Economics* 101, 264–269.

Drazen, Allan, and William Easterly, 2001, Do crises induce reform? Simple empirical tests of conventional wisdom, *Economics and Politics* 13, 129–157.

Drazen, Allan, and Elhanan Helpman, 1990, Inflationary consequences of anticipated macroeconomic policies, *Review of Economic Studies* 57, 147–164.

Durnev, Art, 2011, The real effects of political uncertainty, Working paper, McGill Univ.

Erb, Claude B., Campbell R. Harvey, and Tadas E. Viskanta, 1996, Political risk, economic risk, and financial risk, *Financial Analysts Journal*, December, 29–46.

Gomes, Francisco J., Laurence J. Kotlikoff, and Luis M. Viceira, 2012, The excess burden of government indecision, *Tax Policy and the Economy* 26, NBER, Univ. of Chicago Press.

Gomes, Francisco J., Alexander Michaelides, and Valery Polkovnichenko, 2009, Fiscal policy in an incomplete markets economy, Working paper, London Business School.

Grossman, Gene M., and Elhanan Helpman, 1994, Protection for sale, *American Economic Review* 84, 833–850.

Hermes, Niels, and Robert Lensink, 2001, Capital flight and the uncertainty of government policies, *Economics Letters* 71, 377-381.

Julio, Brandon, and Youngsuk Yook, 2012, Corporate financial policy under political uncertainty: International evidence from national elections, *Journal of Finance* 67, 45–83.

Kogan, Leonid, Stephen A. Ross, Jiang Wang, and Mark M. Westerfield, 2006, The price impact and survival of irrational traders, *Journal of Finance* 61, 195–229.

Li, Jinliang, and Jeffery A. Born, 2006, Presidential election uncertainty and common stock returns in the United States, *Journal of Financial Research* 29, 609–622.

McGrattan, Ellen R., and Edward C. Prescott, 2005, Taxes, regulations, and the value of U.S. and U.K. corporations, *Review of Economic Studies* 72, 767–796.

Pantzalis, Christos, David A. Stangeland, and Harry J. Turtle, 2000, Political elections and the resolution of uncertainty: The international evidence, *Journal of Banking and Finance* 24, 1575–1604.

Pástor, Ľuboš, and Pietro Veronesi, 2012, Uncertainty about government policy and stock prices, *Journal of Finance*, forthcoming.

Persson, Torsten, and Guido Tabellini, 1994, Is inequality harmful for growth?, *American Economic Review* 84, 600–621.

Rose-Ackerman, Susan, 1999, *Corruption and Government: Causes, Consequences, and Reform*, Cambridge University Press, Cambridge.

Santa-Clara, Pedro, and Rossen Valkanov, 2003, The presidential puzzle: Political cycles and the stock market, *Journal of Finance* 58, 1841–1872.

Shleifer, Andrei, and Robert W. Vishny, 1993, Corruption, *Quarterly Journal of Economics* 108, 599–617.

Sialm, Clemens, 2006, Stochastic taxation and asset pricing in dynamic general equilibrium, *Journal of Economic Dynamics and Control* 30, 511–540.

Sialm, C., 2009, Tax changes and asset pricing, *American Economic Review* 99, 1356–1383.

Strulovici, Bruno, 2010, Learning while voting: Determinants of collective experimentation, *Econometrica* 78, 933–971.

Ulrich, Maxim, 2011, How does the bond market perceive government interventions?, Working paper, Columbia University.

Voth, Hans-Joachim, 2002, Stock price volatility and political uncertainty: Evidence from the interwar period, Working paper, UPF.