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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%, presumably in response to the increased likelihood of the preservation of the eurozone. 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.<sup>1</sup> 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

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<sup>1</sup>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.<sup>2</sup> 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. We interpret political uncertainty broadly as uncertainty about the government’s future actions. 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 shocks

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<sup>2</sup>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).

affect stock prices both directly, by affecting the amount of 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 fundamental *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 continuous flow of political news, lead investors to revise their beliefs about the likelihood of the various future government policy choices. For instance, in the example from the first paragraph, the Greek prime minister’s announcement of his wish to hold a referendum must have led investors to update their beliefs about the probability that Greece will decide to leave the eurozone in the future.<sup>3</sup>

We decompose the equity risk premium into three components, which correspond to the three types of shocks introduced above. 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.

The composition of the equity risk premium is highly state-dependent. Importantly, the political risk premium is larger in weaker economic conditions. 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. The political risk premium is also larger when political signals are more precise (e.g., when political debates are more informative) as well as when there is more political uncertainty.

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

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<sup>3</sup>For another example, consider November 19, 2012. When U.S. stocks jumped 1.5% at the open, the CNN Money ‘Breaking News’ headline read: “U.S. stocks open higher as investors see signs of progress in resolving the fiscal cliff.” Note that stock prices here respond to the *signs of progress*, not to the eventual resolution of the fiscal cliff. That is exactly how stock prices in our model respond to political shocks.

policy is then likely to be replaced, so its impact is temporary.

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, which results from the government's tendency 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. Political uncertainty thus reduces the value of the put protection that the government provides to the market.

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 an 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 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 below average.

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 analysis. To proxy for political uncertainty, we use the policy uncertainty index of Baker, Bloom, and Davis (2012). 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. Our evidence is consistent with all of these 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.<sup>4</sup> Tax uncertainty also features in Croce, Kung, Nguyen, and Schmid (2012), who explore its asset pricing implications in a production economy with recursive preferences. Croce, Nguyen, and Schmid (2012) examine the effects of fiscal uncertainty on long-term growth when agents facing model uncertainty care about the worst-case scenario. Finally, Ulrich (2013b) studies the policy problem of a government that cares about welfare as well as public spending. He analyzes the bond market implications of Knightian uncertainty about the effectiveness of government policies. All of these studies are quite different from ours. They analyze fiscal policy, whereas we consider a broader set of government actions. They use different modeling techniques and none of them feature Bayesian learning.

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. Their study differs from ours in three key respects. First, 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. None of our main results would obtain in Pástor and Veronesi's model, which features no learning about political costs and, by extension, no political shocks. Given this modeling difference, stock prices respond to the stream of political news in our model but not in theirs. Second, 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 new policies were identical a priori, as in Pástor and Veronesi's model. We find that policy heterogeneity can have a substantial effect on the equity risk premium, as well as on other properties of stock prices such as their level, volatility, and correlations. Third, our study has a different

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<sup>4</sup>Other studies, such as McGrattan and Prescott (2005), Sialm (2009), and Gomes, Michaelides, and Polkovnichenko (2013), relate stock prices to tax rates, without emphasizing tax-related uncertainty.

focus. Pástor and Veronesi examine the stock market reaction to the announcement of the government’s policy decision, whereas we analyze how stock prices respond to political signals about what the future policy decision might be. Accordingly, our focus is on the risk premium, volatility, and correlation 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. Brogaard and Detzel (2012) find a positive relation between the equity risk premium and their search-based measure of economic policy uncertainty in an international setting. Santa-Clara and Valkanov (2003) relate the equity risk premium to political cycles. Belo, Gala, and Li (2013) link the cross-section of stock returns to firms’ exposures to the government sector. Bittlingmayer (1998), Voth (2002), and Boutchkova, Doshi, Durnev, and Molchanov (2012) find a positive relation between political uncertainty and stock volatility in a variety of settings. Finally, while our focus is on the financial effects of political uncertainty, others have analyzed the real effects.<sup>5</sup>

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 analyzes an extension of our model. 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 additional material as well as all the proofs.

## 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

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<sup>5</sup>For example, Julio and Yook (2012) find that firms reduce their investment prior to major elections. Durnev (2012) finds that corporate investment is less sensitive to stock prices during election years. Baker, Bloom, and Davis (2012) find that policy uncertainty reduces investment and increases unemployment. Gomes, Kotlikoff, and Viceira (2012) find that uncertainty about government policies regarding taxes and Social Security results in welfare losses. Fernández-Villaverde et al. (2012) find that changes in uncertainty about future fiscal policy have a negative effect on economic activity.



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

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

where  $(\mu, \sigma, \sigma_1)$  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  $\tau$ ,  $0 < \tau < T$ , when the government makes an irreversible policy decision.<sup>6</sup> At that time  $\tau$ , 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  $n = \{1, \dots, N\}$  are the potential new policies and policy 0 is the “old” policy prevailing since time 0. Let  $g^0$  denote the impact of the old policy and  $g^n$  denote the impact of the  $n$ -th new policy, for  $n = \{1, \dots, N\}$ . The value of  $g_t$  is then a simple step function of time:

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

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  $\tau$ .

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 distributions of all policy impacts are normal:

$$g^0 \sim N(0, \sigma_g^2) \quad (3)$$

$$g^n \sim N(\mu_g^n, \sigma_{g,n}^2) \quad \text{for } n = \{1, \dots, N\} . \quad (4)$$

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  $\{g^0, g^1, \dots, g^N\}$  are unknown to all agents—the government as well as the investors who own the firms.

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

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

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

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  $T$ .<sup>7</sup> Investors always know which government policy is in place.

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

$$\max_{n \in \{0, \dots, N\}} \left\{ \mathbb{E}_\tau \left[ \frac{C^n W_T^{1-\gamma}}{1-\gamma} \mid \text{policy } n \right] \right\}, \quad (6)$$

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).<sup>8</sup> 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  $\tau$ . 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  $C^n = 1$ :

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

where the  $c^n$  values are uncorrelated across policies as well as independent of the Brownian motions in Eq. (1). Uncertainty about  $\{C^n\}_{n=1}^N$ , which is given by  $\sigma_c$  as of time 0, is the source of *political uncertainty* in the model. Political uncertainty—uncertainty about the government's future policy choice—is related to  $\sigma_c$  because when investors are less certain about political costs, they are also less certain about which policy the government will adopt in the future. In addition, if  $\sigma_c = 0$  then the government's policy choice is perfectly predictable immediately before time  $\tau$ , whereas  $\sigma_c > 0$  introduces an element of surprise into

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<sup>7</sup>No dividends are paid before time  $T$  because the investors' preferences (Eq. (5)) do not involve intermediate consumption. Firms in our model reinvest all of their earnings, as mentioned earlier.

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

the policy decision. Due to the uncertainty about political costs, stock prices before time  $\tau$  respond to political news, as explained later in Sections 2.2 and 4.2.

Given its objective function in Eq. (6), the government is “quasi-benevolent”: it maximizes the investors’ welfare on average (because  $E_0 [C^n] = 1$  for all  $n$ ), but it also deviates 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.<sup>9</sup> This literature presents various reasons why governments might not maximize aggregate welfare. For example, governments care about the distribution of wealth.<sup>10</sup> Governments tend to be influenced by special interest groups.<sup>11</sup> They might also be susceptible to corruption.<sup>12</sup> 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.

We create a wedge between the government and the social planner by adding random political costs to the government’s objective function. Modifying the objective function in this way is a modeling device that we employ to capture uncertainty about the government’s future actions; we do not mean to imply that politicians must have distorted objectives. A plausible alternative interpretation is that the government operates under complex political constraints arising from various conflicts of interest, and those constraints preclude it from achieving the social planner’s solution. That is, even if the government had exactly the same objective as investors, its politically-constrained optimal policy choice could be different from the social planner’s unconstrained choice. Instead of trying to model the complicated and stochastic web of political constraints, we model the random deviations from the social planner in a simpler way through the government’s objective function in Eq. (6).

The same objective function could potentially be applied in corporate finance theory to

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<sup>9</sup>For example, in his well-known graduate textbook, Drazen (2000) argues that “the very starting point of political economy is the inapplicability of the paradigm of policy being chosen by a social welfare maximizer.”

<sup>10</sup>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.

<sup>11</sup>See, for example, Grossman and Helpman (1994) and Coate and Morris (1995).

<sup>12</sup>See, for example, Shleifer and Vishny (1993) and Rose-Ackerman (1999).

model the preferences of CEOs. While CEOs generally act in the shareholders' interest, they might also deviate from this objective in an unforeseeable manner (e.g., to derive private benefits, to enhance their own personal careers, etc.). The main difference from our setting is that a CEO's decisions affect mostly his own firm and its competitors whereas the government's decisions can affect all firms. Therefore, uncertainty about a CEO's actions is largely firm-specific whereas uncertainty about the government's actions is largely systematic. The non-diversifiable nature of government-induced uncertainty is crucial for our results since it permeates the stochastic discount factor, as we show later in Section 4.1.

Government policies also merit more discussion. We interpret policy changes broadly as government actions that change the economic environment. Recent examples include the Wall Street reform, health care reform, and the various ongoing structural changes in Europe, such as labor market reforms and tax reforms. More extreme examples include the shift from communism to capitalism in Eastern Europe some twenty years ago and decisions to go to war. 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 Eq. (4). In contrast, a potential new policy that has already been tried (and learned about) in the past might merit a lower  $\sigma_{g,n}$ . We abstract from the fact that government policies may affect some firms more than others, focusing on the aggregate effects.

### 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 Eqs. (3) and (4). Between times 0 and  $\tau$ , 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

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

where the posterior mean and variance evolve as

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

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

Above,  $d\widehat{Z}_t$  denotes the expectation errors, which reflect shocks to the average profitability across all firms.<sup>13</sup> When the average profitability is higher than expected, agents revise their beliefs about  $g^0$  upward, and vice versa (see Eq. (9)). Uncertainty about  $g^0$  declines deterministically over time due to learning (see Eq. (10)). Before time  $\tau$ , 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 Eq. (4).

If there is no policy change at time  $\tau$ , then agents continue to learn about  $g^0$  after time  $\tau$ , and the processes (9) and (10) continue to hold also for  $t > \tau$ . If there is a policy change at time  $\tau$ , 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  $N(\widehat{g}_\tau, \widehat{\sigma}_\tau^2)$  to the prior  $N(\mu_{g,n}^n, \sigma_{g,n}^2)$ . 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  $\tau$ . 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:

$$ds_t^n = c^n dt + h dZ_{c,t}^n, \quad n = 1, \dots, N. \quad (11)$$

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. Taking a broader perspective, government actions are not fully predictable, and learning about  $c^n$  is a simple modeling device that we employ to capture the gradual resolution of uncertainty about those future actions.

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

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

where the posterior mean and variance evolve as

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

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<sup>13</sup>The  $d\widehat{Z}_t$  shocks are related to the  $dZ_t$  shocks from Eq. (1) as follows:  $d\widehat{Z}_t = dZ_t + [(g^0 - \widehat{g}_t)/\sigma] dt$ .

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

Eq. (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 ( $d\widehat{Z}_{c,t}^n = h^{-1}(ds_t^n - E_t[ds_t^n])$ ). 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 agents to learn about  $C^n$  before time  $\tau$ . There is no such learning in Pástor and Veronesi's model; their political cost is drawn at time  $\tau$  from the prior distribution in Eq. (7). Learning about  $C^n$  introduces political shocks to the economy, which play a crucial role here. Due to these shocks, stock prices respond to political news in our model but not in theirs. Second, we let the government 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 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  $\mu_g^n$  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. In addition to these modeling differences, our focus differs from that of Pástor and Veronesi. They emphasize the announcement returns associated with policy changes, whereas we analyze the risk premium, volatility, and correlation induced by political uncertainty. They concentrate on the instantaneous price response at time  $\tau$ , whereas we emphasize the asset pricing effects of a continuous stream of political shocks before time  $\tau$ .

### 3. Optimal government policy choice

In this section, we analyze the government's policy choice at time  $\tau$ . After a period of learning about  $g^0$  and  $\{C^n\}_{n=1}^N$ , the government chooses one of  $N + 1$  policies,  $\{0, 1, \dots, N\}$ , at time  $\tau$ . 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 Eq. (8) to

the prior in Eq. (4). It is useful to introduce the following notation:

$$\tilde{\mu}^n = \mu_g^n - \frac{\sigma_{g,n}^2}{2}(T - \tau)(\gamma - 1) \quad n = 1, \dots, N \quad (15)$$

$$\tilde{\mu}^0 = \hat{g}_\tau - \frac{\hat{\sigma}_\tau^2}{2}(T - \tau)(\gamma - 1) . \quad (16)$$

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

$$\mu_g^0 = \hat{g}_\tau \quad (17)$$

$$\sigma_{g,0} = \hat{\sigma}_\tau , \quad (18)$$

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

We refer to  $\tilde{\mu}^n$  in Eqs. (15) and (16) as the ‘‘utility score’’ of policy  $n$ , for  $n = 0, 1, \dots, N$ . 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  $\{0, 1, \dots, N\}$ , we have*

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

*if and only if*

$$\tilde{\mu}^n > \tilde{\mu}^m . \quad (20)$$

Lemma 1 shows that the policy with the highest utility score delivers the highest utility to investors at time  $\tau$ . 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 Eq. (6). The government chooses policy  $n$  at time  $\tau$  if and only if the following condition is satisfied for all policies  $m \neq n, m \in \{0, \dots, N\}$ :

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

The above condition yields our first proposition.

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

$$\tilde{\mu}^n - \tilde{c}^n > \tilde{\mu}^m - \tilde{c}^m , \quad (21)$$

where we define

$$\tilde{c}^n = \frac{c^n}{(\gamma - 1)(T - \tau)} \quad n = 0, 1, \dots, N . \quad (22)$$

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

**Corollary 1:** *The government changes its policy at time  $\tau$  if and only if*

$$\hat{g}_\tau < \max_{n \in \{1, \dots, N\}} \{\tilde{\mu}^n - \tilde{c}^n\} + \frac{\hat{\sigma}_\tau^2}{2} (T - \tau) (\gamma - 1) . \quad (23)$$

The government finds it optimal to change its policy if  $\hat{g}_\tau$ , 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 related to our interpretation later on that the government effectively provides put protection to the market.

Before time  $\tau$ , agents face uncertainty about the government's action at time  $\tau$  because they know neither  $\hat{g}_\tau$  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  $\tau$ , evaluated at any time  $t \leq \tau$  for any policy  $n \in \{1, \dots, N\}$ , is given by*

$$p_t^n = \int_{-\infty}^{\infty} \Pi_{m \neq n, m \in \{1, \dots, N\}} [1 - \Phi_{\tilde{c}^m}(\tilde{c}^n + \tilde{\mu}^m - \tilde{\mu}^n)] \Phi_{\tilde{\mu}^0}(\tilde{\mu}^n - \tilde{c}^n | \hat{g}_t) \phi_{\tilde{c}^n}(\tilde{c}^n) d\tilde{c}^n . \quad (24)$$

Above,  $\phi_{\tilde{c}^n}(\cdot)$  and  $\Phi_{\tilde{c}^n}(\cdot)$  are the normal pdf and cdf of  $\tilde{c}^n$ , respectively, and  $\Phi_{\tilde{\mu}^0}$  is the normal cdf of  $\tilde{\mu}^0$ .<sup>14</sup> 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.

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<sup>14</sup>As of time  $t$ ,  $\tilde{c}^n \sim \mathcal{N}\left(\frac{\tilde{c}_t^n}{(\gamma-1)(T-\tau)}, \frac{\hat{\sigma}_{c,t}^2}{(\gamma-1)^2(T-\tau)^2}\right)$  and  $\tilde{\mu}^0 \sim \mathcal{N}\left(\hat{g}_t - \frac{\hat{\sigma}_\tau^2}{2} (T - \tau) (\gamma - 1), \hat{\sigma}_t^2 - \hat{\sigma}_\tau^2\right)$ .



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

$$M_t^i = E_t \left[ \frac{\pi_T}{\pi_t} B_T^i \right], \quad (25)$$

where  $\pi_t$  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.<sup>15</sup> 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.<sup>16</sup> Assuming complete markets, standard arguments imply that the state price density is uniquely given by

$$\pi_t = \frac{1}{\lambda} E_t [B_T^{-\gamma}], \quad (26)$$

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

#### 4.1. The state price density

Our main focus is on the behavior of stock prices before political uncertainty is resolved at time  $\tau$ . Before time  $\tau$ , 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 Eqs. (9) and (13). The  $N+1$  posterior means,  $(\hat{g}_t, \hat{c}_t^1, \dots, \hat{c}_t^N)$ , represent stochastic state variables that affect asset prices before time  $\tau$ . The posterior variances of  $g^0$  and  $\{c^n\}_{n=1}^N$  vary deterministically over time (see Eqs. (10) and (14)). We denote the full set of  $N+2$  state variables, including time  $t$ , by

$$S_t \equiv (\hat{g}_t, \hat{c}_t^1, \dots, \hat{c}_t^N, t) . \quad (27)$$

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*

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

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<sup>15</sup>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).

<sup>16</sup>We do not want to give the impression that the risk-free rate is unimportant. Ulrich (2012) argues that a substantial fraction of the variation in the aggregate price-dividend ratio is driven by the real risk-free rate.

where the function  $\Omega(S_t)$  is given in Eq. (A1) in the Appendix.

The dynamics of  $\pi_t$ , 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*

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

where

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

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

Eq. (29) shows that the SDF is driven by two types of shocks, which we refer to as economic shocks ( $d\widehat{Z}_t$ ) and political shocks ( $d\widehat{Z}_{c,t}^n$ ).<sup>17</sup> We discuss economic shocks first.

#### 4.1.1. Economic shocks

Economic shocks are represented by the Brownian motion  $d\widehat{Z}_t$ , which drives the aggregate fundamentals of the economy. In the filtered probability space, capital  $B_t$  follows the process

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

which shows that stochastic variation in total capital is perfectly correlated with  $d\widehat{Z}_t$ . We further subdivide economic shocks into capital shocks and impact shocks.

*Capital shocks*, measured by  $-\gamma\sigma d\widehat{Z}_t$ , would affect the SDF in the same way even if all of the parameters were known. Capital shocks are unrelated to government policy.

*Impact shocks*, measured by  $\sigma_{\pi,0} d\widehat{Z}_t$ , are induced by learning about the impact of the prevailing (old) policy. Recall from Eq. (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 Eq. (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 strength of the  $\widehat{g}_t$  shocks is larger (i.e., when  $\sigma^{-1}$  is larger).

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<sup>17</sup>We suppress the time  $t$  subscripts in  $\sigma_{\pi,0}$  and  $\sigma_{\pi,n}$  even though both quantities are time-dependent. Similarly, we suppress the time subscripts later in  $\sigma_{M,0}$ ,  $\sigma_{M,n}$ , and  $\mu_M^i$ .

While a general characterization of  $\partial\Omega/\partial\hat{g}_t$  (and thus also  $\sigma_{\pi,0}$ ) is cumbersome, we obtain elegant and insightful simplifications in the limiting cases.

**Corollary 3:** *The market price of risk associated with impact shocks is given by*

$$-\sigma_{\pi,0} \rightarrow \gamma(\tau - t)\hat{\sigma}_t^2\sigma^{-1} \quad \text{as } \hat{g}_t \rightarrow -\infty \quad (33)$$

$$\rightarrow \gamma(T - t)\hat{\sigma}_t^2\sigma^{-1} \quad \text{as } \hat{g}_t \rightarrow \infty. \quad (34)$$

This corollary shows that impact shocks have a larger effect on marginal utility when  $\hat{g}_t \rightarrow \infty$  compared to  $\hat{g}_t \rightarrow -\infty$  (because  $T > \tau$ ). Intuitively, as  $\hat{g}_t$  decreases, the current policy becomes increasingly likely to be replaced by the government at time  $\tau$  (Corollary 1). In the limit as  $\hat{g}_t \rightarrow -\infty$ , the current policy is certain to be replaced. Therefore, the policy's impact is temporary, lasting only until time  $\tau$ , and the market price of risk associated with learning about this impact is proportional to  $\tau - t$ . In contrast, when  $\hat{g}_t \rightarrow \infty$ , the current policy is certain to be retained. Its impact is permanent, lasting until time  $T$ , and the price of impact risk is proportional to  $T - t$ . The corollary also shows that  $\sigma_{\pi,0} < 0$  in both limiting cases, indicating that good news about  $g^0$  reduces marginal utility.

#### 4.1.2. Political shocks

The second type of shocks from Eq. (29), *political shocks*, are given by  $\sum_{n=1}^N \sigma_{\pi,n} d\hat{Z}_{c,t}^n$ . These shocks arise due to learning about political costs  $\{C^n\}_{n=1}^N$  (see Eq. (13)). Political shocks are orthogonal to economic shocks in that  $d\hat{Z}_{c,t}^n$  is independent of  $d\hat{Z}_t$ . It follows from Eq. (31) that political shocks have a bigger effect on the SDF when the sensitivity of marginal utility to  $\hat{c}_t^n$  (i.e.,  $\partial\Omega/\partial\hat{c}_t^n$ ) is larger, when the uncertainty about political costs ( $\hat{\sigma}_{c,t}$ ) is larger, as well as when the accuracy of the political signals ( $h^{-1}$ ) is larger.

Similar to impact shocks, the magnitude of political shocks is state-dependent as a result of the dependence of the sensitivity  $\partial\Omega/\partial\hat{c}_t^n$  on  $\hat{g}_t$ . When  $\hat{g}_t$  is large, this sensitivity is close to zero, and so is  $\sigma_{\pi,n}$ . In the limit, political shocks do not affect the SDF.

**Corollary 4:** *As  $\hat{g}_t \rightarrow \infty$ ,  $\sigma_{\pi,n} \rightarrow 0$  for all  $n = 1, \dots, N$ .*

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

The logic behind this corollary is simple. As  $\hat{g}_t$  increases, the current policy becomes increasingly likely to be retained by the government (Corollary 1). In the limit, it 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  $\hat{g}_t$  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*

$$M_t^i = B_t^i e^{(\mu - \gamma\sigma^2)(T-t)} \frac{H(S_t)}{\Omega(S_t)}, \quad (35)$$

where  $\Omega(S_t)$  and  $H(S_t)$  are given in Eqs. (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*

$$\frac{dM_t^i}{M_t^i} = \mu_M^i dt + (\sigma + \sigma_{M,0}) d\hat{Z}_t + \sum_{n=1}^N \sigma_{M,n} d\hat{Z}_{c,t}^n + \sigma_1 dZ_t^i, \quad (36)$$

where

$$\sigma_{M,0} = \left( \frac{1}{H} \frac{\partial H}{\partial \hat{g}_t} - \frac{1}{\Omega} \frac{\partial \Omega}{\partial \hat{g}_t} \right) \hat{\sigma}_t^2 \sigma^{-1} \quad (37)$$

$$\sigma_{M,n} = \left( \frac{1}{H} \frac{\partial H}{\partial \hat{c}_t^n} - \frac{1}{\Omega} \frac{\partial \Omega}{\partial \hat{c}_t^n} \right) \hat{\sigma}_{c,t}^2 h^{-1} \quad (38)$$

and

$$\mu_M^i = (\gamma\sigma - \sigma_{\pi,0}) (\sigma + \sigma_{M,0}) - \sum_{n=1}^N \sigma_{\pi,n} \sigma_{M,n}. \quad (39)$$

Eq. (36) shows that individual stock returns are driven by both economic shocks ( $d\hat{Z}_t$ ) and political shocks ( $d\hat{Z}_{c,t}^n$ ), 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  $\mu_M^i$  since the risk-free rate is zero.<sup>18</sup> This risk premium, given in Eq. (39), does not depend on  $i$ , so it also represents the market-wide

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<sup>18</sup>Alternatively,  $\mu_M^i$  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.

equity risk premium. The premium can be further decomposed as follows:

$$\mu_M^i = \underbrace{\underbrace{\gamma\sigma^2}_{\text{Capital shocks}} + \underbrace{(\gamma\sigma\sigma_{M,0} - \sigma\sigma_{\pi,0} - \sigma_{M,0}\sigma_{\pi,0})}_{\text{Impact shocks}}}_{\text{Economic shocks}} - \underbrace{\sum_{n=1}^N \sigma_{\pi,n}\sigma_{M,n}}_{\text{Political shocks}} . \quad (40)$$

Eq. (40) shows that the risk premium has three components corresponding to the three types of shocks introduced earlier. Recall that impact shocks are induced by learning about  $g^0$  (i.e., by  $d\widehat{g}_t$ ), whereas political shocks are induced by learning about  $C^n$  (i.e., by  $d\widehat{Z}_{c,t}^n$ ,  $n = 1, \dots, N$ ). 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  $B_t$  (Eq. (32), a capital shock) but also expected future capital via  $\widehat{g}_t$  (Eq. (9), an impact shock).

The last term in Eq. (40) represents the risk premium induced by political shocks. It is interesting that political shocks command a risk premium despite being orthogonal 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 uncertainty about which of the new policies the government might adopt in the future.

The second term in Eq. (40), 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 *impact 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 impact risk premium is 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 both  $\sigma_{M,n}$  and  $\sigma_{\pi,n}$  depend on  $S_t$  for all  $n = 0, \dots, N$ .

Impact shocks affect stocks returns through  $\sigma_{M,0}d\widehat{Z}_t$  in Eq. (36). While the general formula for  $\sigma_{M,0}$  is unwieldy, its limiting values, given below, are simple.

**Corollary 5:** *The contribution of impact shocks to stock return volatility is given by*

$$\sigma_{M,0} \rightarrow (\tau - t)\widehat{\sigma}_t^2\sigma^{-1} \quad \text{as } \widehat{g}_t \rightarrow -\infty \quad (41)$$

$$\rightarrow (T - t)\widehat{\sigma}_t^2\sigma^{-1} \quad \text{as } \widehat{g}_t \rightarrow \infty . \quad (42)$$

This corollary is closely related to Corollary 3. Combining Corollaries 3 and 5, we obtain simple formulae for the impact risk premium at time  $t$  in the limiting cases:

$$\text{Impact risk premium} \rightarrow 2\gamma(\tau - t)\widehat{\sigma}_t^2 + \gamma(\tau - t)^2\widehat{\sigma}_t^4\sigma^{-2} \quad \text{as } \widehat{g}_t \rightarrow -\infty \quad (43)$$

$$\rightarrow 2\gamma(T - t)\widehat{\sigma}_t^2 + \gamma(T - t)^2\widehat{\sigma}_t^4\sigma^{-2} \quad \text{as } \widehat{g}_t \rightarrow \infty. \quad (44)$$

Both expressions are intuitive. Similar to our discussion of Corollary 3, when  $\widehat{g}_t \rightarrow -\infty$ , impact shocks are temporary, lasting only until time  $\tau$ , and the impact risk premium depends on  $\tau - t$ . In contrast, when  $\widehat{g}_t \rightarrow \infty$ , impact shocks are permanent, lasting until time  $T$ , and the impact risk premium is related to  $T - t$ . The impact risk premium is lower when  $\widehat{g}_t \rightarrow -\infty$  compared to  $\widehat{g}_t \rightarrow \infty$ . This difference is related to the implicit put protection that the government provides to the market, as discussed later. Finally, we see that the impact risk premium is positive in both limiting cases. In general, this premium varies with economic conditions in an interesting non-monotonic fashion, as we show later.

Political shocks affect stock returns through  $\sum_{n=1}^N \sigma_{M,n} d\widehat{Z}_{c,t}^n$  in Eq. (36).

**Corollary 6:** *As  $\widehat{g}_t \rightarrow \infty$ ,  $\sigma_{M,n} \rightarrow 0$  for all  $n = 1, \dots, N$ .*

This corollary shows that the contribution of political shocks to stock return volatility diminishes as  $\widehat{g}_t \rightarrow \infty$ . The intuition is the same as that behind Corollary 4. Since both  $\sigma_{M,n}$  and  $\sigma_{\pi,n}$  go to zero as  $\widehat{g}_t \rightarrow \infty$ , so does the political risk premium. More generally, we show later that the political risk premium is larger when  $\widehat{g}_t$  is lower.

The volatility and correlation of stock returns follow from Proposition 5. The variance of firm  $i$ 's returns,  $(\sigma_t^i)^2$ , and the correlation between firms  $i$  and  $j$ ,  $\rho_t^{ij}$ , are given by

$$(\sigma_t^i)^2 = (\sigma + \sigma_{M,0})^2 + \sum_{n=1}^N \sigma_{M,n}^2 + \sigma_1^2 \quad (45)$$

$$\rho_t^{ij} = \frac{(\sigma + \sigma_{M,0})^2 + \sum_{n=1}^N \sigma_{M,n}^2}{(\sigma + \sigma_{M,0})^2 + \sum_{n=1}^N \sigma_{M,n}^2 + \sigma_1^2}. \quad (46)$$

The correlations are always positive, due to firm homogeneity. In addition, the correlations and volatilities comove perfectly over time. Their only time-varying determinants are  $\sigma_{M,0}$  and  $\sigma_{M,n}$  (whose time subscripts are suppressed); in contrast,  $\sigma_1$  is constant. Therefore, any time variation in  $\sigma_{M,0}$  or  $\sigma_{M,n}$  pushes both  $(\sigma_t^i)^2$  and  $\rho_t^{ij}$  in the same direction.

Beyond these properties, it seems difficult to characterize volatility or correlation in more analytical detail. While we can simplify  $\sigma_{M,0}$  and  $\sigma_{M,n}$  in certain limiting cases (Corollaries 5 and 6), Eqs. (37) and (38) are very complicated in their full generality (see the Technical

Appendix). Even the signs of  $\sigma_{M,n}$  are ambiguous—they depend not only on the parameter values but also on the investors’ beliefs about all available policies. To illustrate this point, consider a given policy  $n^*$  in two different scenarios. In Scenario 1, investors assign zero probability to all other new policies except for one that is less desirable than  $n^*$ . In that scenario, a political shock  $d\hat{Z}_{c,t}^{n^*} > 0$ , which increases the perceived political cost of policy  $n^*$ , is bad news because it increases the probability that the less desirable policy will be adopted. Therefore, an increase in  $\hat{c}_t^{n^*}$  depresses stock prices, so that  $\sigma_{M,n^*} < 0$ . In Scenario 2, investors assign zero probability to all other new policies except for one that is more desirable than  $n^*$ . The same political shock  $d\hat{Z}_{c,t}^{n^*} > 0$  is then good news because it makes the adoption of the more desirable policy more likely; therefore,  $\sigma_{M,n^*} > 0$ . Note that  $\sigma_{M,n^*} < 0$  in Scenario 1 but  $\sigma_{M,n^*} > 0$  in Scenario 2: how stock prices respond to political news depends on current beliefs about alternative policy options. The same news about the same policy can be good or bad, depending on what we believe about the alternative policies.<sup>19</sup>

### 4.3. Stock price reaction to the policy decision

When the government announces its policy decision at time  $\tau$ , stock prices jump. Let  $M_\tau^i$  denote the market value of firm  $i$  immediately before the announcement, and  $M_{\tau+}^{i,n}$  denote the firm’s value immediately after the announcement of policy  $n$ . Closed-form expressions for  $M_\tau^i$  and  $M_{\tau+}^{i,n}$  are given in the Appendix. We define each firm’s “announcement return” as the instantaneous stock return at time  $\tau$  conditional on the announcement of policy  $n$ :

$$R^n(\hat{g}_\tau) = \frac{M_{\tau+}^{i,n}}{M_\tau^i} - 1. \quad (47)$$

The announcement return depends on  $\hat{g}_\tau$  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*

$$R^0(\hat{g}_\tau) = \frac{\sum_{n=0}^N p_\tau^n e^{-\gamma(T-\tau)(\tilde{\mu}^n - \tilde{\mu}^0) + \frac{\gamma}{2}(T-\tau)^2(\sigma_{g,n}^2 - \hat{\sigma}_\tau^2)}}{\sum_{n=0}^N p_\tau^n e^{(1-\gamma)(T-\tau)(\tilde{\mu}^n - \tilde{\mu}^0)}} - 1. \quad (48)$$

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

$$R^n(\hat{g}_\tau) = [1 + R^0(\hat{g}_\tau)] e^{(\tilde{\mu}^n - \tilde{\mu}^0)(T-\tau) - \frac{\gamma}{2}(T-\tau)^2(\sigma_{g,n}^2 - \hat{\sigma}_\tau^2)} - 1. \quad (49)$$

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<sup>19</sup>Similar logic applies to  $\sigma_{\pi,n}$  whose signs are also ambiguous. See the Technical Appendix for more detail.

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

**Corollary 7:** *The ratio of the gross announcement returns for any pair of policies  $m$  and  $n$  in the set  $\{0, 1, \dots, N\}$  is given by*

$$\frac{1 + R^m(\widehat{g}_\tau)}{1 + R^n(\widehat{g}_\tau)} = e^{(\widetilde{\mu}^m - \widetilde{\mu}^n)(T-\tau) - \frac{\gamma}{2}(T-\tau)^2(\sigma_{g,m}^2 - \sigma_{g,n}^2)} . \quad (50)$$

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:

$$0 < \mu_g^m - \mu_g^n - \frac{1}{2}(T-\tau)(\gamma-1)(\sigma_{g,m}^2 - \sigma_{g,n}^2) < \frac{\gamma}{2}(T-\tau)(\sigma_{g,m}^2 - \sigma_{g,n}^2) . \quad (51)$$

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 Eq. (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 7 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 7 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 8:** *Holding the utility score  $\widetilde{\mu}^n$  constant, policies with higher uncertainty  $\sigma_{g,n}$  elicit lower announcement returns.*



Corollary 8 follows immediately from Corollary 7. 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 main results on the asset pricing effects of 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,  $\tilde{\mu}^L = \tilde{\mu}^H$ . 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 Eq. (15) that to ensure  $\tilde{\mu}^L = \tilde{\mu}^H$ , we must have

$$\mu_g^H - \mu_g^L = \frac{1}{2} (\sigma_{g,H}^2 - \sigma_{g,L}^2) (T - \tau) (\gamma - 1) . \quad (52)$$

Table 1 reports the parameter values that we use to calibrate the model. Given the model's simplicity, we do not attempt a serious calibration; what we aim for is a sensible parametric illustration. For the first eight parameters ( $\sigma_g$ ,  $\sigma_c$ ,  $\mu$ ,  $\sigma$ ,  $\sigma_1$ ,  $T$ ,  $\tau$ , and  $\gamma$ ), 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  $\sigma$ , so that learning about  $C^n$  is as fast as 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  $\sigma_g = 2\%$ . 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 Eq. (52) 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.

Fig. 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.<sup>20</sup> 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*. The variable  $\hat{g}_t$  is a natural measure of economic conditions because it is the only economic state variable in the model.<sup>21</sup> We set the values of  $\hat{c}_\tau^L$  and  $\hat{c}_\tau^H$  equal to their initial values at time 0 ( $\hat{c}_\tau^L = \hat{c}_\tau^H = -\sigma_c^2/2$ ) to make both new policies equally likely. We label policy  $H$  as the “new risky policy” and policy  $L$  as the “new safe policy” (since  $\sigma_{g,H} > \sigma_{g,L}$ ).

Fig. 1 shows that when  $\hat{g}_t$  is very low, the probability that the old policy will be retained is close to zero. A low  $\hat{g}_t$  indicates that the old policy is “not working,” so the government is likely to replace it (Corollary 1). Both new policies receive equal probabilities of almost 50% when  $\hat{g}_t$  is very low. In contrast, when  $\hat{g}_t$  is very high, the old policy is almost certain to be retained because a high  $\hat{g}_t$  boosts the old policy’s utility score. It is possible for the government to replace the old policy even when  $\hat{g}_t$  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  $\hat{g}_t$  increases. Interestingly, when  $\hat{g}_t = 0$ , 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  $\tau$ ). Therefore, the old policy is likely to be replaced only if its perceived impact  $\hat{g}_t$  is sufficiently negative.

Fig. 1 implies that the amount of political uncertainty in the economy is endogenous and dependent on economic conditions. In good conditions (i.e., when  $\hat{g}_t$  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 but 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).

Fig. 2 plots M/B as a function of  $\hat{g}_t$  for three different combinations of  $\hat{c}_t^L$  and  $\hat{c}_t^H$ . In the baseline scenario (solid line), we set  $\hat{c}_t^L = \hat{c}_t^H = -\frac{1}{2}\sigma_c^2$ , which is the prior mean from Eq. (7).

<sup>20</sup>As of time 0, the probabilities of policies 0,  $L$ , and  $H$  are 63.4%, 18.3%, and 18.3%, respectively.

<sup>21</sup>Recall that  $\hat{g}_t$  fully captures persistent variation in aggregate profitability. We abstract from government-unrelated business-cycle variation, for simplicity. In the presence of such variation,  $\hat{g}_t$  would be an imperfect proxy for economic conditions. But as long as at least *some* of the persistent variation in profitability is government-related, the effects identified here will be present. See Section 6. for more information.

In this scenario, policies  $H$  and  $L$  are perceived as equally likely to be adopted at time  $\tau$ . In the other two scenarios, we maintain  $\widehat{c}_t^L = -\frac{1}{2}\sigma_c^2$  but vary  $\widehat{c}_t^H$ . 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.

Fig. 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 Eqs. (9) and (32)), so they represent horizontal movements in Fig. 2. The figure 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 Fig. 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  $\tau$  (i.e.,  $p_t^0 \approx 0$ ). Therefore, shocks to  $\widehat{g}_t$  are temporary, lasting one year only (cf. Corollary 5). 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 Fig. 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  $\widehat{g}_t$ . For those values, a positive shock to  $\widehat{g}_t$  substantially increases  $p_t^0$  (see Fig. 1), so it 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 Eq. (13)), so they represent vertical movements in Fig. 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 8). In contrast, political

shocks do not matter in strong economic conditions—when  $\hat{g}_t$  is above 1% or so, the three lines in Fig. 2 coincide. When  $\hat{g}_t$  is very high, the old policy is almost certain to be retained, so news about the political costs of the new policies is irrelevant.

The effects of political shocks on stock prices are summarized by  $\sigma_{M,n}$  from Proposition 5. In this two-policy example, the signs of  $\sigma_{M,H}$  and  $\sigma_{M,L}$  in the limiting case of  $\hat{g}_t \rightarrow -\infty$  are unambiguous:  $\sigma_{M,H} > 0$  and  $\sigma_{M,L} < 0$ . These signs are intuitive. Consider an increase in  $\hat{c}_t^H$ , the perceived political cost of policy  $H$ , which is less desirable than  $L$  from the stockholders' perspective (Corollary 8). Since the higher political cost makes policy  $H$  less likely, it represents good news for investors, and it increases the stock market value ( $\sigma_{M,H} > 0$ ). Similarly, a political shock that makes policy  $L$  less likely is bad news, and it decreases the market value ( $\sigma_{M,L} < 0$ ). Similar logic applies to  $\sigma_{\pi,n}$  from Proposition 3, for which we obtain  $\sigma_{\pi,H} < 0$  and  $\sigma_{\pi,L} > 0$ . For more details, see the Technical Appendix.

To summarize, Fig. 2 shows that economic and political shocks, which are orthogonal to each other, exert independent influences on stock prices. Political shocks matter especially in poor economic conditions, whereas economic shocks matter more in good conditions.

## 5.2. *The risk premium and its components*

We now examine the equity risk premium and its three components from Eq. (40). Fig. 3 plots the three components as a function of  $\hat{g}_t$ . 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,  $\hat{c}_t^L$  and  $\hat{c}_t^H$  are set equal to their prior mean, so that policies  $L$  and  $H$  are equally likely, and all quantities are computed at time  $t = \tau - 1$ .

Fig. 3 shows a hump-shaped pattern in the risk premium. The premium is about 4.6% per year when  $\hat{g}_t$  is low, 3.7% when  $\hat{g}_t$  is high, and 5.5% for intermediate values of  $\hat{g}_t$ . This hump-shape is not induced by the capital-shock component, which contributes a constant 1.25% regardless of  $\hat{g}_t$ . 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  $\hat{g}_t$  is low. This component accounts for about two thirds of the total premium when  $\hat{g}_t$  is below -1.5% or so, contributing a bit over 3% per year.<sup>22</sup> This contribution shrinks as

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<sup>22</sup>The Appendix provides an analytical expression for the political risk premium as  $\hat{g}_t \rightarrow -\infty$ . Also note that the 3% number is only illustrative. In a more realistic extension of our model in Section 6., we obtain

$\hat{g}_t$  increases, and for  $\hat{g}_t > 0.3\%$  or so, the political risk premium is essentially zero. The non-linear dependence of the political risk premium on  $\hat{g}_t$  is closely related to the non-linear probability patterns in Fig. 1. When  $\hat{g}_t < -1.5\%$ , 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  $\hat{g}_t > 0.3\%$ , 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 risk premium is the largest component of the risk premium when  $\hat{g}_t$  is high. When  $\hat{g}_t$  is above  $0.5\%$  or so, this component contributes about  $2.5\%$  per year to the total premium. Its contribution is much lower, only about  $0.2\%$ , when  $\hat{g}_t$  is very low. This difference is not surprising since impact shocks are temporary when  $\hat{g}_t$  is low but permanent when  $\hat{g}_t$  is high (compare Eqs. (43) and (44)). Recall that when  $\hat{g}_t$  is low, the probability of a policy change is high; as a result, shocks to  $\hat{g}_t$  are temporary and they have a small effect on the risk premium. By essentially guaranteeing a policy change if economic conditions turn bad, the government effectively provides put protection to the market.

This put protection is worth little when  $\hat{g}_t$  is high because a policy change is then unlikely. Given the permanent nature of the shocks to  $\hat{g}_t$ , the impact risk premium is higher when  $\hat{g}_t$  is high. The premium is even higher, about  $3.5\%$ , for intermediate values of  $\hat{g}_t$  for which the probability of a policy change is highly sensitive to  $\hat{g}_t$ . A negative shock to  $\hat{g}_t$  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  $\hat{g}_t$ , as explained earlier. Given the double effect of the  $\hat{g}_t$  shocks, investors demand extra compensation for holding stocks in intermediate economic conditions. For example, when  $\hat{g}_t = 0$ , impact shocks account for about two thirds of the  $5\%$  total risk premium.

Overall, Fig. 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. An additional force, which operates in intermediate economic conditions, is the uncertainty

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smaller magnitudes of the political risk premium in weak conditions, such as  $1.3\%$  in Panel A of Fig. 8. Neither  $3\%$  nor  $1.3\%$  are empirical estimates; both come out of parametric illustrations of simple models.

about whether the current policy will be replaced. Due to that uncertainty, the largest values of the equity premium in Fig. 3 obtain in slightly-below-average economic conditions.

### 5.3. Comparative statics

Figs. 4 and 5 examine the robustness of the results from Fig. 3 to other parameter choices. In Panels A and B of Fig. 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  $\sigma_g$  affects primarily the impact risk premium, which is higher for larger values of  $\sigma_g$ . This is intuitive because when  $\sigma_g$  is larger, the impact  $g^0$  is more uncertain, and the  $\hat{g}_t$  shocks are more volatile (see Eqs. (9) and (10)). In Panels C and D, we replace  $\sigma_c = 10\%$  by 5% and 20%. We see that  $\sigma_c$  affects mostly the political risk premium, which is higher when  $\sigma_c$  is larger. This makes sense because larger values of  $\sigma_c$  make political costs more uncertain, thereby increasing the volatility of political shocks (see Eqs. (13) and (14)). In Panels A and B of Fig. 5, we replace  $h = 5\%$  by 2.5% and 10%. Similar to  $\sigma_c$ ,  $h$  affects mostly 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 those costs is slower and political shocks are less volatile (see Eqs. (13) and (14)). In Panels C and D, we replace  $\tau - t = 1$  year by 1.5 and 0.5 years. This change affects mostly the impact risk premium. When time  $\tau$  is closer, two things happen. First, the posterior uncertainty about  $g^0$  is smaller, which pushes the impact risk premium down. Second, the probability of a policy change is more sensitive to the  $\hat{g}_t$  shocks for intermediate values of  $\hat{g}_t$ , which pushes the impact risk premium up. Overall, Figs. 4 and 5 lead to the same qualitative conclusions as Fig. 3 about the relative importance of economic and political shocks in different economic conditions.

The iso-utility assumption ( $\tilde{\mu}^L = \tilde{\mu}^H$ ), which we make for simplicity, is not crucial to our results. We obtain very similar results when we let the new policies yield different levels of utility a priori, as long as there is nontrivial uncertainty about the adoptions of the two policies. For example, in the previous version of the paper, we replaced the baseline values  $(\sigma_{g,L}, \sigma_{g,H}) = (1\%, 3\%)$  by  $(0.9\%, 3.1\%)$  and  $(1.1\%, 2.9\%)$ . In the former case, we find a larger political risk premium compared to the baseline because the two new policies are more different from each other, making the choice between them more important. In contrast, the premium is smaller in the latter case because the two policies are then more similar. Apart from these quantitative differences, we reach the same broad conclusions.

#### 5.4. The effects of policy heterogeneity

In Fig. 6, 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. As before, we keep policies  $H$  and  $L$  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 Fig. 3, we have  $\sigma_{g,L} = 1\%$  and  $\sigma_{g,H} = 3\%$ , so that  $\mathcal{H} = 2\%$ . In Fig. 6, 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  $\mu_g^H$  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  $\hat{c}_\tau^L = \hat{c}_\tau^H = -\sigma_c^2/2$ , as before. Panel B plots the total equity premium, whereas Panels C and D plot its components due to economic and political shocks, respectively.

Fig. 6 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  $\hat{g}_t$ , the political risk premium is 0.8% when  $\mathcal{H} = 1\%$  and 7% when  $\mathcal{H} = 3\%$ , compared to 3% 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 risk premium. 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.

Fig. 7 describes the same setting as Fig. 6, 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 Fig. 2, for the same reason—the government's implicit put supports stock prices in poor economic conditions. Panels C and D show that stocks are more volatile and more correlated in poor conditions. Comparing very good conditions ( $\hat{g}_t = 2\%$ ) with very bad ones ( $\hat{g}_t = -2\%$ ), volatility is more than 50% higher in bad conditions (21% versus 13.4%) and the correlation is 80% higher (78% 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 diversified away.

Departing from the baseline case and looking across the three values of  $\mathcal{H}$  in Panel B of Fig. 7, 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 weak conditions, the correlation is 88% when  $\mathcal{H} = 3\%$  but only 51% 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 Fig. 6 is zero, and both volatility and correlation are independent of economic conditions. That is, the state-dependence of both volatility and correlation in Fig. 7 is solely due to political uncertainty.

### 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  $\tau$ . 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 Fig. 7.

At high positive values of  $\hat{g}_t$ , the dash-dot line coincides with the other lines plotted in Fig. 7. The reason is that when  $\hat{g}_t$  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  $\hat{g}_t$  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 Fig. 7 shows that precluding policy changes can increase or decrease the level of stock prices: it decreases M/B when  $\hat{g}_t$  is highly negative, but it increases M/B when  $\hat{g}_t$  is only slightly negative. When  $\hat{g}_t$  is highly negative—in dire economic conditions—the government’s ability to change policy is valuable because the positive effect of the put protection 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. Model extension: Business cycles

In our model, the perceived government impact  $\hat{g}_t$  is the only economic state variable that fully characterizes economic conditions. In reality, the economy can also exhibit government-unrelated business-cycle variation in profitability. We omit such variation from our baseline model to simplify the exposition of the key economic mechanism. In this section, we extend the model to allow for policy-unrelated persistent variation in profitability. To preview our results, we find that our main conclusions about the political risk premium and its dependence on economic conditions continue to hold. In addition, since the extended model is closer to reality, the parametric illustration in this section provides a more realistic assessment of the likely magnitude of the political risk premium. We find this magnitude is smaller than in our baseline model when economic conditions are poor, but it remains substantial.<sup>23</sup>

We modify the profitability process in Eq. (1) as follows:

$$d\Pi_t^i = (\mu_t + g_t) dt + \sigma dZ_t + \sigma_1 dZ_t^i, \quad (53)$$

where  $\mu_t$  follows the mean-reverting process

$$d\mu_t = \beta (\bar{\mu} - \mu_t) dt + \sigma_\mu dZ_{\mu,t}. \quad (54)$$

Agents do not observe  $\mu_t$ , but they learn about it by observing  $d\Pi_t^i$  and an additional signal:

$$dS_t = \mu_t dt + \sigma_S dZ_{S,t}. \quad (55)$$

Above,  $\beta$ ,  $\bar{\mu}$ ,  $\sigma_\mu$ , and  $\sigma_S$  are known constants, and  $dZ_{\mu,t}$  and  $dZ_{S,t}$  are Brownian motions uncorrelated with all others. We assume normal uncorrelated priors about  $\mu_t$  and  $g_t$  at time 0

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<sup>23</sup>In a separate extension of our model, we allow the precisions of political signals to vary across policies (i.e., we allow policies to have different values of  $h$  in Eq. (11)). We find that the basic implications of our model generalize to a setting with different signal precisions. We also find that policies with more precise political signals contribute more to the political risk premium. The details are in the Technical Appendix.

and characterize the resulting learning process. We show that the government's decision rule is the same as in our basic model, except for an additional term that reflects the persistent variation in  $\mu_t$ . We show that the signals  $dS_t$  introduce an additional state variable  $\hat{\mu}_t$ , the posterior mean of  $\mu_t$ , whose variation represents the second set of economic shocks to stock prices. The details of the calculations are in the Technical Appendix.

We calibrate the model for the two-policy case and the parameter values in Table 1, as before. We choose  $\bar{\mu} = 10\%$  for consistency with Table 1. We also choose  $\beta = 0.35$  and  $\sigma_\mu = 2\%$ , which correspond to estimates of the mean-reverting process for aggregate profitability reported in Pástor and Veronesi (2006). We vary  $\sigma_S$  from 1% to 5%, 10%, and infinity. Similar to Fig. 3, we plot the components of the risk premium as a function of economic conditions, redefined here as  $\hat{\mu}_t + \hat{g}_t$  (see Eq. (53)).

Fig. 8 shows that the political risk premium depends on economic conditions in a manner similar to that in Fig. 3. The premium is substantial when the conditions are weak, but it dwindles as the conditions improve. The magnitudes depend on the value of  $\sigma_S$ . When  $\sigma_S \rightarrow \infty$ , the political risk premium is 3% in weak conditions and zero in strong conditions, just like in Fig. 3. For smaller and more realistic values of  $\sigma_S$ , the premium is smaller than in Fig. 3 in weak conditions but larger in strong conditions. For example, when  $\sigma_S = 1\%$ , the political risk premium is about 1.3% in weak economic conditions (for which  $\hat{\mu}_t + \hat{g}_t = 0$ ) and half that in strong conditions (for which  $\hat{\mu}_t + \hat{g}_t = 0.2$ ; the prior mean of  $\mu_t + g_t$  is 0.1). Such magnitudes of the political risk premium seem economically plausible.

When  $\sigma_S \rightarrow \infty$ , the additional signal in Eq. (55) is worthless. As a result,  $\hat{g}_t$  and  $\hat{\mu}_t$  are perfectly correlated and it makes no difference whether economic conditions are defined as  $\hat{\mu}_t + \hat{g}_t$  or  $\hat{g}_t$ . Smaller values of  $\sigma_S$  imply a stronger signal and thus more independent variation in  $\hat{\mu}_t$ . As a result, economic conditions are less dependent on  $\hat{g}_t$ , which in turn weakens the dependence of the political risk premium on economic conditions. But that dependence is clearly present even for relatively small values of  $\sigma_S$ , as discussed in the previous paragraph. The model's main implications thus continue to hold when we broaden the definition of economic conditions to include government-unrelated business-cycle variation.

The risk premium plotted in Fig. 8 includes not only the three components analyzed in Fig. 3 but also a fourth component induced by the additional signal from Eq. (55). That component is equal to 1% when  $\sigma_S = 1\%$ , regardless of economic conditions, but it disappears as  $\sigma_S \rightarrow \infty$  because the additional signal is then worthless.

We have also constructed a number of additional plots to investigate the properties of the

extended model. We summarize the results here while relegating the plots to the Technical Appendix, to save space. First, we examine plots of stock prices and risk premia as functions of  $\hat{g}_t$  and  $\hat{\mu}_t$ . Holding  $\hat{g}_t$  constant, we find that M/B increases with  $\hat{\mu}_t$  while the risk premium and its components do not depend on  $\hat{\mu}_t$ . Holding  $\hat{\mu}_t$  constant, we find the same nonlinear dependence of M/B and risk premia on  $\hat{g}_t$  as in the basic model. Second, we analyze the sensitivity of the risk premia to various parameter choices. We find that the political risk premium increases with  $\sigma_c$ ,  $T - \tau$ , and  $h^{-1}$ , which is intuitive. There is also some dependence on  $\beta$ ,  $\sigma_\mu$ , and  $\sigma_g$ . Note that if either  $\beta \rightarrow \infty$  or  $\sigma_\mu \rightarrow 0$ , then  $\mu_t$  becomes a constant quantity (equal to  $\bar{\mu}$ ), and we converge back to our baseline model.

## 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 it makes political signals more potent. It also makes stocks more correlated because political signals 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 of the new policies will be chosen by the government, which leads them to respond more strongly to political signals.

### 7.1. Data

To proxy for political uncertainty, we use the policy uncertainty (PU) index of Baker, Bloom, and Davis (2012). The PU index is constructed as a weighted average of three com-

ponents. 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.<sup>24</sup> Fig. 9 plots the monthly time series of the PU index for January 1985 through December 2010.<sup>25</sup> 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 as of this writing.

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 Fig. 9: 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 in this century.

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

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<sup>24</sup>The same measures of forecast dispersion, which come from the Survey of Professional Forecasters, are used by Ulrich (2013a, 2013b) to analyze Treasury bond prices. Ulrich (2013a) attributes half of all variation in bond market volatility to uncertainty about future monetary policy. Ulrich (2013b) finds that uncertainty about fiscal spending raises bond yields as well as option-implied bond volatilities.

<sup>25</sup>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](http://www.policyuncertainty.com). In both panels of Fig. 9, PU is scaled to have the same mean and volatility as the other variable plotted in the same panel.

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.

## 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.<sup>26</sup> Indeed, Fig. 9 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:

$$PU_t = a + b E_t + e_t , \tag{56}$$

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

$$PU_t = a + b E_t + c PU_{t-1} + e_t , \tag{57}$$

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

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<sup>26</sup>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. The following quote is also telling: “You never let a serious crisis go to waste. And what I mean by that it’s an opportunity to do things you think you could not do before.” (Rahm Emmanuel, White House chief of staff, November 2008)

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, Fig. 9 reveals a strong association between PU and both volatility and correlation, especially in the second half of the sample. To assess the significance of this association, we consider the following regressions:

$$VC_t = a + b PU_t + e_t \quad (58)$$

$$VC_t = a + b PU_t + c VC_{t-1} + e_t, \quad (59)$$

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 Figs. 2 and 7). To evaluate this prediction, we run the following regressions with interaction terms:

$$VC_t = a + b PU_t E_t + c PU_t + d E_t + e_t \quad (60)$$

$$VC_t = a + b PU_t E_t + c PU_t + d E_t + e VC_{t-1} + e_t. \quad (61)$$

The model predicts  $b < 0$ . Table 4 shows strong support for this prediction when  $VC$  stands for volatility but weaker 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. Either force can prevail, depending on the parameter values (Figs. 3 through 5). The two forces are difficult to separate empirically because they operate in similar states of the world—we tend to be more uncertain about government actions when the 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 that 26 years of monthly realized returns are not enough to ensure decent power for this test.

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 Figs. 2 through 6). To see whether the PU index indeed commands a higher risk premium when the economy is weaker, we run the regression

$$R_{t+1,t+h} = a + b PU_t E_t + c PU_t + d E_t + e_t . \quad (62)$$

Panel A of 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 is some evidence of a political risk premium that is higher in weaker economic conditions.<sup>27</sup>

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<sup>27</sup>In related analysis, Baker, Bloom, and Davis (2012) use their index to examine the determinants of large

As an additional test, we rerun the same regressions on a different estimate of the equity premium,  $EP_t$ , obtained as the fitted value from the predictive regression of the aggregate excess stock market return over the following quarter on the current values of three predictors: the aggregate dividend yield, the one-month T-bill rate, and the term spread.<sup>28</sup> The dividend yield is equal to total dividends paid over the previous 12 months divided by the current total market capitalization. The term spread is the difference between the yields on the five-year and one-year zero-coupon Treasury bonds, obtained from CRSP. In a simple regression of  $EP_t$  on  $PU_t$ , the estimate of the slope coefficient is positive and statistically significant. When we control for the five measures of economic conditions, the slope remains positive but turns insignificant. We also run the regression (62) with  $R_{t+1,t+h}$  replaced by  $EP_t$ . The results are in Panel B of Table 5. Those results indicate  $b < 0$ , and they are stronger than in Panel A: all five point estimates of  $b$  are negative, and four of them are significant at the 5% level. Again, the political risk premium seems to be higher in weaker conditions.

Finally, we emphasize that our simple empirical analysis is only illustrative. We do not attempt to establish causality. Also, 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. If that is the case, then some of our empirical results are consistent not only with our model but also with other economic mechanisms. Its shortcomings notwithstanding, we view the PU 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 news. 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. 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

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daily U.S. stock market movements since 1980. They find “a dramatic increase in the proportion of large stock movements driven by policy news or policy changes” post-2007 while the economy was weak.

<sup>28</sup>We thank the referee for suggesting this additional equity premium measure.



to the market. 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 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; for instance, by adding intermediate consumption, it might be possible to derive the model's implications for bond prices.<sup>29</sup> We empirically examine one time-series proxy for political uncertainty in the U.S.; future work could construct other proxies, look across countries, and test the predictions of our model in a variety of other settings. More work on the government's role in asset pricing is clearly warranted.

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<sup>29</sup>Along those lines, Ulrich (2013b) models the government in a similar spirit to Pastor and Veronesi (2012), though with a different objective function and Knightian uncertainty about future government spending. He estimates the model structurally and derives its implications for the term structure of interest rates.

## 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.

A.1. *Definition of  $\Omega$  in Propositions 2, 3, 4, and 5.*

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

In Eq. (A1), we have

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

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

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

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

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

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

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

A.2. *Definition of  $H$  in Propositions 4 and 5.*

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

where

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

A.3. Formulae relevant for announcement return calculations.

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

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

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

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

A.4. The political risk premium in the two-policy setting.

Consider the setting from Section 5, in which  $N = 2$  and  $\tilde{\mu}^L = \tilde{\mu}^H$ . As  $\hat{g}_t \rightarrow -\infty$ ,

$$\begin{aligned} \text{Political risk premium} &= -\sigma_{\pi,H}\sigma_{M,H} - \sigma_{\pi,L}\sigma_{M,L} \\ &\rightarrow 2 \left( \frac{\int \phi_{\tilde{c}^H}(\tilde{c}) \phi_{\tilde{c}^L}(\tilde{c}) d\tilde{c}}{(\gamma - 1)(T - \tau)(G_1^{-1} + p_t^H)} \right)^2 \hat{\sigma}_{c,t}^4 h^{-2}, \end{aligned} \quad (\text{A5})$$

where

$$G_1 = \exp \left\{ \frac{\gamma}{2} (\sigma_{g,H}^2 - \sigma_{g,L}^2) (T - \tau)^2 \right\} - 1 > 0.$$

In the limit, we also obtain  $\frac{1}{\Omega} \frac{\partial \Omega}{\partial \tilde{c}_t^H} = -\frac{1}{\Omega} \frac{\partial \Omega}{\partial \tilde{c}_t^L}$  and  $\frac{1}{H} \frac{\partial H}{\partial \tilde{c}_t^H} = \frac{1}{H} \frac{\partial H}{\partial \tilde{c}_t^L} = 0$ . As a result,  $\sigma_{\pi,H} = -\sigma_{\pi,L}$ ,  $\sigma_{M,H} = -\sigma_{M,L}$ , and both policies contribute equally to the political risk premium.

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Table 1  
Parameter choices

This table reports the baseline parameter values used to produce the theory figures. All variables are reported on an annual basis except for  $\gamma$ , which denotes risk aversion. The parameter choices for the first 8 parameters are the same as in Pástor and Veronesi (2012). The value of  $h = 5\%$  is chosen equal to the value of  $\sigma$ , 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  $\sigma_g = 2\%$ .

$\sigma_g$	$\sigma_c$	$\mu$	$\sigma$	$\sigma_1$	$T$	$\tau$	$\gamma$	$h$	$\sigma_{g,L}$	$\sigma_{g,H}$
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:

$$\begin{aligned} \text{Specification 1:} \quad & PU_t = a + bE_t + e_t \\ \text{Specification 2:} \quad & PU_t = a + bE_t + cPU_{t-1} + e_t . \end{aligned}$$

Political uncertainty  $PU_t$  is proxied by the policy uncertainty index of Baker, Bloom, and Davis (2012), 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 (-7.24)	-0.69 (-5.12)	-20.95 (-4.10)	-0.02 (-3.38)	-0.75 (-8.61)
Specification 2	-0.05 (-3.90)	-0.09 (-2.75)	-2.90 (-1.85)	-0.00 (-1.58)	-0.09 (-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:

$$\begin{aligned} \text{Specification 1:} \quad & VC_t = a + bPU_t + e_t \\ \text{Specification 2:} \quad & VC_t = a + bPU_t + cVC_{t-1} + e_t . \end{aligned}$$

$PU_t$  is the policy uncertainty index of Baker, Bloom, and Davis (2012), 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 (9.81)	0.15 (7.25)	0.01 (4.81)	0.08 (5.27)
Specification 2	0.09 (6.43)	0.07 (5.14)	0.00 (3.45)	0.01 (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:

$$\begin{aligned} \text{Specification 1:} \quad & VC_t = a + bPU_tE_t + cPU_t + dE_t + e_t \\ \text{Specification 2:} \quad & VC_t = a + bPU_tE_t + cPU_t + dE_t + eVC_{t-1} + e_t . \end{aligned}$$

$PU_t$  is the policy uncertainty index of Baker, Bloom, and Davis (2012), 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 (-2.41)	-0.04 (-0.96)	-3.53 (-2.36)	-0.00 (-0.00)	-0.00 (-0.08)
Correlation: VW	-0.03 (-1.92)	-0.03 (-0.60)	-3.54 (-2.03)	-0.00 (-0.26)	0.04 (1.28)
Volatility: Realized	-0.00 (-5.46)	-0.01 (-4.39)	-0.39 (-4.52)	-0.00 (-3.74)	-0.00 (-3.17)
Volatility: Implied	-0.04 (-4.50)	-0.12 (-3.69)	-3.48 (-3.18)	-0.01 (-5.48)	-0.05 (-1.91)
Panel B. Specification 2					
Correlation: EW	-0.02 (-2.04)	-0.03 (-1.07)	-2.35 (-1.97)	0.00 (0.05)	-0.00 (-0.05)
Correlation: VW	-0.02 (-1.48)	-0.03 (-0.79)	-2.04 (-1.54)	-0.00 (-0.10)	0.02 (1.13)
Volatility: Realized	-0.00 (-4.11)	-0.01 (-3.86)	-0.21 (-3.11)	-0.00 (-2.77)	-0.00 (-2.58)
Volatility: Implied	-0.01 (-2.81)	-0.05 (-3.71)	-0.19 (-0.36)	-0.00 (-2.76)	-0.03 (-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?” Panel A reports the estimated slope coefficients  $b$  and their  $t$ -statistics from the regression

$$R_{t+1,t+h} = a + bPU_t E_t + cPU_t + dE_t + e_t .$$

$R_{t+1,t+h}$  is the aggregate stock market return in excess of the one-month T-bill rate over  $h = 3, 6,$  and 12 months following month  $t$ . Panel B runs the same regression, but it replaces  $R_{t+1,t+h}$  with a month- $t$  fitted value from the predictive regression of the next quarter’s return ( $R_{t+1,t+3}$ ) on the current values of three predictors: the aggregate dividend yield, the one-month T-bill rate, and the term spread. The dividend yield is equal to total dividends paid over the previous 12 months divided by the current total market capitalization. The term spread is the difference between the yields on the five-year and one-year zero-coupon Treasury bonds.  $PU_t$  is the policy uncertainty index of Baker, Bloom, and Davis (2012), 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 slope coefficients in Panel B are multiplied by ten to show more significant digits. The sample period is January 1985 through December 2010.

Horizon	Measure of Economic Conditions				
	CFI	-REC	IPG	P/E	-DEF
Panel A. Equity premium: Future realized excess return					
3 months	-0.02 (-1.30)	-0.05 (-1.24)	-0.89 (-0.71)	-0.01 (-2.17)	-0.03 (-1.19)
6 months	-0.04 (-2.09)	-0.11 (-1.53)	-2.50 (-1.17)	-0.01 (-3.18)	-0.09 (-1.97)
12 months	-0.09 (-2.41)	-0.21 (-1.78)	-6.48 (-1.76)	-0.02 (-2.85)	-0.15 (-1.69)
Panel B. Equity premium: Fitted value from a regression					
	-0.09 (-3.42)	-0.27 (-3.12)	-6.46 (-2.35)	-0.02 (-4.75)	-0.01 (-0.10)

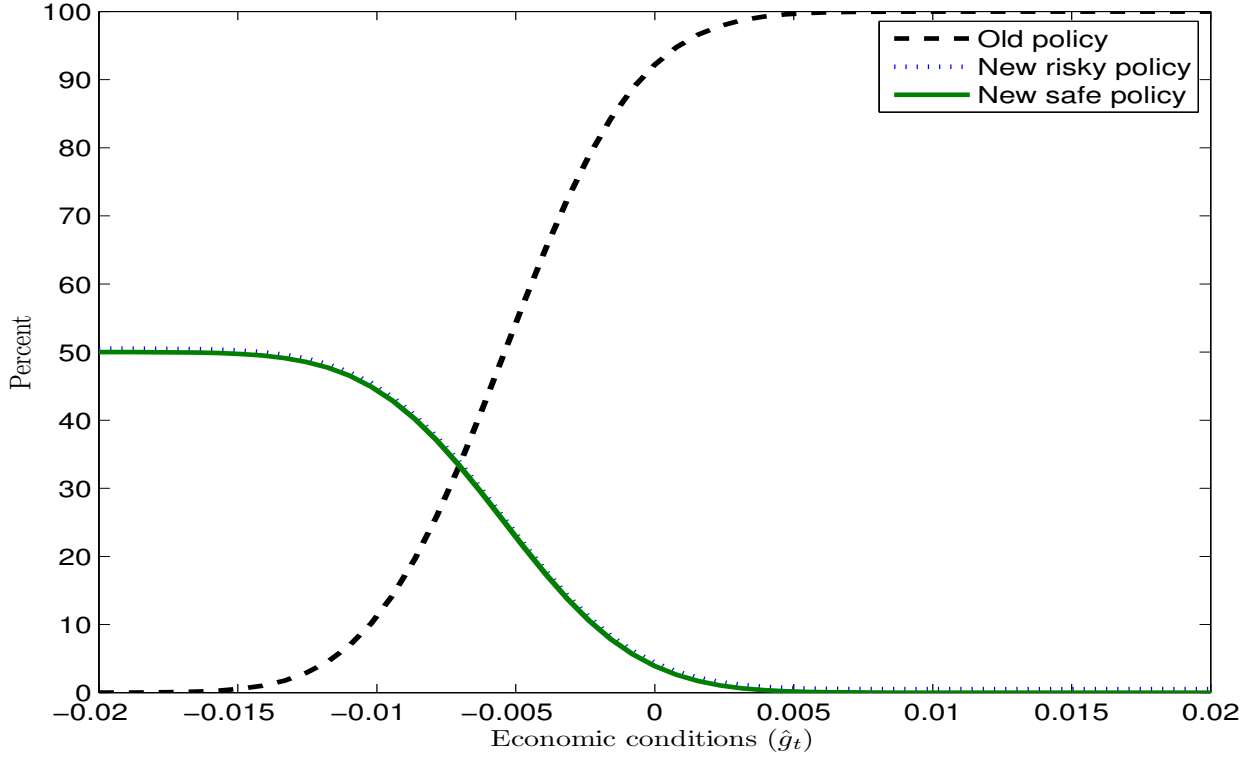


Fig. 1. Probability of adopting the given government policy. This figure plots the probabilities of the three government policy choices—the old policy, the new risky policy (H), and the new safe policy (L)—as a function of  $\hat{g}_t$ , which is the posterior mean of the old policy’s impact  $g^0$  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  $\hat{c}_t^L$  and  $\hat{c}_t^H$  are set equal to their initial value at time 0 ( $\hat{c}_t^L = \hat{c}_t^H = -\sigma_c^2/2$ ), so that both new policies are equally likely; as a result, the solid and dotted lines coincide. The parameters are from Table 1.

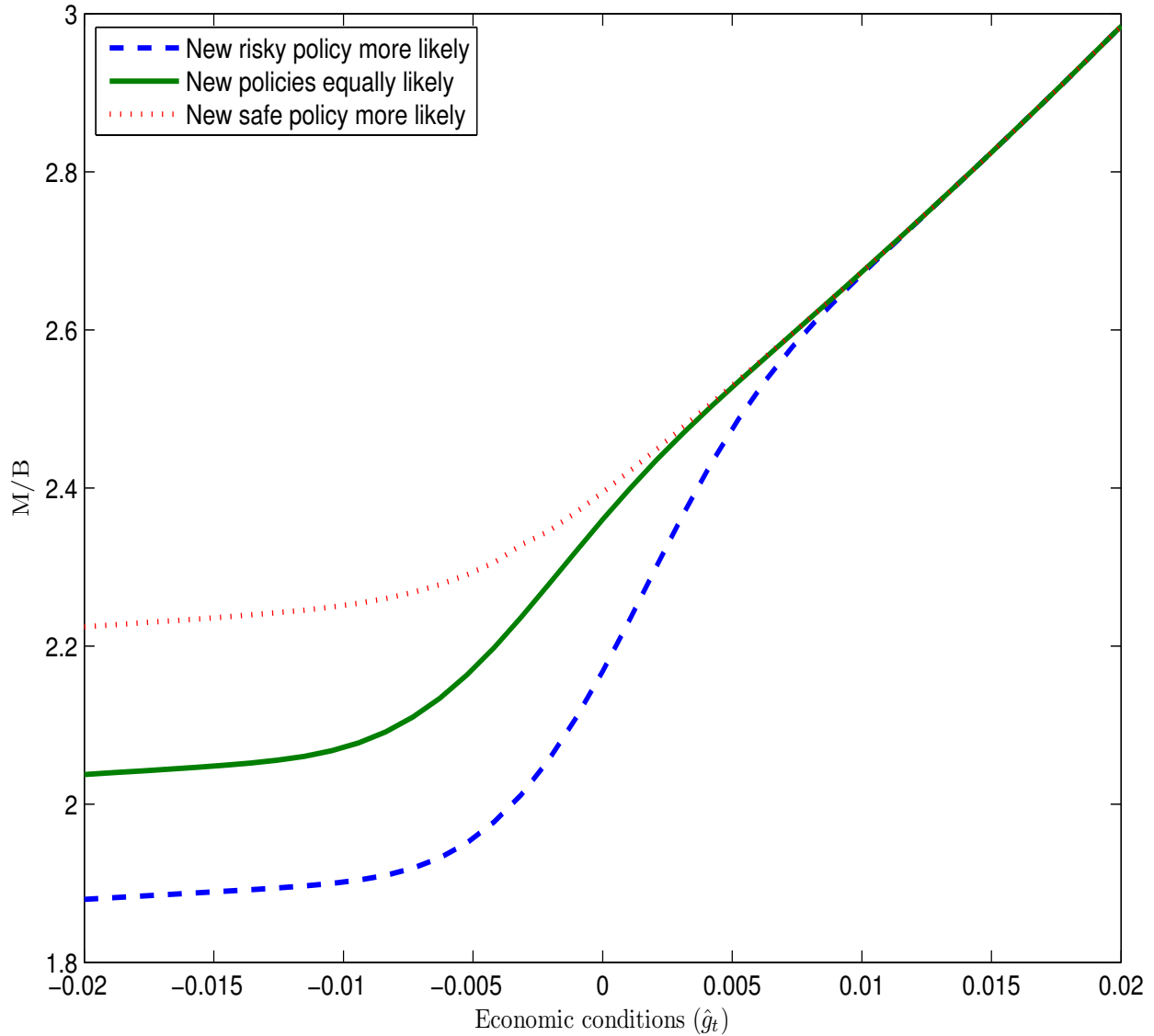


Fig. 2. The level of stock prices: The effects of economic and political shocks. This figure plots the aggregate stock price level, measured by the market-to-book ratio  $M/B$ , as a function of  $\hat{g}_t$ , which is the posterior mean of the old policy's impact  $g^0$  as of time  $t$ . High values of  $\hat{g}_t$  indicate strong economic conditions; low values indicate weak conditions. The solid line corresponds to the scenario in which  $\hat{c}_t^L = \hat{c}_t^H$  are both equal to their initial value, so that both new policies are equally likely to be adopted at time  $\tau$ . The dashed (dotted) line corresponds to the scenario in which  $\hat{c}_t^L$  is equal to its initial value but  $\hat{c}_t^H$  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  $\hat{c}_t^L$  and  $\hat{c}_t^H$  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.

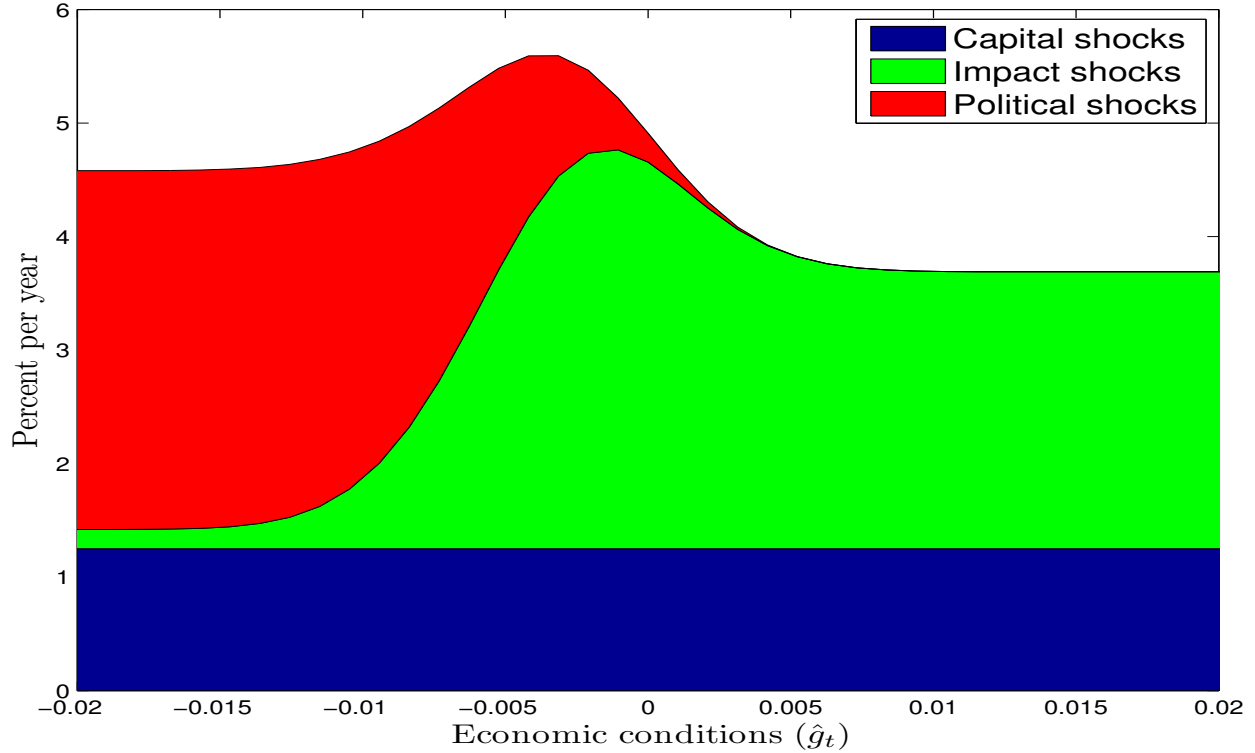


Fig. 3. The equity risk premium and its components. This figure plots the equity risk premium and its components as a function of  $\hat{g}_t$ , which is the posterior mean of the old policy's impact  $g^0$  as of time  $t$ . High values of  $\hat{g}_t$  indicate strong economic conditions; low values 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  $\hat{c}_t^L$  and  $\hat{c}_t^H$  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.

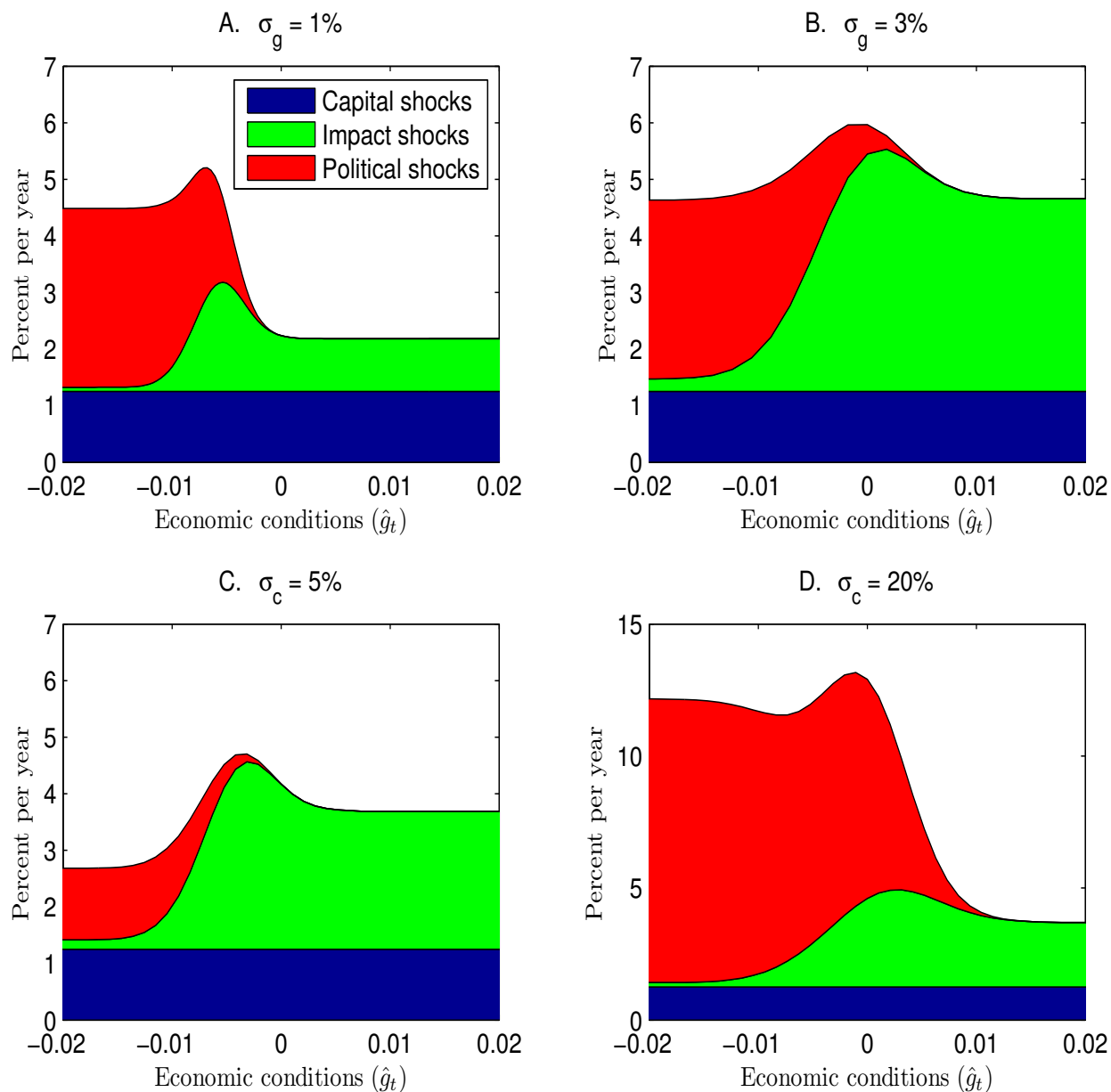


Fig. 4. The equity risk premium and its components: The effects of  $\sigma_g$  and  $\sigma_c$ . Each of the four panels is analogous to Fig. 3—the flat blue area at the bottom represents the risk premium due to capital shocks, the middle green area represents the risk premium due to impact shocks, 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  $\sigma_g$  and  $\sigma_c$ , which vary across the four panels.

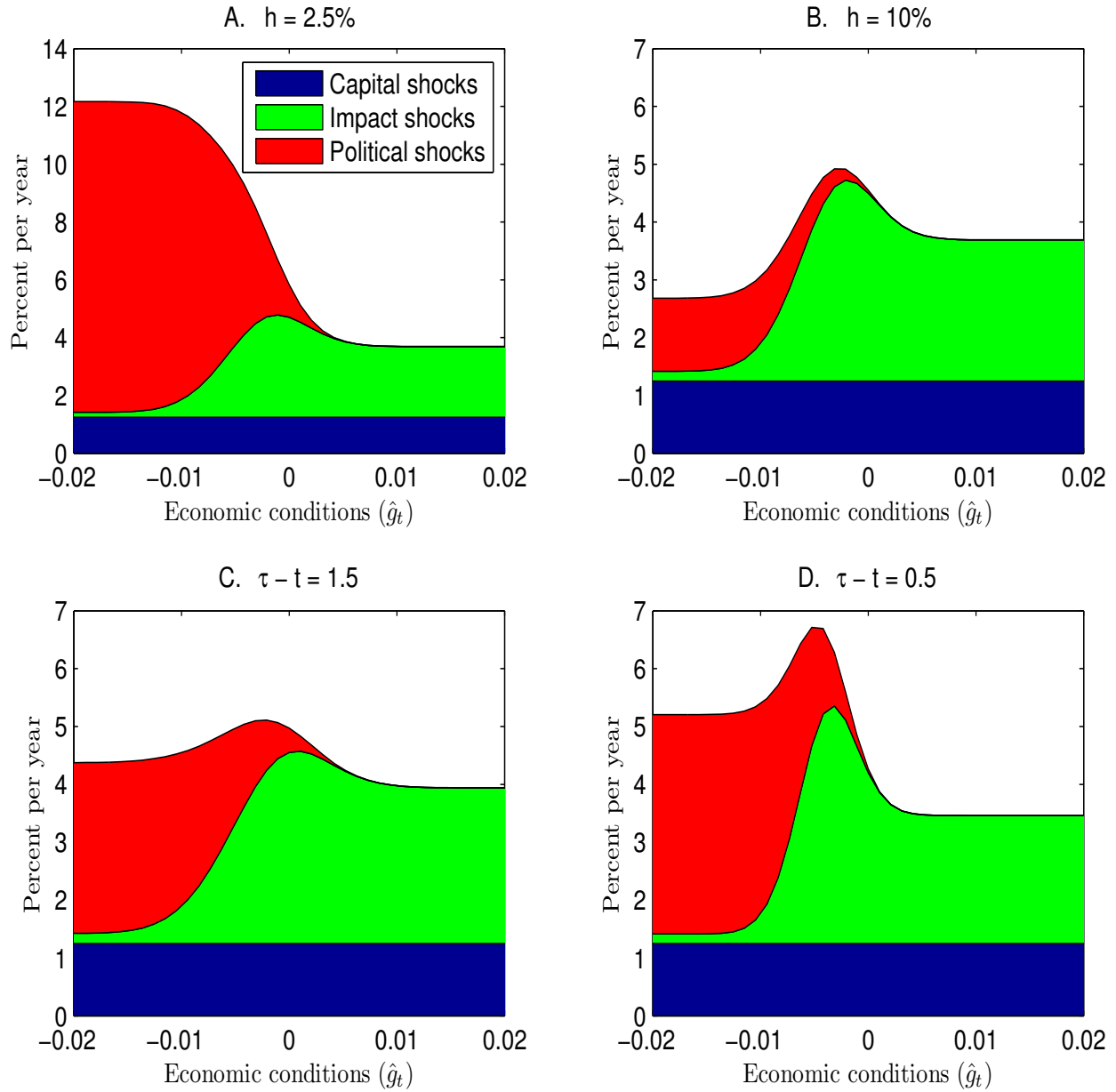


Fig. 5. The equity risk premium and its components: The effects of  $h$  and  $t$ . Each of the four panels is analogous to Fig. 3—the flat blue area at the bottom represents the risk premium due to capital shocks, the middle green area represents the risk premium due to impact shocks, and the top red 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.

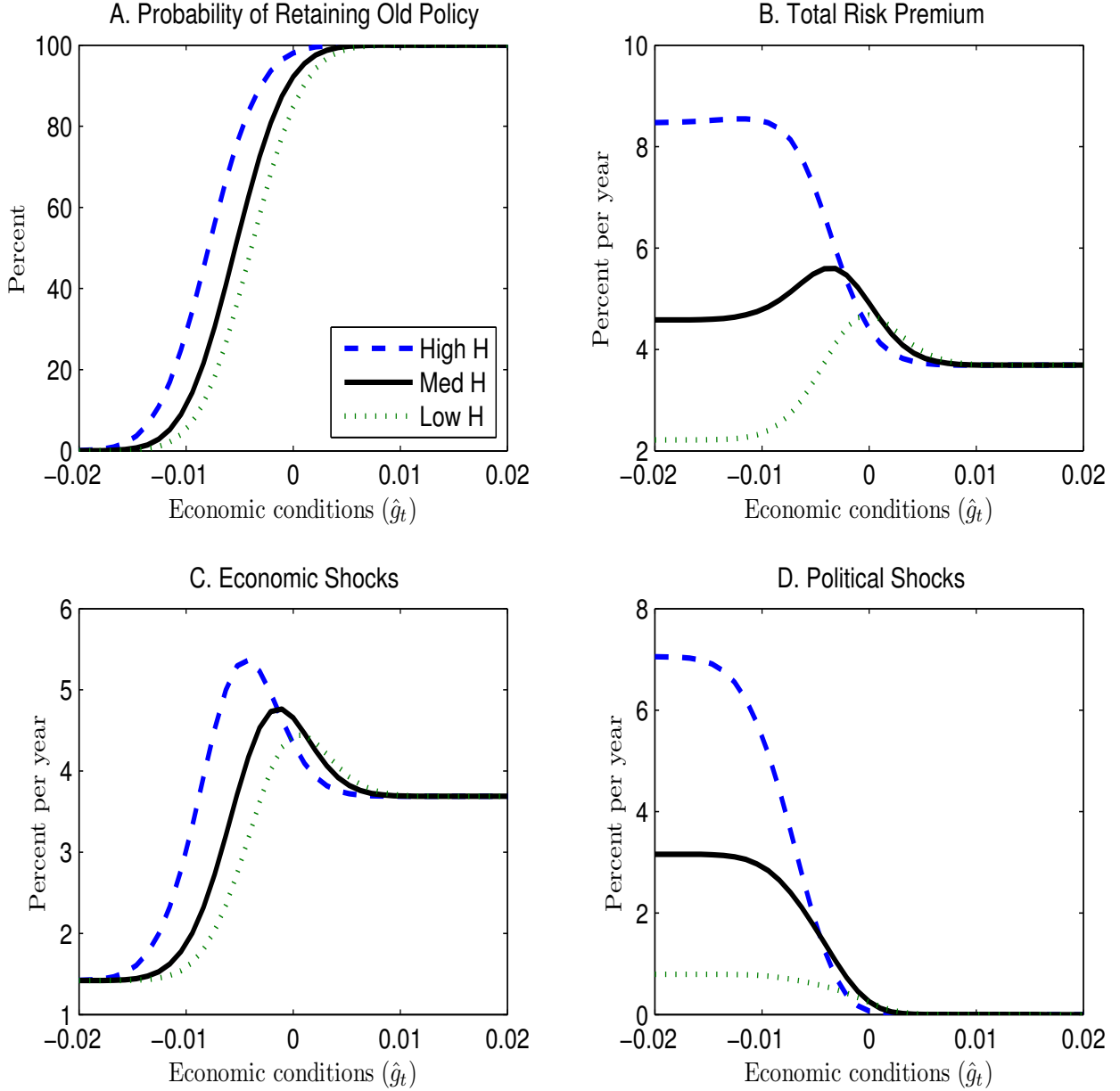


Fig. 6. The equity risk premium and its components: The effect of policy heterogeneity. Panel A plots the probability of retaining the old policy, as perceived at time  $t = \tau - 1$ , for different values of  $\hat{g}_t$  and three different levels of heterogeneity among the new policies. Heterogeneity  $\mathcal{H}$  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  $\mu_g^H$  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  $\hat{c}_t^L$  and  $\hat{c}_t^H$  are set equal to their initial value at time 0, so that both new policies are equally likely to be adopted at time  $\tau$ . 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  $C^H$ ).



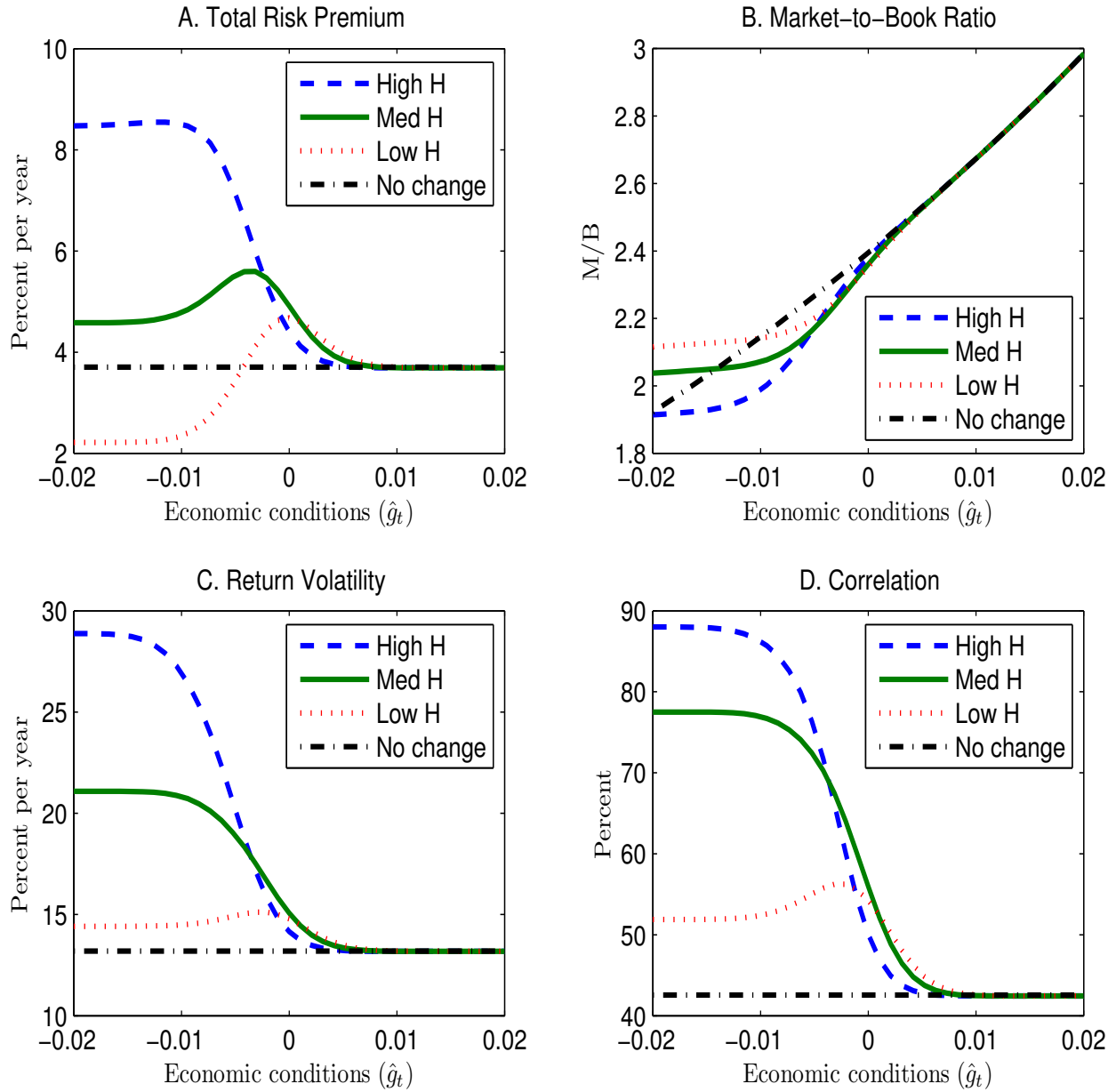


Fig. 7. Stock price level, volatility, and correlation: The effect of policy heterogeneity. This figure is constructed in the same way as Fig. 6 except that it plots additional quantities of interest—the stock price level, measured by the market-to-book ratio, the volatility of each stock’s return, and 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  $\tau$ . Comparing the dash-dot line to the other three lines thus highlights the effect of precluding the government from changing its policy.

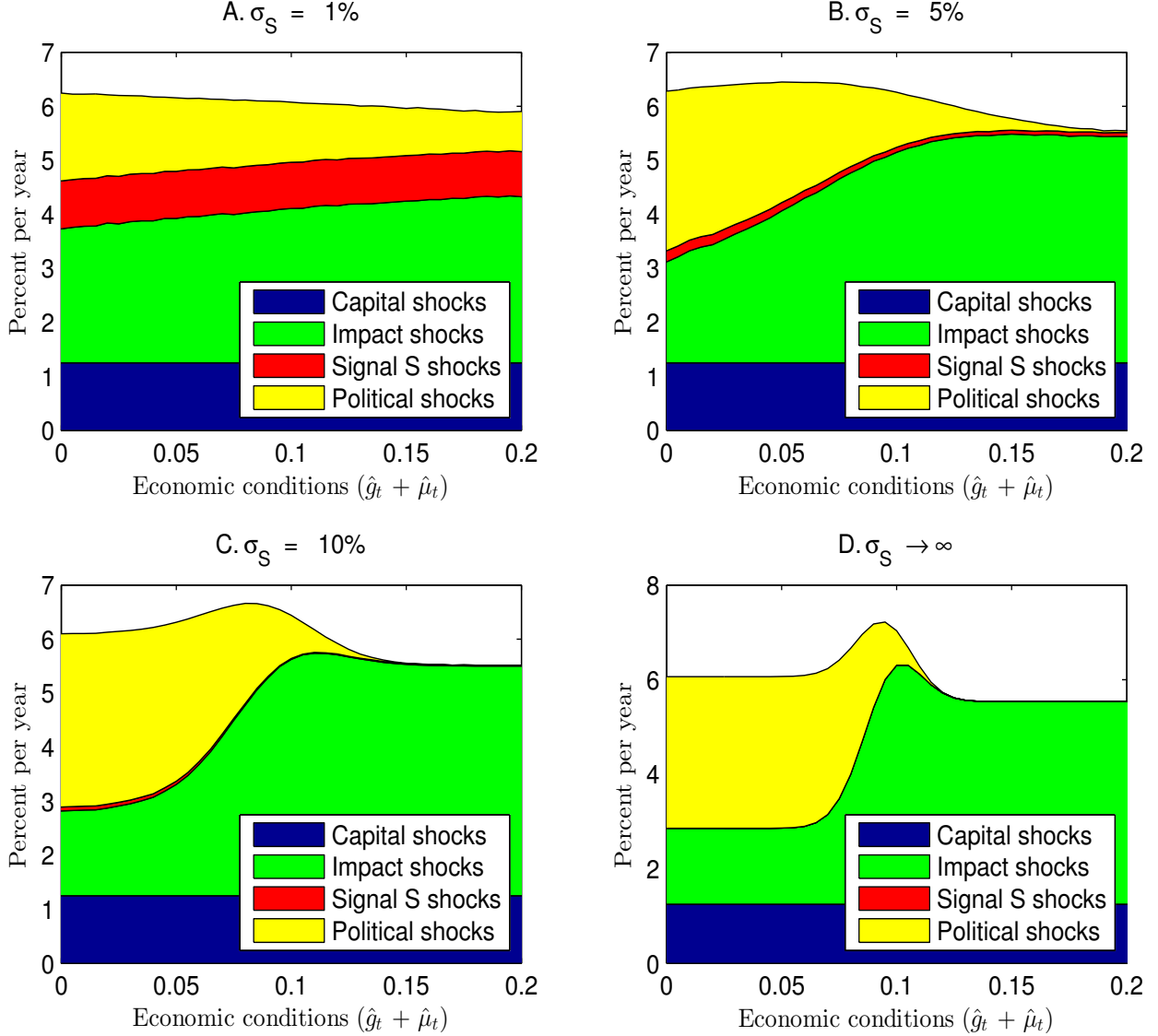


Fig. 8. The equity risk premium and its components: Business-cycle model extension. For the model extension on policy-unrelated business cycles, this figure plots the equity risk premium and its components as a function of economic conditions. The four panels correspond to different values of  $\sigma_S$ , which reflects the precision of the additional signal  $S$ , or  $dS_t$  from Eq. (55), that agents use to learn about the business cycle variable  $\mu_t$  (higher  $\sigma_S$  means a less precise signal). 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 green area, second from the bottom, 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 red area, third from the bottom, represents the component of the risk premium that is due to the additional signal  $S$ . Finally, the yellow area at the top represents the component of the risk premium that is due to “political shocks,” which reflect learning about  $C^L$  and  $C^H$ . The four areas add up to the total equity risk premium. The values of  $\hat{c}_t^L$  and  $\hat{c}_t^H$  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; in addition,  $\bar{\mu} = 10\%$ ,  $\beta = 0.35$ , and  $\sigma_\mu = 2\%$ .

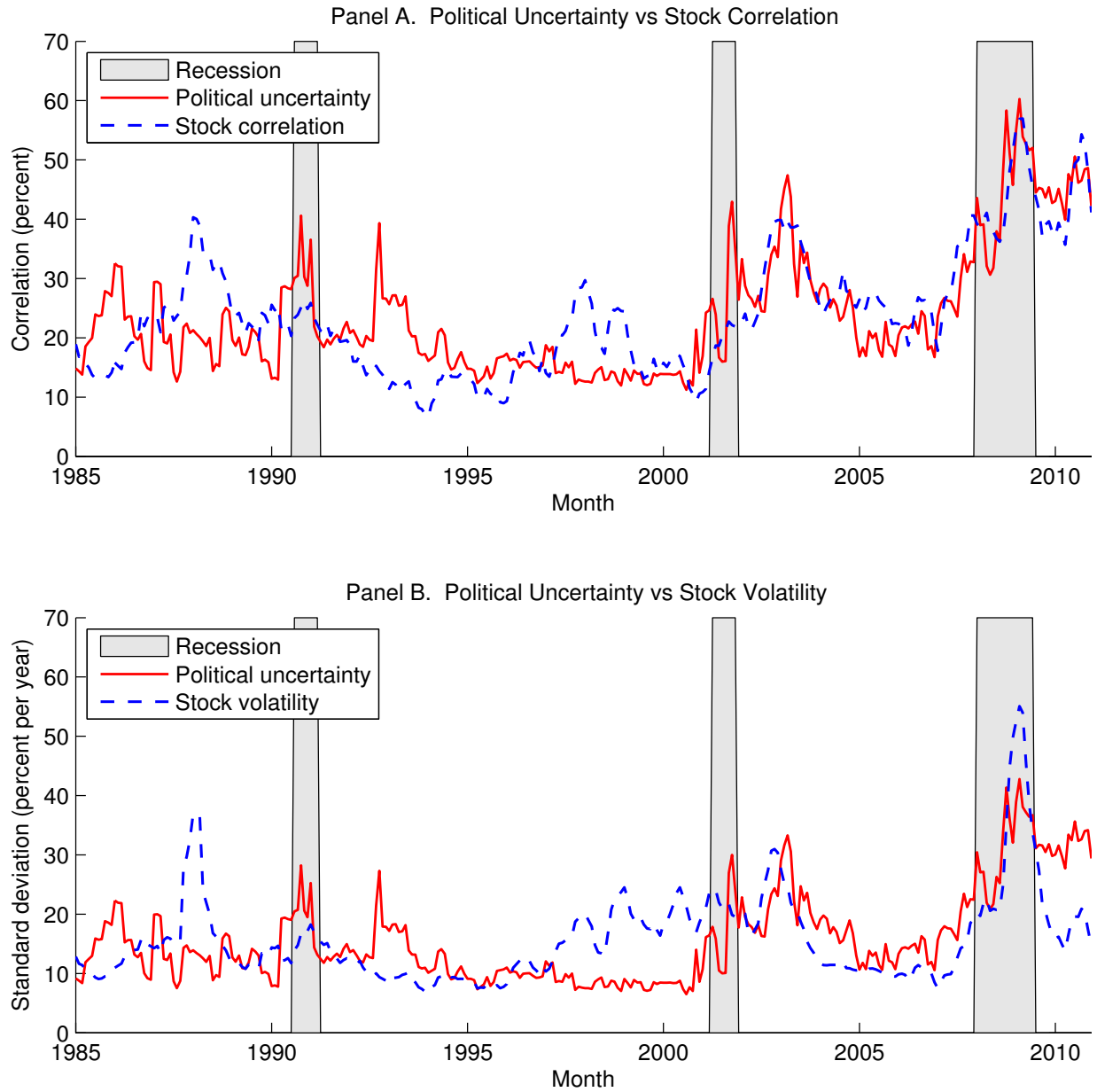


Fig. 9. Political uncertainty versus stock market correlation and volatility. The solid line in each panel plots the policy uncertainty (PU) index of Baker, Bloom, and Davis (2012), which is our proxy for political uncertainty. In each panel, PU is scaled to have the same mean and volatility as the other 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.