Partisan Conflict, News, and Investors' Expectations

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Abstract

In this paper, I consider the role of news provided by the media as signals used by investors to learn about the underlying degree of partisan conflict. Partisan conflict is relevant for investment decisions because it affects the efficacy of government policy in preventing bad economic outcomes such as recessions and crises. Agents do not observe the true degree of political disagreement (and hence the quality of policies), but can create expectations based on the observation of informative signals. Using a Bayesian learning model, I illustrate how these signals affect investment decisions by changing agents' expectations. I show that an unexpected increase in the partisan conflict index (a summary of the signals observed) reduces the perceived quality of government intervention increasing tail risks. This lowers expected returns and induces reductions in the level of investment.

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1 Introduction

The government, through its regulatory institutions and budgetary decisions, implements policies which affect the environment in which firms operate. These policies are typically designed to prevent negative economic outcomes such as recessions and crises. Unfortunately, there is significant amount of uncertainty regarding the timing of implementation and the effectiveness of these policies. Investors are therefore making investment decisions under varying degrees of uncertainty. The economic consequences of policy-related uncertainty has been documented in a series of recent papers which point to the political system as the main driver of the slow recovery from the Great Recession. For example, Baker, Bloom, and Davis (2016) compute an index of economic policy uncertainty (EPU) from newspaper articles and show that higher degrees of uncertainty are associated with lower aggregate investment in the US. Using the EPU index, Gulen and Ion (2016) show that approximately two thirds of the 32% drop in corporate investments observed during the Great Recession can be attributed to policy uncertainty.[1] Azzimonti (2018a) argues that this uncertainty can be traced back to the degree of political discord in the US. Using a semantic search methodology to measure the frequency of newspaper articles reporting lawmakers' disagreement about policy, a partisan conflict index (PCI) is constructed. The author finds a negative relationship between the PCI and aggregate investment in the US (see Azzimonti, 2018a) and that foreign direct investment into the US tends to be lower when the PCI rises (see Azzimonti, 2018b).

In this paper, I provide a theory consistent with these empirical findings. In particular, I consider the role of news provided by the media as signals used by investors to learn about the underlying degree of partisan conflict. In a reduced-form political economy model with Bayesian learning, I illustrate how these signals affect investment decisions by changing investors' expectations. The returns to investment depend both on idiosyncratic productivity of firms and on the aggregate state of the economy. I assume that the government is able to reduce the probability of a recession or crisis by adopting preventive policies or undertaking reforms, but face political costs to do so. When parties are polarized and the government is divided, partisan conflict is elevated, and the quality of policies adopted is lower. Partisan conflict, thus, exacerbates economic risk by increasing the likelihood of recessions or crises.

Investors do not observe the true value of partisan conflict at the time of making decisions. This key assumption captures the idea that the profitability of investment is not only risky, but also *uncertain*. Moreover, as the future path of government policy cannot be predicted with certainty, investors also face economic policy uncertainty (EPU). I show

[1] See Julio and Yook (2012, 2014) and Durnev (2010) for studies showing that political uncertainty (proxied by national election years) is associated with lower foreign direct investment in a panel of countries.

that the relationship between partisan conflict and economic policy uncertainty is inverted u-shaped, as increases in the former only introduce economic policy uncertainty for moderate levels of political discord. When disagreement is extreme, agents know with high certainty that the status-quo will remain unchanged due to government inaction. This does not imply that investment is optimally higher when partisan conflict is extremely large, as government policies are inefficient and the likelihood of negative economic outcomes is large.

I assume that investors can obtain imperfectly informative signals about true partisan conflict by reading newspapers, reports, and other sources of information. Periods in which they observe a large proportion of articles reporting political discord result in beliefs about partisan conflict being updated upwards. This decreases expected returns on investment—as tail risks are perceived to be more likely—which in turn induces a reduction in the overall level of private investment.

Literature Review: This paper is related to a growing literature studying the effects of economic policy uncertainty on the aggregate economy. Early examples are Bernanke (1983), Pindyck (1993), and Dixit and Pindyck (1994). More recently, see Bloom (2009) Fernández-Villaverde and Rubio-Ramírez (2010,) Fernández-Villaverde, Guerrón, Kuester, and Rubio-Ramírez (2015), or Stokey (2013). A common assumption is that fiscal policy follows an exogenous process where its volatility changes over time. In periods of high variability, economic agents delay hiring, investment, or production decisions, and these amplify business cycles.[2] Canes-Wrone and Park (2011) takes this one step further by connecting surges in policy uncertainty with the electoral cycle. They argue that agents have incentives to delay decisions that are subject to large reversibility costs right before elections, particularly when polarization is high and the election is competitive, as these imply high levels of economic policy uncertainty. Their main implication is a pre-election decline in investment. Azzimonti and Talbert (2013) propose an alternative channel by which political disagreement affects economic decisions. Using a standard partisan model of fiscal policy determination embedded in a neoclassical real business cycle model, they show that polarization increases induce economic policy uncertainty, causing long run investment to decline. The main difference between this paper and the ones mentioned above is that PCI represents a signal about unobservable government dysfunction, rather than the degree of economic policy uncertainty.

The empirical finance literature has tried to identify the effect of news shocks on asset

[2]These papers are mostly concerned with uncertainty about government policy rather than uncertainty about the state of the economy. This is an important distinction in light of Bachmann, Elstner, and Sims (2013), who find (using US micro-data) that economic uncertainty is inconsistent with a wait-and-see hypothesis.

prices, and more recently on business cycle fluctuations, since the work of Beaudry and Portier (2006). As in this paper, the expectation formation process is modeled as a signal extraction problem in which news provide noisy information about the underlying state of the economy (see Beaudry and Portier, 2014). The effects of political disagreement—the main driving force affecting the likelihood of recessions in this paper—are typically abstracted from.[3] Exceptions are Pastor and Veronesi (2013) and Kelly, Pastor, and Veronesi (2013), where political news affect economic outcomes. In Pastor and Veronesi's model, agents are uncertain about the effects of current government policy on stock returns, as well as on the political costs associated from changing the status-quo. The main determinant of investment delays in their model is the 'wait and see' response of agents to policy uncertainty (e.g., the volatility of political costs), a second moment effect. In this paper, on the other hand, partisan conflict depresses investment more directly through a reduction in expected returns. This first moment effect is present even when policy uncertainty is low, in sharp contrast with their results. In addition, I focus on political disagreement, while Pastor and Veronesi's main explanatory variable is economic policy uncertainty.

The paper is organized as follows. I present the model in Section 2 and characterize it in Section 3. Section 4 concludes.

2 Model

Consider an infinite horizon economy populated by productive firms which own capital stock K at the outset of the period and have access to a linear production technology

$$f(z, K) = e^z K.$$

Total factor productivity e^z depends the firm's idiosyncratic productivity level ε and the aggregate state of the economy ν as follows

$$z = \varepsilon + \nu,$$

where ε is normally distributed with mean μ and variance σ^2. The distribution of ν satisfies

$$\text{with probability } p: \qquad \nu = \log(1-\kappa)$$

[3] Because partisan conflict affects tail risks, this paper is tangentially related to studies highlighting the effects of time-varying volatility caused by rare events (Gabaix, 2008; Shen 2005; Kelly and Jiang 2014, among others).

$$\text{with probability } 1-p: \qquad \nu = 0,$$

with $\kappa < 1$. The realization $\nu = 0$ indicates 'normal times' whereas $\nu = \log(1-\kappa)$ indicates a 'recession' (or crisis) where productivity is lower than average.[4]

The capital stock follows

$$K' = I + (1-\delta)K',$$

where δ denotes the depreciation rate of capital, K' the stock of capital next period, and I denotes investment. The firm faces adjustment costs of investment $\Phi(I)$, that can be interpreted as costs of installation and de-installation of capital.

Assumption 1 *Adjustment costs are increasing and convex in investment,* $\Phi_I > 0$ *and* $\Phi_{II} > 0$.

The optimal investment decision of the firm will be characterized in Section 3.

2.1 Government Policy

The government can implement policies or undertake reforms in order to prevent recessions or crises, thus reducing tail-risk by lowering p. Examples are banking regulation (e.g. reserve requirements or deposit insurance), financial reforms (e.g. Dodd-Frank), budget rules (e.g. a balanced budget amendment to prevent excessive debt creation and hence the likelihood of defaults), enhancing homeland security (e.g. the Intelligence Reform and Terrorism Prevention Act of 2004), or simply managing the federal budget to reduce the risk of 'fiscal cliffs'. The degree of sophistication, or quality of the policy, enhances the probability of preventing such events. To capture this, I assume that p is a decreasing function of quality x:

$$p(x) = \frac{1}{m}e^{-x}, \tag{1}$$

where m is a positive number.At each period, the objective of the government is to maximize the benefit of a preventive policy or reform, $1-p(x)$ (e.g. reduce the probability of a negative TFP shock), minus the cost associated with implementing it, denoted by $TC(x)$

$$\max_x \, [1-p(x)] - TC(x). \tag{2}$$

Implementing these policies involves effort and political costs. We would expect the costs of good policies or reforms to increase with x, the degree of policy sophistication (due to

[4] The choice of $\nu = 0$ for normal times is without loss of generality for the main result and given the other assumptions of the model. It was done to simplify the exposition.

data gathering, intelligence, policy design, etc.). These represent resource costs. In addition, there may be political costs. For example, when policymakers are divided, it is more costly to implement a reform of a given quality even if such policy would result on a more efficient allocation. This could be due to the fact that legislators have different views about the costs and benefits of a policy, or because it affects their constituency asymmetrically. Polarization and divided government make policy implementation more politically costly and, therefore, less likely. To capture this, I assume that the total cost of implementing a reform of quality x also depends on political disagreement,

$$TC(x) = \frac{1}{m}\left(\epsilon + \theta e^{-\frac{1}{c}}\right) x,$$

where ϵ and θ are constants that satisfy $\epsilon + \theta < 1$, $\frac{\epsilon+\theta}{m} < 0.5$ and $c \geq 0$ denotes the degree of 'partisan conflict'.

High levels of partisan conflict make policy implementation more costly, $\partial TC/\partial c > 0$. We can think of partisan conflict as resulting from the interaction between two parties with different objectives in the political arena. Policymakers' ideological differences (polarization) are clearly important determinants of political disagreement. The further apart parties' views over policies are, the higher the level of conflict should be, and hence the more difficult it would be to reach consensus. How political power is divided between the two parties must also affect the degree of conflict (as suggested by Alesina and Rosenthal, 1995). Consider the extreme case of one particular party controlling both chambers of Congress and the presidency. Then partisan conflict should be low, regardless of how polarized these parties are. There are other factors affecting the political environment, such as the influence of interest groups, the political affiliation of the President and his relationship with both chambers of Congress, the composition of Congress committees, etc. Rather than modeling the determinants of a complex political process, I focus on this reduced form in order to concentrate on the implications of partisan conflict on investment decisions. It would be interesting, in future work, to model these interactions explicitly.

Partisan conflict is assumed to be constant for T periods, when an election is held and a new value of c is drawn from a distribution $F(c)$ with positive support. The rationale behind this specification is that elections change the pool of policymakers, affecting the views and the balance of power of different political players. The effects of partisan conflict on government policy are summarized in Lemma 2.1.

Lemma 2.1 *In this economy:*

i. The government's optimal policy x satisfies

$$x(c) = -\ln\left(\epsilon + \theta e^{-\frac{1}{c}}\right),$$

with $x(0) = -\ln \epsilon$ *and* $\lim_{c\to\infty} x(c) = -\ln(\epsilon + \theta)$.

ii. The likelihood of a recession (or crisis) is characterized by

$$p(c) = \frac{1}{m}\left(\epsilon + \theta e^{-\frac{1}{c}}\right),$$

where $p(0) = \frac{\epsilon}{m}$ *and* $\lim_{c\to\infty} p(c) = \frac{\epsilon+\theta}{m}$.

iii. Partisan conflict reduces the quality of reforms and increases the probability of recessions or crises:

$$\frac{\partial x(c)}{\partial c} < 0 \qquad \text{and} \qquad \frac{\partial p(c)}{\partial c} > 0.$$

Proof 2.1 *Optimal policy x results from solving Problem 2. The probability of a recession is obtained by replacing x(c) into eq. (1).*

Figure 1 depicts government's policy x as a function of partisan conflict (left panel), together with the probability of a crisis (right panel).

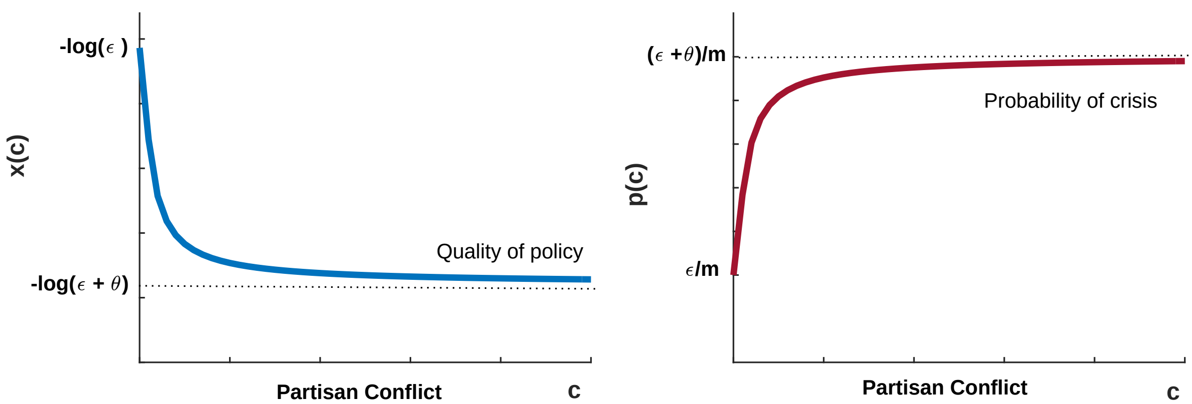

Figure 1: Government policy and probability of a recession or crisis as a function of partisan conflict.

We can see that when c increases, the quality of preventive measures and reforms goes down. That political dysfunction is associated with lower quality policies is consistent with the observation that legislative productivity declines when gridlock intensifies (Binder, 1999). This increases the probability of negative outcomes, $p(c)$, making investment riskier, as highlighted in the following corollary.

Corollary 2.1 *Partisan conflict reduces the profitability of investment*

$$\frac{\partial E(z)}{\partial c} < 0,$$

and exacerbates economic risk by increasing the volatility of investment returns

$$\frac{\partial Var(z)}{\partial c} > 0.$$

Proof 2.2 *From the definition of* z, $E(z) = \mu + E(\nu)$, *so* $\partial E(z)/\partial c = \partial p/\partial c\,[ln(1-\kappa)] < 0$ *as* $ln(1-\kappa) < 0$. *For the second result, note that* $Var(z) = \sigma^2 + Var(\nu)$, *with* $Var(\nu) = [ln(1-\kappa)]^2(p(c) - p(c)^2)$. *So* $\partial Var(z)/\partial c = [ln(1-\kappa)]^2(1-2p)\partial p/\partial c$. *The result follows from the fact that* $p < 0.5$.

2.2 Information structure

Investors do not know the true value of partisan conflict c at the time of making decisions. This key assumption captures the idea that the profitability of investment is not only risky, but also *uncertain*. Since the probability of a recession or crisis p depends on partisan conflict c—which is unobservable—the distribution of TFP shocks is unknown: The model features Knightian uncertainty. Moreover, as x depends on c, the future path of government policy is also uncertain. Thus, investors face economic policy uncertainty in the sense of Baker, Bloom, and Davis (2016). The relationship between partisan conflict, economic policy uncertainty, and investment will be characterized in more detail below, but it is useful at this point to properly define these concepts in the context of the model.

Definition 2.1 *'Political uncertainty' refers to the variance of partisan conflict* $Var(c|\Omega)$ *given the set of available information at that time* Ω. *'Economic policy uncertainty' refers to the variance of government policy,* $Var(x|\Omega)$.

The prior distribution of c at time 0 is assumed to be inverse-gamma with parameters α_0 and β_0,

$$c \sim \text{IG}(\alpha_0, \beta_0). \tag{3}$$

Investors observe n unbiased signals s^i, with $i \in \{1, ..., n\}$, between the outset of any period and the time of investment. It is assumed that signals s^i are drawn from an exponential distribution centered around the true value of partisan conflict c,

$$s^i \sim \exp(c). \tag{4}$$

Since this distribution has positive support, s^i always takes non-negative values.[5] Intuitively, these signals capture period t's flow of political news associated with future policies or a potential reform. Investors observe political speeches, debates, and negotiations through news outlets on a daily basis. These events provide information about the degree of political disagreement allowing them to revise their beliefs about the likelihood of effective policies being implemented.

Let $\hat{\alpha}$ and $\hat{\beta}$ denote investors' prior beliefs over the parameters of this distribution at the beginning of a period. After observing the signals, agents update their beliefs using Bayes' rule. The posterior distribution of c at the time of making an investment decision during non-election years (e.g. at any period $t < T$), is thus given by an inverse gamma IG$(\hat{\alpha}', \hat{\beta}')$ where the posterior parameters evolve according to

$$\hat{\alpha}' = \hat{\alpha} + n, \qquad \text{and} \qquad \hat{\beta}'(\bar{s}) = \hat{\beta} + n\bar{s}.$$

In the expression above, $\bar{s}$ denotes the sample mean $\bar{s} = \sum_{i=1}^{n} s^i/n$ of the political signals observed in the current period (see Appendix 5.1 the derivation of the posterior distribution and its moments). The posterior mean of partisan conflict, $\hat{c}'(\bar{s})$, is equal to

$$\hat{c}'(\bar{s}) \equiv E(c|\Omega) = \frac{\hat{\beta}'(\bar{s})}{\hat{\alpha}' - 1},$$

with $\Omega = \{\bar{s}, \hat{\alpha}, \hat{\beta}(\bar{s})\}$ denoting the set of available information to the investor. The posterior variance, or political uncertainty, equals

$$Var(c|\Omega) = \frac{\hat{c}'(\bar{s})^2}{(\hat{\alpha}' - 2)} \tag{5}$$

indicating that greater expected partisan conflict is—keeping everything else constant—associated with more political uncertainty, $\partial Var(c|\Omega)|\partial\hat{c}' > 0$. Hence, periods of intense disagreement between policymakers not only reduce the expectations about the effectiveness of policies, but may also introduce higher uncertainty to investors.

Political uncertainty also induces economic policy uncertainty in this model, as $Var(x|\Omega) \neq 0$ when partisan conflict c is unknown. Notice that if c were observable, $x(c)$ would be con-

[5] Recall that the pdf of an exponential distribution is $f(s) = \frac{1}{c}e^{-\frac{s}{c}}$, for $s \geq 0$ and 0 otherwise.

stant between elections, so $Var(x|\Omega) = 0$, $t \in \{k, k+T\}$, $\forall k \geq 0$. Because c is unobservable, agents must form expectations about the path of government policy at every point in time. The relationship between EPU and partisan conflict described in the following Lemma.

Lemma 2.2 *The relationship between expected partisan conflict, $\hat{c}'$, and economic policy uncertainty, $Var(x|\Omega)$, is non-monotonic*

$$\frac{\partial Var(x|\Omega)}{\partial \hat{c}'} \begin{cases} \geq 0 & if \quad \hat{c}' \leq \varsigma \\ < 0 & if \quad \hat{c}' > \varsigma \end{cases},$$

where ς solves

$$\epsilon = \varsigma(\epsilon + \theta e^{-\frac{1}{\varsigma}}).$$

Proof 2.3 *See Appendix 5.2.*

This follows from the negative relationship between x and c, and the fact that political uncertainty is increasing in partisan conflict. When $c = 0$, policymakers choose the optimal effort level $x^* = -\ln(\epsilon)$, and political uncertainty is negligible. As c rises, so does $Var(c|\Omega)$, which in turn causes EPU to increase. Because effort decreases with partisan conflict, the effect of political uncertainty on EPU weakens as c goes up. Eventually, $c > \varsigma$, so even though political uncertainty is very large, agents can predict with relative certainty that the government will make no effort to prevent adverse events, $x \sim 0$, so EPU is small. The relationship between EPU and partisan conflict is illustrated in Figure 2.

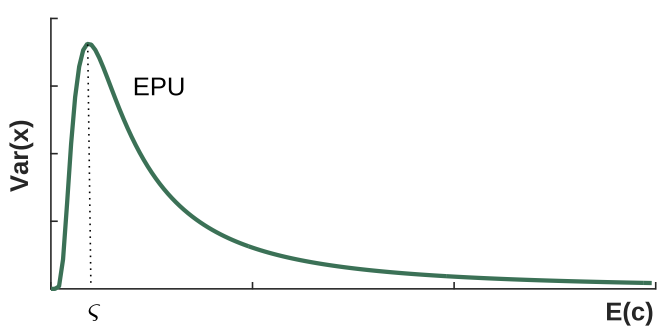

Figure 2: Economic Policy Uncertainty, $Var(x|\Omega)$, as a function of partisan conflict.

Result: *We should expect partisan conflict to induce economic policy uncertainty for moderate levels of government dysfunction, as investors cannot predict with certainty which policy will be undertaken. Under extreme levels of partisan conflict, on the other hand, we should* *expect partisan conflict and EPU to move in opposite direction, as a government gridlock becomes more likely.*

In this model, expected partisan conflict $\hat{c}'(\bar{s})$ changes for two reasons: (i) because there is an election every T periods, where true partisan conflict c changes and priors are reset according to eq. (3); and (ii) because between elections (when c is unchanged), agents receive signals $\bar{s} > 0$ about the true value of partisan conflict. We are mostly interested in understanding the effects of the latter.

2.3 The Partisan Conflict Index

The posterior mean of partisan conflict, $\hat{c}'(\bar{s})$, can be written as a weighted sum between the prior mean and the sample mean as follows

$$\hat{c}'(\bar{s}) = \omega\bar{s} + (1-\omega)\hat{c} \quad \text{with} \quad \omega = \frac{n}{\hat{\alpha} + n - 1}. \tag{6}$$

Positive values of the political signal $s^i > 0$ indicate disagreement between policymakers. When investors observe an increase in the number of articles reporting partisan conflict in their sample, beliefs about c—and hence the total cost of adopting the policy—are updated upwards. This, in turn, lowers investors' expectations about the quality of government policy. In what follows, we will refer to $\bar{s}$ as the *partisan conflict index*, a news-generated indicator that summarizes investors' information about political disagreement. This definition is consistent with the empirical counterpart computed in Azzimonti (2018). From the discussion above, we can conclude that

Result: *Higher values of the PCI, keeping everything else constant, result in beliefs about partisan conflict being updated upwards and hence are associated with*

i. Higher tails risks
$$\frac{\partial p(\bar{s})}{\partial \bar{s}} > 0.$$

ii. More political uncertainty
$$\frac{Var(c|\Omega)}{\partial \bar{s}} > 0.$$

iii. Higher EPU only for moderate values of the PCI (e.g., as long as $\hat{c}' < \varsigma$).

The first point follows from the fact that the probability of a bad economic outcome is increasing in partisan conflict from Lemma 2.1 and that true partisan conflict rises with the partisan conflict index, as seen in eq. (6). The second point follows from Corollary 2.1, whereas the third is a consequence of Lemma 2.2.

These results are illustrated in the following graph, which depicts the evolution of signals and beliefs for a simulated economy that lasts $T = 9$ periods (and assuming $c = 10$).

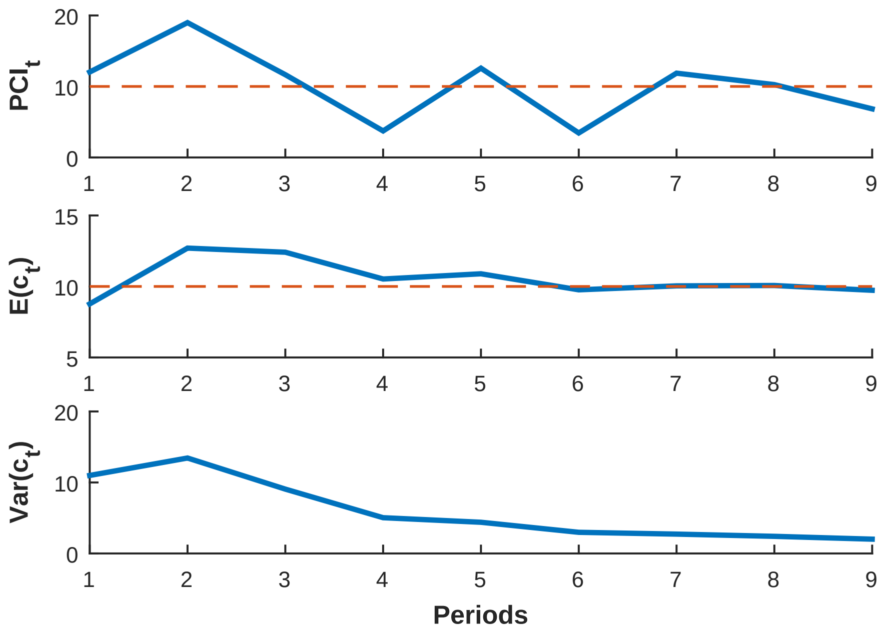

Figure 3: Evolution of signals $\bar{s}$, or PCI (first plot), posterior beliefs about partisan conflict, $E(c|\Omega) = \hat{c}'$ (second plot), and political uncertainty $Var(c|\Omega)$ (third plot).

Note: Parameter values $c = 10$, $\alpha_0 = 4$, $\beta_0 = 10$, $n = 5$, $T = 9$.

The first plot in Figure 3 shows the evolution of the partisan conflict index $\bar{s}$ over time (solid line) together with the true value of partisan conflict c (dotted line). As agents observe increases in the number of newspaper articles reporting political disagreement $\bar{s}$, their beliefs about true partisan conflict $\hat{c}'$ rise, as seen in the second plot. The effect of these signals is larger in the first few periods (that is, right after an election), as investors have little information about c. As time goes by, signals are given relatively lower weight. The last plot, which depicts the evolution of $Var(c|\Omega)$, illustrates that uncertainty about partisan conflict c decreases over time. However, the decline is non-monotonic, as extremely high realizations of the PCI (as seen in period 2) may introduce significant political uncertainty. Notice that higher partisan conflict is not always associated with greater political uncertainty. While higher realizations of $\bar{s}$ increase $Var(c|\Omega)$, its effect is tamed by the fact that as agents learn about the true value of partisan conflict, they give a smaller weight to $\bar{s}$. This can be seen by re-writing eq. (5) for a given period t as follows,

$$Var(c|\Omega) = \frac{\hat{c}'(\bar{s})^2}{(\alpha_0 + tn - 2)},$$

where we just substituted out $\hat{\alpha}' = \alpha_0 + tn - 2$. Note that as we move forward in time there are two effects: first, there is a new realization of $\bar{s}$ (which increases the numerator of $Var(c|\Omega)$); second, there is an increase in the denominator of n through t. This implies that political uncertainty may increase under extremely large realizations of PCI (as in $t = 5$), but that would not necessarily be the case for moderate increases (as in $t = 7$).

Recall that after T periods there is an election in which the value of c changes. Because agents reset their priors about c according to eq. (3), political uncertainty increases significantly in election periods.

Result: *We should expect partisan conflict to be more volatile around midterm and presidential elections.*

The effects of elections on expected partisan conflict are ambiguous in our model, as $\hat{c}'$ may increase or decrease depending on the distance between the prior $c_0 = \frac{\beta_0}{\alpha_0 - 1}$ and the true value of partisan conflict c. If agents underestimate true partisan conflict $c_0 < c$, the sequence $\hat{c}'$ would be increasing. If they were to overestimate it $c_0 > c$, the sequence $\hat{c}'$ would be decreasing instead. Finally, note that because x is unobservable and beliefs are reset every T periods, investors never learn the true value of partisan conflict, so signals are always informative in this model.

3 Partisan conflict and aggregate investment

In this section, I analyze the effects of PCI in the economy. The timing of events can be summarized as follows

- At the outset of a given period, firms own capital K and have priors $\hat{\alpha}$ and $\hat{\beta}$.
- Signals $\{s_1, ..., s_n\}$ are observed and beliefs are updated.
- Firms observe productivity shocks ε and ν and compute z.
- Investment decisions I take place.
- The government chooses x given c (both unobservable).
- Production and consumption take place.

- After T periods there is an election, where beliefs are reset according to eq. (3).

Government decisions are summarized in Lemma 2.1. Firms decide how much to invest given total factor productivity z and expectations about the evolution of z, in order to maximize the value of the firm $V(z, K)$

$$V(z,K) = \max_{\{I,K'\}} \left\{ \quad f(z,K) - I - \Phi(I) + \frac{1}{1+r^*}\mathbb{E}\left[V(z',K') \setminus \Omega\right] \right\}$$
$$\text{s.t. } I = K' - (1-\delta)K. \tag{7}$$

with $\Omega = \{\bar{s}, \hat{\alpha}, \hat{\beta}(\bar{s})\}$ denoting the available information to the investor at the time of making decisions. Note that the partisan conflict index affects investor's decisions through the expectation term $\mathbb{E}\left[V(z', K') \setminus \Omega\right]$, since the probability of a negative economic outcome $p(\bar{s})$ depends on the average signal $\bar{s}$.

Letting q denote the current valued Lagrange multiplier on constraint (12), we have that

$$q = \Phi_I + 1. \tag{8}$$

The firm invests such that the marginal cost of an additional unit of capital (which equals 1 plus the marginal adjustment cost) equals the shadow price of capital q, also known as Tobin's q. The optimality condition with respect to K' is

$$q = \frac{1}{1+r^*}\mathbb{E}\left[f'_K + (1-\delta)q' \setminus \Omega\right], \tag{9}$$

where f'_K denotes the marginal product of capital next period. Eq. (9) represents the Euler equation for the firm, in which the (shadow) price of capital equals the expected discounted value of the return on capital next period plus the future shadow price of capital (or re-sell value). After manipulating eqs. (8) and (9), we obtain

$$\Phi_I + 1 = \frac{1}{1+r^*}\mathbb{E}_{z',p(c)}\left[e^{z'} + (1-\delta)[\mathbb{E}_{\bar{s}'}\Phi'_I + 1] \setminus \Omega\right] \tag{10}$$

This dynamic equation determines the evolution of capital over time. The first expectation is taken not only over possible realizations of z', but also over the probability of recessions $p(c)$, as agents do not observe c, the true value of partisan conflict at the time of investment. Moreover, when considering the effect on future periods, we need to take into consideration possible observations of $\bar{s}$, which the term $\mathbb{E}_{\bar{s}'}$ makes explicit when evaluating the shadow price of investment after next period. In general, this difference equation does not allow for an analytical representation. Under the following set of conditions, namely full depreciation and quadratic adjustment costs, investment can be solved for in closed form.

Assumption 2 *There is full depreciation $\delta = 1$ and adjustment costs satisfy*

$$\Phi(I) = \frac{1}{2}\gamma I^2.$$

Under the assumption, the Euler equation of firms eq. (10) becomes

$$\gamma I + 1 = \frac{1}{1+r^*}\mathbb{E}_{z',p(c)}\left[e^{z'} \setminus \Omega\right] \tag{11}$$

The following proposition characterizes investment decisions as a function of the partisan conflict index $\bar{s}$.

Proposition 3.1 *Let $\hat{p}(\bar{s})$ denote the expected probability of a recession or crisis as a function of the partisan conflict index $\bar{s}$. Under Assumption 3, we have*

$$I(\bar{s}_t) = \frac{1}{\gamma}\left[\frac{1}{1+r^*}e^{\frac{2\mu+\sigma^2}{2}}\left(\hat{p}(\bar{s})e^{\ln(1-\kappa)} + 1 - \hat{p}(\bar{s})\right) - 1\right] \tag{12}$$

with

$$\hat{p}(\bar{s}) \quad = \quad \frac{1}{m}\left(\epsilon + \theta\frac{\left[\hat{\beta}'(\bar{s})\right]^{\hat{\alpha}'}}{\left[1+\hat{\beta}'(\bar{s})\right]^{\hat{\alpha}'}}\right), \tag{13}$$

where

$$\hat{\alpha}' = \hat{\alpha} + n, \qquad \text{and} \qquad \hat{\beta}'(\bar{s}) = \hat{\beta} + n\bar{s}.$$

Proof 3.1 *Expected returns satisfy*

$$E\left[e^{z'}|\Omega\right] = E\left[e^{\varepsilon'+\nu'}|\Omega\right] = E\left[e^{\nu'}e^{\varepsilon'}|\Omega\right]$$

where the second equality follows from properties of the exponential function. Define $\hat{p}(\bar{s}) \equiv \mathbb{E}\left[p(c)|\Omega\right]$, then

$$E\left[e^{\nu'}e^{\varepsilon'}|\Omega\right] = \left(\hat{p}(\bar{s})e^{\log(1-\kappa)} + 1 - \hat{p}(\bar{s})\right)E\left[e^{\varepsilon'}|\Omega\right],$$

since $\nu = 0$ with probability $1 - \hat{p}(\bar{s})$ and using the assumption that economic ε shocks and political signals s_i are independent.

Because $\varepsilon \sim N(\mu, \sigma^2)$ and iid over time, we obtain

$$E\left[e^{\varepsilon'}|\Omega\right] = e^{(2\mu+\sigma^2)/2}.$$

To obtain an expression for $\hat{p}(\bar{s})$, recall that

$$p(c) = \frac{1}{m}\left(\epsilon + \theta e^{-\frac{1}{c}}\right).$$

At the time of making an investment decision, agents do not know the true value of c. Their information set consists of a prior $\hat{\beta}$ and $\hat{\alpha}$, and a set of signals $\{s^i\}_{i=1}^n$. Given the signals, agents update their priors so that $\hat{\alpha}' = \hat{\alpha} + n$ and $\hat{\beta}'(\bar{s}) = \hat{\beta} + n\bar{s}$, with $\bar{s} = \sum_i s_t^i$. Moreover, they know that c is distributed according to an $IG(\hat{\alpha}', \hat{\beta}'(\bar{s}))$. Given this distribution, their best guess for the probability of a recession or crisis is

$$\hat{p}(\bar{s}) = E[p(c)|\Omega] = E\left[\frac{1}{m}\left(\epsilon + \theta e^{-\frac{1}{c}}\right)|\Omega\right],$$

Using the fact that $c \sim IG(\hat{\alpha}', \hat{\beta}'(\bar{s}))$, we obtain

$$\hat{p}(\bar{s}) = \int_0^\infty \frac{1}{m}\left(\epsilon + \theta e^{-\frac{1}{c}}\right)\frac{\hat{\beta}'^{\hat{\alpha}'} e^{-\frac{\hat{\beta}'}{c}} c^{-\hat{\alpha}'-1}}{\Gamma(\hat{\alpha}')}dc,$$

where dependence of β' on $\bar{s}$ has been suppressed for readability and $\Gamma(\hat{\alpha}')$ denotes the Gamma function, $\Gamma(\alpha) = \int_0^\infty x^{\alpha-1}e^{-x}\,dx$. This is equivalent to

$$\hat{p}(\bar{s}) = \frac{1}{m}\epsilon + \frac{1}{m}\theta\int_0^\infty e^{-\frac{1}{c}}\frac{\hat{\beta}'^{\hat{\alpha}'} e^{-\frac{\hat{\beta}'}{c}} c^{-\hat{\alpha}'-1}}{\Gamma(\hat{\alpha}')}dc,$$

Multiplying and dividing by $\tilde{\beta}^{\hat{\alpha}'}$, where $\tilde{\beta}' = 1 + \hat{\beta}'$, and re-arranging, we obtain

$$\hat{p}(\bar{s}) \quad = \quad \frac{1}{m}\epsilon + \frac{1}{m}\theta\frac{\hat{\beta}'^{\hat{\alpha}_t}}{(1+\hat{\beta}')^{\hat{\alpha}'}}\underbrace{\int_0^\infty \frac{\tilde{\beta}'^{\hat{\alpha}'} e^{-\frac{\tilde{\beta}'}{c}} c^{-\tilde{\alpha}'-1}}{\Gamma(\tilde{\alpha})}dc}_{=1}.$$

which delivers eq. (13). Given this, we can obtain expression (12) by re-arranging eq. (11). Q.E.D.

At the investment stage, agents do not know the true value of c but have observed a series of political signals from the news and updated their beliefs. The expression for $\hat{p}(\bar{s})$ follows from the fact that the posterior is inverse-gamma with parameters $\hat{\alpha}'$ and $\hat{\beta}'$. I have made explicit the dependence on $\bar{s}$ to emphasize the role of signals about partisan conflict on agents' expectations.

We can show how aggregate investment depends on PCI.

Corollary 3.1 *Aggregate investment $I(\bar{s}_t)$ is decreasing in the partisan conflict index $\bar{s}$,*

$$\frac{\partial I(\bar{s})}{\partial \bar{s}} < 0.$$

Proof 3.2 *Differentiate eq. (12) using the closed form expression obtained in Proposition 3.1.*

This Corollary establishes our main result, namely, that aggregate investment declines when the partisan conflict indicator rises. Intuitively, as investors observe a large proportion of news articles reporting political disagreement, they expect effective measures aimed at preventing rare-events not to be undertaken. This lowers expected returns, and hence the incentives to invest. Notice that real investment may be affected even if there is no actual change in fundamentals, that is, even if partisan conflict c remains the same. This suggests that perceptions about political dysfunction, and hence decisions depending on these perceptions, may also be affected by the dynamics characterizing the media market.

It is worth mentioning that the distributional assumptions determining the stochastic behavior of priors (inverse-gamma) and news-shocks (exponential) were made primarily for tractability. The main result is robust to more standard distributional assumptions, such as a normally distributed prior c and signals s. However, the normality assumption could result in negative realizations of partisan conflict or posterior probability of rare events outside of the $[0, 1]$ interval. The IG-exponential assumption, on the other hand, ensures that $\hat{p}_t(\bar{s}_t) \in [0, 1]$ and $\hat{c}' > 0$, $\forall t$.

4 Conclusion and extensions

This paper highlights the relationship between agents' expectations about political discord and their subsequent investment decisions. Partisan conflict is relevant for investment decisions because it affects the efficacy of government policy in preventing bad economic outcomes such as recessions and crises. Agents do not observe the true degree of political disagreement (and hence the quality of policies), but can create expectations based on the observation of informative signals. These capture information that investors gather from newspaper articles, reports by non-partisan agencies (such as the Congressional Budget Office, Pew Research, Brookings Institution papers, etc.), political discourse and debates or exchange between politicians. Using a Bayesian learning model, I show that increases in the partisan conflict index (a summary of the signals observed) reduces the perceived quality of government intervention increasing the probability of a negative economic outcome. This lowers expected returns to investment inducing reductions in aggregate investment.

This model is clearly very stylized, but it points to a link between the flow of political news and investors' expectations. This affects investors behavior even when the true degree of partisan conflict remains unchanged. I assumed that the only shock to true partisan conflict is the outcome of elections. It would be interesting, however, to extend the model to allow for other shocks to partisan conflict arising at random times (for example through a Poisson process). The rationale is that policymakers must react to unexpected shocks such as a terrorist attack, a natural disaster, a financial crisis triggered by another country, or sovereign default by a trade partner, among others. The degree of conflict at that point in time may change significantly, depending on how controversial the specific issue that needs immediate resolution is. Investors would react by re-setting their priors, which would cause a spike in political uncertainty. These shocks would emphasize the importance of the partisan conflict index, as news signals would be very informative right after the shock.

I also assumed that there is no uncertainty about the state of the economy outside of that caused by political uncertainty. We could consider an environment in which the distribution of returns was subject to shocks—either to the variance of idiosyncratic shocks σ or even to the size of the recession κ—caused by external factors (such as a war, a financial crisis/recession suffered by a trade partner, a monetary policy shocks, etc.). Agents would react to this additional source of uncertainty by changing their investment decisions, even if the partisan conflict index were constant. Moreover, we would expect policies to react to these shocks in order to stabilize the economy. It would be interesting to analyze such environment, and the implications of this for the relationship between partisan conflict, news, and economic policy uncertainty.

The assumption of full depreciation and a quadratic cost of adjustment cost facilitated an analytical characterization for the investment rule as a function of signals of partisan conflict. The drawback of this assumption is that investment is independent of the current stock of capital, implying that the model exhibits no dynamics other than those arising from the acquisition of information. Relaxing the model to less than full depreciation or assuming that adjustment costs are proportional to the stock of capital (e.g. a cost on the investment rate rather than over the total level of investment), we could characterize a model with a transition to the ergodic set. Such characterization, however, would require the computation of the model under specific parameters, as investment rules would not be able to be obtained in closed form. In particular, not only current signals would be relevant to compute expectations but also potential future signals over partisan conflict, as each unit of investment would give returns for a long period of time. This could be an interesting extension to the model.

Finally, I assumed that partisan conflict is always detrimental for the economy. Clearly, the U.S. constitutional system of checks and balances was designed to prevent extreme and/or dictatorial policies, which may negatively affect the economy as well. Those considerations could be included in an extended version of the model in which policymakers had different views about the size of the government and the role of redistributive policies (e.g. different ideal points). We would expect that news about partisan conflict may have asymmetric effects on investment, as a gridlock could be beneficial for investors under a left-wing government but not under a right-wing government. The analysis of this environment, while of great interest, is left for future research.

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5 Appendix

5.1 Posterior Distribution Derivation

Suppose that we observe n signals $s = \{s_1, ..., s_n\}$, which are mutually independent given c, and $s_i \sim exp(c)$. Then, the likelihood is

$$\begin{aligned} L(c|s) &= \prod_{i=1}^{n} \frac{1}{c} e^{-\frac{s_i}{c}} \\ &= \frac{1}{c^n} e^{-\frac{n\bar{s}}{c}}, \end{aligned}$$

where $\bar{s} = \frac{1}{n}\sum_{i=1}^{n} s_i$. A conjugate inverse gamma prior $IG(\hat{\alpha}, \hat{\beta})$ has pdf

$$f(c) = \frac{\hat{\beta}^{\hat{\alpha}} c^{-\hat{\alpha}-1} e^{-\frac{\hat{\beta}}{c}}}{\Gamma(\hat{\alpha})} \qquad x > 0,$$

where $\Gamma(\hat{\alpha})$ denotes the Gamma function. By Bayes' rule,

$$\begin{aligned} p(c|s) &\propto p(s|c)p(c) \\ &\propto c^{-\hat{\alpha}-1} e^{-\frac{\hat{\beta}}{c}} \frac{1}{c^n} e^{-\frac{n\bar{s}}{c}} \\ &\propto c^{-(\hat{\alpha}+n)-1} e^{-\frac{\hat{\beta}+n\bar{s}}{c}} \\ &\sim IG(\hat{\alpha}+n, \hat{\beta}+n\bar{s}). \end{aligned}$$

Let $\hat{\alpha}_0 = \alpha_0$ and $\hat{\beta}_0 = \beta_0$. Then, the posterior parameters evolve according to

$$\hat{\alpha}' = \hat{\alpha} + n \qquad \text{and} \qquad \hat{\beta}' = \hat{\beta} + n\bar{s},$$

where primes denote future periods. To compute the mean and the variance of c, note that

$$\begin{aligned}
E(c^k) &= \int_0^\infty c^k \frac{\hat{\beta}^{\hat{\alpha}} c^{-\hat{\alpha}-1} e^{-\frac{\hat{\beta}}{c}}}{\Gamma(\hat{\alpha})} dc \\
&= \frac{\hat{\beta}^{\hat{\alpha}}}{\Gamma(\hat{\alpha})} \int_0^\infty c^{k-\hat{\alpha}-1} e^{-\frac{\hat{\beta}}{c}} dc \\
&= \frac{\hat{\beta}^{\hat{\alpha}}}{\Gamma(\hat{\alpha})} \frac{\Gamma(\hat{\alpha}-k)}{\hat{\beta}^{\hat{\alpha}-k}} \int_0^\infty \hat{\beta}^{\hat{\alpha}-k} c^{-(\hat{\alpha}-k)-1} \frac{e^{-\frac{\hat{\beta}}{c}}}{\Gamma(\hat{\alpha}-k)} dc \\
&= \hat{\beta}^k \frac{\Gamma(\hat{\alpha}-k)}{\Gamma(\hat{\alpha})} = \hat{\beta}^k \frac{\Gamma(\hat{\alpha}-k)}{(\hat{\alpha}-1)....(\hat{\alpha}-k)\Gamma(\hat{\alpha}-k)} \\
&= \frac{\hat{\beta}^k}{(\hat{\alpha}-1)....(\hat{\alpha}-k)}.
\end{aligned}$$

This implies that

$$E(c|\Omega) = \frac{\hat{\beta}}{\hat{\alpha}-1},$$

$$E(c^2|\Omega) = \frac{\hat{\beta}^2}{(\hat{\alpha}-1)(\hat{\alpha}-2)}.$$

Hence, the variance is

$$Var(c|\Omega) = E(c^2|\Omega) - [E(c|\Omega)]^2 = \frac{\hat{\beta}^2}{(\hat{\alpha}-1)^2(\hat{\alpha}-2)}.$$

5.2 Proof Lemma 2.2

Lemma 5.1 *The variance of government policy,*

$$Var(x|\Omega) = Var\left(-\log(\epsilon + \theta e^{-\frac{1}{c}})\right), \tag{14}$$

is approximately equal to

$$Var(x|\Omega) \simeq \frac{\theta^2}{(\hat{\alpha}'-2)} \frac{e^{-\frac{2}{\hat{c}'}}}{\left(\epsilon + \theta e^{-\frac{1}{\hat{c}'}}\right)^2 \hat{c}'^2}, \tag{15}$$

where $\hat{c}'$ denotes the posterior mean of partisan conflict, $\hat{c}' = E(c|\Omega)$.

Proof 5.1 *A Taylor series expansion of $x(c)$ gives the approximation*

$$x(c) \simeq x(\hat{c}) + \frac{\partial x(\hat{c}')}{\partial \hat{c}}[c - \hat{c}'].$$

Taking the variance of both sides yields:

$$Var(x|\Omega) \simeq \left[\frac{\partial x(\hat{c}')}{\partial \hat{c}'}\right]^2 Var(c|\Omega). \tag{16}$$

We can compute $\frac{\partial x(\hat{c}')}{\partial \hat{c}'}$ *by taking the derivative of* $x(\hat{c}') = -\log(\epsilon + \theta e^{-\frac{1}{\hat{c}'}})$,

$$\frac{\partial x(\hat{c}')}{\partial \hat{c}'} = -\frac{\theta e^{-\frac{1}{\hat{c}'}}}{\epsilon + \theta e^{-\frac{1}{\hat{c}'}}}\frac{1}{\hat{c}'^2}. \tag{17}$$

Replacing eq. (5) and eq.(17) into eq. (16) yields expression 15. *Q.E.D.*

Using Lemma 5.1, we can see that

$$\frac{\partial Var(x|\Omega)}{\partial \hat{c}'} \simeq \frac{2\theta^2 e^{-\frac{2}{\hat{c}'}}}{(\hat{\alpha}' - 2)\left(\epsilon + \theta e^{-\frac{1}{\hat{c}'}}\right)^3 \hat{c}'^4}\left[\epsilon - \hat{c}'\left(\epsilon + \theta e^{-\frac{1}{\hat{c}'}}\right)\right].$$

Let ς denote the solution to

$$\epsilon - \varsigma\left(\epsilon + \theta e^{-\frac{1}{\varsigma}}\right) = 0.$$

Then,

$$\frac{\partial Var(x(c'))}{\partial \hat{c}'} \begin{cases} \geq 0 & \text{if} \quad \hat{c}' \leq \varsigma \\ < 0 & \text{if} \quad \hat{c}' > \varsigma \end{cases}.$$

Q.E.D.