ECONOMIC POLICY, MODEL UNCERTAINTY AND ELECTIONS

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We analyse a game theoretical model in which policy makers have superior knowledge about the working of the economy relative to voters. We show that parties increase their chances of reelection by basing their policies on the model that best fits in with their preferences. Moreover, we show that if parties care much about holding office, they may deliberately base their policies on a model that is electorally attractive, even if this model does not describe the working of the economy correctly. Our paper provides an explanation for the observation that different political parties subscribe to different economic philosophies.

Economists disagree. On almost every topic they produce a wide variety of models and they are rarely, if ever, able to show the superiority of one of them. Disagreement on the correct model of the economy may have important implications for economic policy. Frankel and Rockett (1988), for example, demonstrate that international policy coordination may be sub-optimal when governments in different countries have different perceptions of how the economy works (see also Ghosh and Masson, 1991 and Holtham and Hughes Hallett, 1992).

In recent years, the concept of model uncertainty has mainly been used in the international cooperation literature. However, within countries, discussions among policy makers about macro economic policy also tend to revolve around how the economy works (Schultze, 1989). Several authors have noted that different political parties subscribe to different economic philosophies. Tobin (1972), for instance, contends that in the early seventies conservatives were often monetarists and liberals Keynesians. Harris (1961) and Tufte (1978) notice that in the United States, Republicans show much more faith in the invisible hand than Democrats. Christodoulakis and van der Ploeg (1987) observe a similar phenomenon in Great Britain. It is striking that these authors observe a relationship between the political positions of political parties and their views on how the economy works. This indicates that model selection contains a political element.

In virtually all existing studies on model uncertainty the political element in choosing an economic philosophy is ignored. Frankel and Rockett (1988) take policy makers' beliefs as to how the economy works as exogenous. In Ghosh and Masson (1991), policy makers' beliefs are endogenous in the sense that they are updated in a Bayesian manner when new information about the economy

becomes available. However, they do not provide an explanation for the existence of diverging views on the working of the economy.

Recently, political economic studies have not paid much attention to model uncertainty. The usual assumption is that economic and political agents all share a common economic model. There are two exceptions. The first is the paper by Harrington (1993). Harrington's model revolves around voters caring about income, and policy makers caring about income and holding office. The key feature of the model is that voters differ in their prior beliefs as to how policy affects income. These prior beliefs are updated when new information about the economy becomes available. Unlike voters, policy makers are dogmatic: their beliefs as to how the economy works do not change over time. Though policy makers' beliefs are private information, voters can make inferences about them from past policies. Harrington shows that in this setting, the policy maker in office is inclined to implement policy that is well received by voters, rather than policy that in his view maximizes income. One of the virtues of Harrington's paper is that it provides insight into how model uncertainty may lead to strategic behaviour of the incumbent. However, the model cannot explain the phenomenon observed above that different political parties subscribe to different economic philosophies. In fact, Harrington shows that when parties' economic philosophies differ ex ante, they tend to converge ex post.

The second exception is a model developed by Roemer (1994) in which two political parties representing different groups in society compete by announcing a policy and an economic theory when voters are uncertain about how the economy works. Under the assumption that voters' perception of the working of the economy is affected by policy makers' announcement of the economic theory to which they subscribe and that political parties are fully informed about voters' preferences, Roemer shows that the policies announced by parties fully converge but that the parties announce different economic theories. The model employed in this paper deviates from Roemer's model in that we focus on policies rather than on announcements and explicitly model how voters update their beliefs about how the economy works when new information becomes available.

This paper analyses the implications of asymmetric information about how the economy works for partisan policies. We develop a two-period model in which political parties possess an information advantage about the efficacy of policy. There exist two models of the economy. At the beginning of the game ''nature'' draws a model, being the correct model of the system in both periods. This model is revealed to the parties, but not to the voters. At the end of period 1 elections are held. Voters, being heterogenous in their preferences over economic goals but having the same prior beliefs as to how the economy works, do not observe economic outcomes and are therefore uncertain about the working of the system when casting their ballots. As a consequence, election outcomes depend on voters' beliefs about the efficacy of policy. Due to this, the policy maker has an incentive to make voters believe in one of the models of the

economy. For example, a policy maker who attaches high costs to inflation and low costs to unemployment wants voters to believe in a model which predicts that inflation has no impact on unemployment. Voters can make inferences about the working of the system from policy in period 1. This enables the incumbent to affect voters' beliefs by basing policy in period 1 on the "desired" model, rather than on the correct model. If the policy maker's incentive to increase his chances of reelection is strong enough, he will base policy on the model which best fits in with his preferences.

This paper is organized as follows. The next section presents the model. This model is related to the model developed by Alesina and Cukierman (1990). There are two political parties which have different preferences over economic goals, because they represent different constituencies (see also Hibbs, 1977). Voters are modelled as rational forward-looking agents. In contrast to Alesina and Cukeriman (1990), voters are uncertain about how the economy works, rather than about the policy maker's preferences. In addition, our model differs from previous studies in that policy makers cannot costlessly implement their most desired policies, because they are constrained by the actions of other political agents, like bureaucrats and Congress. Thus in our model, policy makers are not fully flexible in choosing policy as in Alesina and Cukierman, but they are more flexible than the policy makers in Harrington's model in which the incumbent can only choose between two policy alternatives. In section 3, we analyse the optimization problem the incumbent faces in period 1. We show that by basing policy on the "wrong" model of the economy, the incumbent party may increase its chances of reelection. Section 4 discusses the possible equilibria of the model. We show that if policy makers attach a high value to being in office a pooling equilibrium exists in which different political parties adopt different views of the economy. Section 5 concludes this paper.

1. THE MODEL

We consider a two-party system, with party ℓ and r, which lasts two periods. In the first period party ℓ is in office. At the beginning of the second period elections are held after which the winning party takes office. The parties care about two interrelated issues, x which also serves as instrument variable and y, as well as about being in office. In addition, in conducting policy, parties are constrained. They attach costs to deviations of the instrument variable from a benchmark, x_c. Due to this, the governing party cannot costlessly implement its most desired policy. Parties' utility functions are additively separable in utility received from x and y, holding office and deviations of x from x_c. If a party were not interested in holding office, its utility would be given by the following linear-quadratic function:

$$U_i = -\sum_{t=1}^{2} q^{t-1} \cdot \left\{ \alpha \cdot (y_t + \frac{1}{2} \cdot \beta_i x_t^2) + (1-\alpha) \cdot \frac{1}{2} \cdot (x_t - x_c)^2 \right\} \tag{1}$$

$$o < q \leqslant 1, 0 < \alpha < 1, \beta_i > 0$$

where β_i measures the costs party i attaches to x^2 relative to y, q is the discount factor and t is a time index. The last term of (1) implies that parties are constrained in implementing policy. Though this feature of the model is rather unconventional, it seems plausible for most economic and political settings. There are various possible interpretations of this term. One interpretation pertains to the problem of executing policy. In most, if not all, countries, the governing party does not completely control the apparatus of the state. In this context, the role of bureaucrats is well-known. A straightforward interpretation is that x_c represents the policy most desired by bureaucrats and that α is an inverse measure of the extent to which the incumbent party is able to control (or monitor) bureaucrats. Alternatively, x_c may represent the policy most preferred by other political agents, such as Congress members (cf. Alesina and Rosenthal, 1989), foreign policy makers (international agreements) or the central bank. In this setting, α may serve as a measure of bargaining power.

We have deliberately ignored the possibility that $x_c = x_{t-1}$, indicating that policy makers attach costs to deviating policy from the status quo, which can be motivated by for instance uncertainty concerning distributive effects of policy (cf. Fernandez and Rodrik, 1991). The reason for abstaining from this additional source of dynamics is that we want to focus on the strategic implications of policy for the beliefs of voters regarding the working of the economy. Allowing $x_c = x_{t-1}$ would complicate the analysis in two ways. First, the incumbent has an incentive to constrain the policy range for the future policy maker. This issue has been treated by for example Tabellini and Alesina (1990) and Cukierman, Edwards and Tabellini (1992). Secondly, as we will show later x_c affects voter behaviour. If $x_c = x_{t-1}$ then a policy maker may affect his reelection prospects by choosing an appropriate value for x. This incentive arises as a result of a policy maker's desire to attract votes by means of choosing a middle of the road platform. This aspect has been discussed in the literature dealing with spatial voting models.

The precise interpretation of x_c is not the focus of this paper. What matters is that ''political'' costs may induce parties not to implement the policy they desire from an ideological and/or opportunistic point of view. We assume that (1) gives utility of party i regardless of whether it is in office or not.[1]

Following Hibbs (1977) and Alesina (1987) we assume that the two parties represent different constituencies, so that they attribute different costs to x^2. Throughout this paper, it is assumed that party r attributes higher costs to x^2 than party ℓ ($\beta_r > \beta_\ell$). The linear-quadratic specification of the utility function is common in models of model uncertainty (cf. Frankel and Rockett, 1988; Ghosh

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[1] The assumption that both the party in office and the opposition party attach costs to deviations of x_t from x_c is made for mathematical simplicity. However, replacing this assumption with the assumption that only the party in office attaches costs to deviations of x_t from x_c does not alter our results qualitatively (Swank, 1997).

and Masson, 1991 and Holtham and Hughes Hallett, 1992) and is adopted for mathematical convenience.

As mentioned above, the issues x and y are interrelated. There exist two models describing the relationship between x and y:

$$\text{model 1: } y_t = r_1 \cdot x_t + s_1 \quad r_1 < 0 \tag{2}$$
$$\text{model 2: } y_t = r_2 \cdot x_t + s_2 \quad r_1 < r_2 < 0. \tag{3}$$

Because of periodic regime switches, in some periods the (economic) system is described by model 1, and in other periods by model 2. The parameters of the models are fixed and common knowledge. The assumption that $r_1 < r_2 < 0$ is made to facilitate the discussion of the results, but does not alter the conclusions of this paper qualitatively.[2] What matters is that $r_1 \neq r_2$. The parameters s_1 and s_2 can be interpreted as exogenous effects on y_t, but do not play a role in the model. At the beginning of period 1, before x_1 is chosen, nature draws a model which will describe the relationship between x and y over the whole game. Thus if nature draws model 1, the working of the economy will be described by equation (2) for both period 1 and 2. The *a priori* probability that model 1 is chosen is ρ_1 and the *a priori* probability that model 2 is chosen is $(1 - \rho_1)$. One of the key features of our model is that parties possess an information advantage about the relationship between x and y compared to voters. To model that parties have superior knowledge concerning the working of the economy, we assume that parties know which model is drawn, or to put it differently, which model is "correct", while voters only know the *a priori* probabilities that each model is correct. At election time, voters do not know the realisation of y_1. Due to this, they cannot infer information about the working of the economy by just comparing x_1 and y_1.[3]

Except for the efficacy of policy, voters are fully informed at election time: they know parties' utility functions, the parameters of the two models and that the parties possess private information about the relationship between x and y. Voters may make inferences about the working of the economy on the basis of policy in period 1. We assume that the incumbent party has to base its policy, x_1, on either model 1 or model 2 (see section 3). Due to this the policy maker has a discrete choice set. This assumption is made for reasons of tractability. One way of looking at this action space is that policy makers rely on policy advisors and that two types of advisors exist. The first type of advisor bases his advice on model 1 and the second type on model 2. Since voters know the optimization problem the governing party faces, they are able to determine whether the observed x_1 is based on model 1 or model 2. Alternatively, in the advisor setting

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[2] As it will be shown later, the assumption that r_1 and r_2 are negative implies that x_t is always positive. In line with this, we assume $x_c > 0$

[3] Without affecting the results of this paper qualitatively, this assumption can be replaced with the assumption that voters only observe economic outcomes. What matters is that voters cannot infer information about the economy by just comparing x_1 and y_1.

voters observe the type of advisor consulted by the policy maker. However, voters remain uncertain about the working of the economy, since the party in office may try to fool voters, e.g. by basing policy on model 1, when model 2 is correct. In the next section, we will argue that in equilibrium party ℓ has no incentive to base policy in period 1 on model 2 if model 1 is correct. Analogously, party r has no incentive to signal the "wrong" model if model 2 is correct. Let π be a shift variable taking the value 1 if model 1 is correct and taking the value 0 if model 2 is correct. Furthermore, let $x_1(1)$ $(x_1(0))$ be the policy party ℓ follows in period 1 when its policy is based on model 1 (2) and p be the probability assigned by voters to the event that party ℓ bases its policy on model 1 when model 2 is correct. Under the above assumptions, Bayes' rule suggests that voters should revise their prior beliefs about the working of the economy, ρ_1, according to

$$\rho_2 = \text{Prob (model 1 is true: } x_1) = \frac{\rho_1 \cdot \text{Prob } (x_1 \text{: model 1 is true)}}{\text{Prob } (x_1)}. \quad (4)$$

where ρ_2 is the posterior probability that model 1 is correct. We assume that $x_1(1)$ is a better policy to convince voters that model 1 is valid than $x_1(0)$. As we will show in section 3 this assumption implies that if $x_1 = x_1(1)$ is observed then

$$\rho_2 = \frac{\rho_1}{\rho_1 + (1 - \rho_1) \cdot p} \quad (5)$$

and if $x_1 = x_1(0)$ is observed then $\rho_2 = 0$.

In making their vote decisions, voters are rational, forward-looking agents: they cast their ballots for the party which offers them highest expected utility. Like parties, their preferences over x and y are represented by linear-quadratic utility functions. Unlike parties, voters do not attach costs to deviations of x_t from x_c. As mentioned before, the third term in (1) represents a (political) constraint which is only relevant for parties. Let $x_{2,i}$ and $y_{2,i}$ denote the values of x_2 and y_2, respectively, if party i is elected. Voter j's expected utility derived from party i's policy in the second period can be written as:

$$U_j^i = E\left(- y_{2,i} - \frac{1}{2} \cdot \beta_j \cdot x_{2,i}^2 \right) \quad (6)$$

where $E(\cdot)$ is the expectations operator and β_j is the preference weight voter j attributes to x^2 relative to y. Voter j casts his ballot for party ℓ if

$$E\left(- y_{2,\ell} - \frac{1}{2} \cdot \beta_j \cdot x_{2,\ell}^2 \right) - E\left(- y_{2,r} - \frac{1}{2} \cdot \beta_j \cdot x_{2,r}^2 \right) > 0 \quad (7)$$

implying

$$\beta_j < 2 \cdot \left\{ \frac{E(y_{2,\ell}) - E(y_{2,r})}{E(x_{2,r}^2) - E(x_{2,\ell}^2)} \right\} := T \quad (8)$$

Equation (8) implies that every voter j with $\beta_j < T$ votes for party ℓ. The value T depends on voters' beliefs about the working of the economy (through $y_{2,i}$) and on the expectation of the squared value of $x_{2,i}$. Voters are assumed to be fully rational. Hence expectations are based on their knowledge about the optimization problem parties face, if elected in period 2. In period 2, the party in office does not face an electoral constraint. As a consequence, the dominant strategy of the incumbent simply results from maximizing utility it receives from $x_{2,i}$ and $y_{2,i}$, subject to the correct model of the economy. Hence, in period 2, $x_{2,i}$ becomes:

$$x_{2,i} = \frac{(1-\alpha) \cdot x_c - \alpha \cdot [\pi \cdot r_1 + (1-\pi) \cdot r_2]}{(1-\alpha) + \alpha \cdot \beta_i} := x_{2,i}(\pi). \tag{9}$$

Since $\beta_\ell < \beta_r$, $x_{2,\ell}(\pi) > x_{2,r}(\pi)$. Using (2), (3) and (9), $y_{2,i}$ becomes

$$y_{2,i} = [\pi \cdot r_1 + (1-\pi) \cdot r_2] \cdot x_{2,i}(\pi) + \pi \cdot s_1 + (1-\pi) \cdot s_2 := y_{2,i}(\pi) \tag{10}$$

Voters know that period 2 policy is based on $x_{2,i}(\pi)$ and that economic outcomes in the second period are given by $y_{2,i}(\pi)$. However, voters do not know the actual value of π. The optimal forecast of π results from Bayes' rule (see equation 5). Hence, π is 1 with probability ρ_2 and π is 0 with probability $(1 - \rho_2)$. Therefore[4]

$$E(y_{2,i}) = \rho_2 \cdot y_{2,i}(1) + (1 - \rho_2) \cdot y_{2,i}(0) \tag{11}$$

and

$$E(x_{2,i}^2) = \rho_2 \cdot x_{2,i}^2(1) + (1 - \rho_2) \cdot x_{2,i}^2(0) \tag{12}$$

Using (8), (11) and (12) it is easy to derive that voter j casts his ballot for party ℓ if

$$\beta_j < 2 \cdot \left\{ \frac{\rho_2 \cdot r_1 \cdot [x_{2,\ell}(1) - x_{2,r}(1)] + (1 - \rho_2) \cdot r_2 \cdot [x_{2,\ell}(0) - x_{2,r}(0)]}{\rho_2 \cdot [x_{2,r}^2(1) - x_{2,\ell}^2(1)] + (1 - \rho_2) \cdot [x_{2,r}^2(0) - x_{2,\ell}^2(0)]} \right\} = T \tag{13}$$

Substitution of (9) for $i = \ell$ and r into (13) leads after tedious but straightforward algebra to

$$T = -2 \cdot \left\{ \begin{array}{c} \frac{\rho_2 \cdot r_1 \cdot [(1-\alpha) \cdot x_c - \alpha \cdot r_1] + (1 - \rho_2) \cdot r_2 \cdot [(1-\alpha) \cdot x_c - \alpha \cdot r_2]}{\{\rho_2 \cdot [(1-\alpha) \cdot x_c - \alpha \cdot r_1]^2 + (1 - \rho_2) \cdot [(1-\alpha) \cdot x_c - \alpha \cdot r_2]^2\} \cdot *} \\ \{(1 - \alpha + \alpha \cdot \beta_\ell)^{-1} + (1 - \alpha + \alpha \cdot \beta_r)^{-1}\} \end{array} \right\} \tag{14}$$

Voters are heterogenous. They differ in the preference weight they attribute to x. We assume that there is a continuum of voters in terms of β_j. Let β_m denote the preference weight of the median voter. Equation (13) indicates that if $\beta_m < T$,

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[4] Recall that the parameters r_1, r_2, s_1 and s_2 are assumed to be fixed and known.

party ℓ wins the elections and that if $\beta_m > T$, party r wins the elections. In this setting parties need only be concerned with the preference weight of the median voter, β_m. However, β_m is not known with certainty, but randomly distributed over the interval $[0, \infty)$ with probability density function $f(\beta_m)$. The statistical properties of β_m are common knowledge. Using the statistical properties of β_m, the probability that party ℓ wins the elections equals:[5]

$$P_\ell = P_\ell(\rho_2) = \int_0^T f(\beta_m) d\beta_m \qquad (15)$$

As in Alesina (1988), the probability function, P_ℓ, exhibits the usual features of spatial voting models: (1) $0 \leqslant P_\ell \leqslant 1$ and (2) $(\partial P_\ell)/(\partial \beta_\ell) > 0$ and $(\partial P_\ell)/(\partial \beta_r) > 0$. The second feature implies that if the preference parameter of one party moves towards the preference parameter of the other party, it increases its chances of winning the elections.

The probability P_ℓ depends on the beliefs that voters hold about the working of the economy. To see this, differentiate (15) with respect to ρ_2, which yields:

$$\frac{\partial P_\ell}{\partial \rho_2} = \frac{(r_2 - r_1) \left\{ \dfrac{(1 - \alpha) \cdot x_c}{(1 - \alpha) + \alpha \cdot \beta_\ell} + \dfrac{(1 - \alpha) \cdot x_c}{(1 - \alpha) + \alpha \cdot \beta_r} \right\}}{[x_{2,\ell}(1) - x_{2,r}(1)] \cdot [x_{2,\ell}(0) - x_{2,r}(0)] \cdot D^2} \cdot 2 \cdot f(T) \qquad (16)$$

where

$$D = \rho_2 \cdot [x_{2,r}^2(1) - x_{2,\ell}^2(1)] + (1 - \rho_2) \cdot [x_{2,r}^2(0) - x_{2,\ell}^2(0)]$$

Equation (16) shows that if political costs are absent, $\alpha = 1$, then $(\partial P_\ell)/(\partial \rho_2) = 0$. In that case the probability that party ℓ wins the elections is independent of which model is correct and only depends on the preference weights voters and parties attribute to x_2^2. Hence, in the absence of political costs, voters need not to be concerned with the working of the economy and need only to compare their preferences with parties' preferences.

However, if political costs are present $(0 < \alpha < 1)$, P_ℓ depends on voters' perception of the working of the economy as can be seen from (16). Since $r_2 - r_1 > 0$ and $x_{2,\ell}(\pi) > x_{2,r}(\pi)$, $(\partial P_\ell)/(\partial \rho_2) > 0$. Hence, the higher voters' belief that model 1 is correct, the higher is the probability that party ℓ wins the elections. To understand this result, suppose that some voter, say voter v, would be indifferent to party ℓ and r if model 2 were the correct model of the economy. This implies that voter v's bliss point, x_v, lies exactly between the policies party ℓ and r are expected to follow: $|x_{2,\ell}^e - x_v| = |x_v - x_{2,r}^e|$. Now suppose that model 1 turns out to be the correct model. Due to this, voter v's bliss point and $x_{2,i}$ rise. But since parties are constrained in implementing their most desired policies (equation 9), voter v's bliss point increases more than $x_{2,i}^e$. This implies that

[5] We ignore the non interesting cases $P_\ell = 1$ and $P_\ell = 0$.

under model 1 $|x_{2,\ell}^e - x_v| < |x_v - x_{2,r}^e|$. Thus voter v who is indifferent to party ℓ and r if model 2 is correct, votes for party ℓ if model 1 holds.

1.1   An Example

Above we have discussed the basic ingredients of our framework. Because we believe that the basic idea behind our model is relevant for several policy issues where policy makers face a trade-off between two objectives (equity–efficiency, public activity–private activity, economic growth–environmental protection, etc.) we have not yet labelled x and y. In this section we discuss the plausibility of the main assumptions underlying our model when it is applied to stabilization policy.

Let y denote unemployment and x denote inflation, so that (1) relates policy makers' utility to unemployment and inflation, and (2) and (3) describe two conflicting views of the Phillips curve. As to the utility function, three assumptions are important. First, political parties and voters differ in their preferences over economic goals. This assumption is a point of departure of partisan models of stabilization policy (Hibbs, 1977 and Alesina, 1987). In partisan models, political parties promote the interests of their core constituencies. Applied to the U.S., the core constituencies of the Democratic party consist of lower income groups and those of the Republican party consist of higher income groups. Individuals differ in their preferences over inflation and unemployment because macroeconomic fluctuations have distributional effects. Lower income groups particularly suffer from unemployment while higher income groups particularly suffer from inflation. Various authors report evidence supporting the partisan theory of stabilization policy. Unemployment tends to be higher under Republican administrations and inflation tends to be higher under Democratic administrations (see Alesina and Rosenthal, 1995 for a survey of this literature).

The second assumption is that voters are aware of political parties' preferences. There are two reasons why we believe they are. First, Swank (1993 and 1995) finds strong support for voter models, in which voters are assumed to take political parties' preferences into account when casting their ballots. The second reason is that political parties are not unambiguous about their preferences. Tufte (1978) compares the rate of usage of "unemployment" and "inflation" in the Economic Report of the president. In reports of Democratic presidents "unemployment" is used twice as often as "inflation", while in reports of Republican presidents "inflation" is mentioned 1.7 times as often as "unemployment".

The third assumption is that political parties are constrained in implementing policy. This assumption seems also consistent with empirical work. In a partisan model without a policy constraint the economy would jump from one point on the Phillips curve to another point. This is not what empirical work usually reports. Reduced form equations of unemployment (or inflation) include lagged terms which indicates that the economy gradually moves along the Phillips

curve. In line with this, Siebrand and Swank (1994) reject a partisan model without adjustment costs of changing policy instruments against a model with adjustment costs.

As to the economic constraints, two assumptions are essential. The first assumption is that model uncertainty exists. Globally model uncertainty can be interpreted in two ways. First, reality is too complex to be captured by a single model. The effects of economic policy depend on the state of the economy. For example, in recessions the effect of expansionary policy on unemployment may be larger than in economic booms.[6] Alternatively, there exist competing models of the economy and there is no consensus about which model is correct. Economic theory indeed offers various conflicting views of the Phillips curve. Some theories suggest that there is a potential role for the government of stabilization of real variables, while other theories imply that all policy makers' attempts to stabilize unemployment are doomed to fail. Among professional economists the dominant view of the Phillips curve has changed over time. Because consensus has not been reached yet, economists' views will probably change in the future as well. In principle, the spirit of our model fits with both interpretations of model uncertainty. What is important is that the policy maker is better informed about the state of the economy or better informed about the dominant view among economists concerning the Phillips curve than voters.

The second assumption as to the economic constraints is that voters are not able to infer the correct model of the economy from contemporaneous outcomes. In our model it is assumed that voters observe the policy selected but not outcomes. This assures that voters remain uncertain about the working of the economy as time elapses. Likewise, we could have assumed that voters observe outcomes, but not policies. Macroeconomic studies suggesting that aggregate demand policy affects inflation and unemployment with different lags abound. The usual finding is that expansionary policy affects inflation two years later than unemployment.

Above we have tried to show that the basic framework of our theoretical model can be applied to stabilization policy. Let us now elaborate upon the main message of our paper. The basic point we try to make is that in a partisan world the selection of a model to base policy on contains a strategic element. The idea is simple. In a partisan world, the policies supplied by political parties differ. In our example, the left wing party pursues more expansionary policy than the right wing party. In order to win the elections, parties have to sell their policies to voters. Apart from preferences, the desirability of policies depends on the structure of the economy. For example, if voters believe that the Phillips curve is flat, the demand for expansionary policy will be low. Due to this, the right wing party in our model, has an incentive to make voters believe that expansionary policy has adverse effects. Likewise, the left wing party wants to convince the electorate, that expansionary policy has favourable effects. The question remains

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[6] This interpretation has been suggested by a referee.

how political parties can make voters believe in a specific model of the economy. Of course parties may announce their views of the economy. However, such announcements are hardly credible as rational voters will understand the background of such announcements. Policy makers' announcements become credible (at least to some extent) if their actions are consistent with their announcements. Thus a right wing policy maker may make voters believe in a flat Phillips curve if his policy is based on a flat Phillips curve. Obviously, if the Phillips curve is not flat, such a strategy involves costs, because policy is based on the wrong model. Whether or not the policy maker adheres to a specific model of the economy depends on whether these costs exceed the electoral benefits. The conditions under which political parties adhere to a specific model are examined in the next section.

2. THE OPTIMIZATION PROBLEM

In period 1, party ℓ faces the problem of choosing between $x_1(1)$ and $x_1(0)$. This choice is determined by the following optimization problem:

$$\max: W_1 + W_2 \tag{17}$$

with respect to x_1, subject to (15), where

$$W_1(x_1) = -\pi \cdot \alpha \cdot (r_1 \cdot x_1 + s_1) - (1-\pi)\alpha \cdot (r_2 \cdot x_1 + s_2)$$
$$-\frac{1}{2} \cdot \alpha \cdot \beta_\ell \cdot x_1^2 - (1-\alpha) \cdot \frac{1}{2} \cdot (x_1 - x_c)^2 + \lambda \tag{18}$$

$$W_2(x_1) = q \cdot \left\{ P_\ell \cdot [-\pi \cdot \alpha \cdot (r_1 \cdot x_{2,\ell} + s_1) - (1-\pi) \cdot \alpha \cdot (r_2 \cdot x_{2,\ell} + s_2) \right.$$
$$-\frac{1}{2} \cdot \alpha \cdot \beta_\ell \cdot x_{2,\ell}^2 - (1-\alpha) \cdot \frac{1}{2} \cdot (x_{2,\ell} - x_c)^2] + [1 - P_\ell] \cdot [-\pi \cdot \alpha \cdot (r_1 \cdot x_{2,r} + s_1)$$
$$\left. - (1-\pi) \cdot \alpha \cdot (r_2 \cdot x_{2,r} + s_2) - \frac{1}{2} \cdot \alpha \cdot \beta_\ell \cdot x_{2,r}^2 - (1-\alpha) \cdot \frac{1}{2} \cdot (x_{2,r} - x_c)^2] + \lambda \cdot P_\ell \right\}. \tag{19}$$

The parameter $\lambda(\lambda > 0)$ measures utility that party ℓ receives from holding office. W_1 is period 1 utility, W_2 is period 2 utility and $\pi \in \{0, 1\}$. Period 1 utility is simply the sum of utility party ℓ receives from x_1 and y_1, the costs attached to deviations of x_1 from x_c and utility received from holding office. Since, by assumption party ℓ is in office in period 1, λ in (18) can be ignored in solving the optimization problem. Equation (19) describes *expected p*eriod 2 utility, since in period 1 election outcomes are uncertain. Expected period 2 utility that party ℓ receives from x and y is given by the utility it receives from its own policy times the probability that it is elected plus the utility it receives from $x_{2,r}$ times the probability that party r is elected. $\lambda \cdot P_\ell$ denotes the expected utility that party ℓ receives from holding office.

To ensure time consistency, (17) is maximized with respect to x_1 given the optimal policies in period 2, $x_{2,i}$. Equation (9) shows that policy in period 2 is independent of x_1. Hence, x_1 only affects period 2 utility through its effects on P_ℓ. Due to this, we can simplify (19) by omitting the terms which are not multiplied by P_ℓ and are irrelevant for the optimization problem. We obtain after some algebra:

$$W'_2 = q \cdot P_\ell \cdot \left\{ -[\pi \cdot \alpha \cdot r_1 + (1 - \pi) \cdot \alpha \cdot r_2 - (1 - \alpha) \cdot x_c] \cdot (x_{2,\ell} - x_{2,r}) \right.$$
$$\left. - \left[\frac{1}{2} \cdot \alpha \cdot \beta_\ell + \frac{1}{2} \cdot (1 - \alpha) \right] \cdot (x_{2,\ell}^2 - x_{2,r}^2) + \lambda \right\} = q \cdot P_\ell \cdot (Z + \lambda).$$

(20)

Z denotes the difference between party ℓ's economic utility when party ℓ is in office and party ℓ's economic utility when party r is in office. Since, in our model, party ℓ always prefers its own policy to party r's policy, Z is always positive.

If in the above optimization problem, voters had known the correct model, π, policy in period 1 would not affect period 2 utility, so that the dynamic optimization problem could be split into two static optimization problems. Hence, party ℓ would base x_1 on the correct model as in (9). In the above optimization problem, period 1 policy affects period 2 utility through its effect on P_ℓ. In the previous section, we have shown that the higher voters' posterior belief that model 1 is correct, the higher is the probability that party ℓ wins the elections. Thus party ℓ increases its chances of reelection if it makes voters believe that model 1 is the correct model of the economy, even if model 2 holds.

A similar optimization problem could be formulated if party r were assumed to be in office in period 1. However, equation (16) indicates that the higher voters' posterior belief that model 1 is correct the lower is the probability that party r wins the elections. As a consequence, party r has an incentive to make voters believe that model 2 is correct and may benefit from basing policy on model 2 even if model 1 is correct.

3. EQUILIBRIA

Our model belongs to the class of signalling games. In our game there are two kinds of players: a sender and receivers of a message. The incumbent party plays the role of sender by choosing a message x_1, to inform voters, who are the receivers, about economic reality. There are two possible types that may characterize a policy maker in period 1. These types correspond with the actual model of the economy which is drawn by nature. A type 1 (2) policy maker is incumbent if nature has drawn model 1 (2).

We assume that there are two possible actions for the incumbent. The first is basing policy on model 1, $x_1(1)$. The second is basing policy on model 2, $x_1(0)$. There exist two distinct information sets. The first corresponds to $x_1(1)$. Voters'

beliefs ρ_2 are defined as σ in this case. The second information set corresponds to $x_1(0)$. If policy is based on model 2 then voters' posterior beliefs are described by μ. Below, the values of σ and μ are determined.

As it is usual in this type of signalling games we can distinguish three types of perfect Bayesian equilibria which occur depending on the parameter values of the model. First, a separating equilibrium characterizes a situation where each type of sender bases policy on a different model. Secondly, a pooling equilibrium holds when both types base policy on the same economic model. Finally, a hybrid equilibrium occurs when one of the types randomizes between basing policy on model 1 and on model 2. A perfect Bayesian equilibrium requires that the players' strategies are optimal given their type, given the equilibrium strategies of the other players and given their beliefs concerning the working of the economy. In addition, voters' beliefs are updated according to Bayes' rule (see equation 5).

3.1 Equilibria in pure strategies

Since the strategy space of the policy maker consists of $x_1(1)$ and $x_1(0)$, there are four possible pure strategies which may be part of a perfect Bayesian equilibrium. Before mentioning them, we introduce some notation. The expression $\{a; b\}$ means that if model 1 is drawn by nature then the incumbent implements policy a and if model 2 is drawn, the policy maker implements policy b.

There are two strategies which possibly satisfy the characteristic of a pooling equilibrium. These are $\{x_1(1); x_1(1)\}$ and $\{x_1(0); x_1(0)\}$. Two strategies may fulfil the condition of a separating equilibrium. These are given by $\{x_1(1); x_1(0)\}$ and $\{x_1(0); x_1(1)\}$.

3.1.1 Separating with $\{x_1(1); x_1(0)\}$.
If this is an equilibrium the policy maker always bases policy on the correct model, since the strategy $\{x_1(1); x_1(0)\}$ means that if model 1 is drawn the policy maker bases policy on model 1, and if model 2 is correct the incumbent bases policy on model 2. If in a separating equilibrium voters observe that policy is based on model 1 (2) they know that model 1 (2) is valid. Thus, $\sigma = 1$ and $\mu = 0$. Let us consider when the strategy $\{x_1(1); x_1(0)\}$ is a separating equilibrium in two steps.

First suppose that model 2 is valid ($\pi = 0$). In this case a trade-off exists between economic utility and popularity, because $x_1(0)$ is optimal for first period economic utility but yields a lower chance of reelection. The action $x_1(0)$ is optimal if:

$$W_1(x_1(1)|\pi = 0) + W_2(\rho_2 = 1|\pi = 0) < W_1(x_1(0)|\pi = 0) + W_2(\rho_2 = 0|\pi = 0)$$

$$(21)$$

or equivalently if

$$W_2(\rho_2 = 1|\pi = 0) - W_2(\rho_2 = 0|\pi = 0) < W_1(x_1(0)|\pi = 0) - W_1(x_1(1)|\pi = 0)$$

(22)

The costs of basing policy on model 1 if model 2 is valid, C, are given by the right hand side of equation (22) and measure the difference between period 1 utility received from policy based on model 2 and period 1 utility received from policy based on model 1, given that model 2 is correct. Using (18), (22) and

$$x_1(1) = \frac{(1-\alpha) \cdot x_c - \alpha \cdot r_1}{(1-\alpha) + \alpha \cdot \beta_\ell}$$

(23)

and

$$x_1(0) = \frac{(1-\alpha) \cdot x_c - \alpha \cdot r_2}{(1-\alpha) + \alpha \cdot \beta_\ell}$$

(24)

we obtain after tedious, but straightforward algebra:

$$C = \frac{\frac{1}{2} \cdot \alpha^2 \cdot (r_1 - r_2)^2}{(1-\alpha) + \alpha \cdot \beta_\ell}.$$

(25)

From (25), it is easy to see that the more r_1 deviates from r_2, the higher are the costs of basing policy in period 1 on the wrong model.

The benefits from basing policy on model 1 if model 2 is correct, B_s, are equal to the left hand side of equation (22). Using (20) it follows that

$$\begin{aligned}
B_s &= q \cdot (Z + \lambda) \cdot [P_\ell(\rho_2|x_1(1)) - P_\ell(\rho_2|x_1(0))] \\
&= q \cdot (Z + \lambda) \cdot [P_\ell(\rho_2 = 1) - P_\ell(\rho_2 = 0)].
\end{aligned}$$

(26)

Thus, B_s is equal to the difference between the utility party ℓ receives under party ℓ and r in period 2 times the increase in the probability that party ℓ wins the elections. We see that if $C > B_s$ then basing policy on model 2 if model 2 is valid is optimal.

Secondly, suppose that model 1 is valid. It is evident that in this case no trade off exists between economic utility and electoral gains, since $x_1(1)$ does not yield economic costs and $x_1(0)$ does not yield political benefits. In section 1 we have shown that the higher ρ_2 the higher P_ℓ. If, $x_1(0)$ is implemented, then $\rho_2 = \mu = 0$. Hence, $x_1(0)$ would yield economic costs associated with basing policy on the wrong model and reduce the policy maker's chance of reelection. As a consequence, $x_1(1)$ is optimal if model 1 holds.

It is straightforward to show that $C > B_s$ is a sufficient condition for this equilibrium. We may conclude that $\{x_1(1); x_1(0)\}$ and the beliefs $\mu = 0$ and $\sigma = 1$ form a separating equilibrium, if and only if $C > B_s$.

3.1.2 Separating with $\{x_1(0); x_1(1)\}$. The strategy $\{x_1(0); x_1(1)\}$ implying $\sigma = 0$ and $\mu = 1$ cannot be a perfect Bayesian equilibrium, because by basing policy on

model 1 if model 2 is valid, the policy maker incurs costs by basing policy on the wrong economic model, and by reducing his chances of reelection.

3.1.3 Reasonable Beliefs.

In what follows we restrict attention to beliefs that are considered to be reasonable. As is usually the case, pooling equilibria may exist with beliefs that are counterintuitive. For instance, in principle one cannot eliminate *a priori* out-of-equilibrium beliefs with the feature that $x_1(0)$ is a better policy than $x_1(1)$ to convince voters that model 1 is true. However, this situation does not seem very realistic. Therefore, we employ a monotonicity assumption regarding the belief function ρ_2, which determines voters' perception of the working of the economy:

$$\text{Monotonicity Assumption (MA): } \sigma \geqslant \mu$$

This assumption implies that $x_1(1)$ is at least as good as $x_1(0)$ to persuade voters that model 1 is valid. Due to the (MA) voters should believe that policy $x_1(0)$ will not be chosen by party ℓ if model 1 is valid, because $x_1(0)$ yields a cost by basing policy on the wrong economic model. Furthermore, the (MA) implies that $x_1(0)$ yields a lower probability of reelection than $x_1(1)$. Therefore, if model 1 is valid policy $x_1(1)$ strictly dominates $x_1(0)$ for party ℓ, given that voters act optimally subject to their beliefs about the working of the economy. As a consequence, when voters observe that party ℓ bases policy on model 2 and chooses $x_1(0)$, they know that model 1 cannot be valid. Then, voters should put zero probability on the occurrence of model 1.

3.1.4 Pooling with $\{x_1(1); x_1(1)\}$.

We have just argued that if model 2 is valid then basing policy on a model which does not necessarily describe the actual working of the economy yields electoral benefits, since implementing $x_1(1)$ increases the chances of reelection. This type of behaviour occurs if a pooling equilibrium for the strategy $\{x_1(1); x_1(1)\}$ exists so that the policy maker bases policy on model 1 even if model 2 is correct. Let us first derive a necessary condition for this pooling equilibrium. If $\{x_1(1); x_1(1)\}$ is an equilibrium strategy then voters cannot extract information about the working of the economy by observing policy $x_1(1)$, so that $\sigma = \rho_1$. In order to derive a necessary condition we need to know when implementing $x_1(1)$ is optimal if model 2 is correct. Hence, we need to compare the costs and the benefits associated with this action. Since $\mu = 0$, basing policy on model 1 if model 2 describes reality is optimal if the benefits of this action:

$$B_p = q \cdot (Z + \lambda) \cdot [P_\ell(\rho_2 = \rho_1) - P_\ell(\rho_2 = 0)] > 0 \tag{27}$$

exceed the cost, which are again given by C as in equation (25). It is easy to show that $B_p > C$ is also a sufficient condition. We conclude that the strategy $\{x_1(1); x_1(1)\}$ and the beliefs $\sigma = \rho_1, \mu = 0$ form a pooling equilibrium, if and only if $B_p > C$.

3.1.5 Pooling with $\{x_1(0); x_1(0)\}$. Pooling with the strategy $\{x_1(0); x_1(0)\}$ is ruled out as an equilibrium, using the monotonicity assumption $\sigma \geqslant \mu$. Then, as argued before, if model 1 is valid it is for both first and second period utility unfavourable to base policy on model 2.

3.1.6 Discussion of equilibria in pure strategies: Existence and Uniqueness. In section 1 we find that P_ℓ increases with ρ_2. Using this and equations (26) and (27), we easily obtain that $B_s > B_p$. Furthermore, above we have derived two results: (1) the strategy $\{x_1(1); x_1(0)\}$ and the beliefs $\mu = 0$ and $\sigma = 1$ form the separating equilibrium if and only if $C > B_s$; (2) the strategy $\{x_1(1); x_1(1)\}$ and the beliefs $\sigma = \rho_1$, $\mu = 0$ form the pooling equilibrium if and only if $B_p > C$.[7] It follows that if $B_p > C$ then $B_s > C$ implying that the separating equilibrium does not exist whereas the pooling equilibrium does. On the other hand, if $C > B_s$, then $C > B_p$, which means that the pooling equilibrium does not exist, whereas the separating equilibrium does. Finally, if $B_p < C < B_s$ neither a pooling nor a separating equilibrium exist. In this case a hybrid equilibrium exists, which is discussed below.

3.2 Hybrid Equilibrium

A hybrid equilibrium characterizes a situation where one of the types of the sender randomizes between basing policy on model 1 with probability p and on model 2 with probability $(1 - p)$. In our model party ℓ always bases policy on model 1 if model 1 is valid. As a consequence, $\mu = 0$ and only when model 2 is valid is randomizing potentially beneficial. The benefits from randomizing are:

$$B_h = q \cdot (Z + \lambda) \cdot \left[P_\ell \left(\rho_2 = \frac{\rho_1}{\rho_1 + (1 - \rho_1) \cdot p} \right) - P_\ell(\rho_2 = 0) \right]. \qquad (28)$$

The value of p is determined such that the policy maker is indifferent between $x_1(1)$ and $x_1(0)$. Hence, p is implicitly determined by $B_h = C$. Since P_ℓ increases with ρ_2 and $B_s > B_h > B_p$, p satisfies $0 < p < 1$. It is straightforward to perform some comparative statics on p. It is possible to show that p increases with ρ_1, q and λ. This means that the higher the future electoral gains of basing policy on model 2 (higher ρ_1, q and λ), the higher the probability that policy is based on model 1 while model 2 is valid.

3.3 Evaluation of the Equilibria

It is worthwhile noting that B_p plays an important role in our model. If $B_p > C$ then the pooling equilibrium holds in which the policy maker bases policy on model 1 even if model 2 is correct. Three parameters determine whether $B_p > C$.

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[7] Recall that other candidates for pooling or separating equilibria do not exist, since the strategy space of the policy maker consists of only $x_1(1)$ and $x_1(0)$.

First, the higher is λ, the higher is B_p. Since the costs of basing policy in period 1 on the wrong model are independent of λ, party ℓ will usually base policy in period 1 on model 1 if it receives high utility from being in office. Secondly, the higher is q, the higher the potential benefits B_p for party ℓ from basing policy in period 1 on model 1. This property is due to the fact that the costs of basing policy in period 1 on the wrong model fall in period 1, while the benefits are reaped in period 2. Finally, B_p increases if the *a priori* probability that model 1 is drawn by nature, ρ_1, increases. The reason for this is that the gain in probability P_ℓ, which affects B_p, rises due to an increase in ρ_1. This can be seen from (16) taking $\rho_2 = \rho_1$ and (27).

The above results indicate that if the values of λ, q and ρ_1 are sufficiently high, so that $B_p > C$, the pooling equilibrium occurs and party ℓ bases policy on model 1, irrespective of which model is correct. Otherwise, depending on the magnitude of B_s, either the separating or the hybrid equilibrium describes what happens in our model.

Analogously, it can be shown that if party r were in office in period 1, in the pooling equilibrium it would base its policy on model 2, irrespective of which model is correct. Thus the outcomes in the pooling equilibrium are consistent with the observations discussed in the introduction that political parties stick to diverging economic philosophies.[8] Note that diverging economic philosophies are the result of strategic behaviour rather than the result of *a priori* different views on the efficacy of economic policy. Political parties adopt partisan views to convince voters of the advantages of their policies. Furthermore, note that in the pooling equilibrium by basing policy on the wrong model party ℓ's policy shifts to the left and party r's policy shifts to the right (see equations 23 and 24). This implies that on average model uncertainty has a diverging effect on partisan policies. Hence, the effect of model uncertainty on partisan policies is just the opposite of the effects of uncertainty about the incumbent's preferences, which induces partisan policies to converge (Alesina and Cukierman, 1990).

4. CONCLUSIONS

In this paper we have analysed the implications of uncertainty about the economic system for partisan policies in a dynamic politico-economic model in which policy makers possess private information as to how the economy works. The following results have been derived.

First, if policy makers cannot implement their most desired policies, election outcomes are related to voters' perceptions of how the economy works.

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[8] It is worth noting that if political parties adhere to their economic philosophies in period 2, again a pooling equilibrium may exist. In this setting the probability of pooling equilibrium is smaller than in the above model, since the costs of subscribing to an economic philosophy increase. In such a model, political parties choose an economic philosophy for the long-run and this economic philosophy may be interpreted as an ideology (Downs, 1957).

Second, the incumbent has an incentive to make voters believe in the model that best fits with his preferences. The policy maker can do so by basing policy on that model.

Third, both costs and benefits are associated with the adoption of a partisan economic philosophy. The more policy makers care about winning the elections the higher are the benefits and the higher is the probability that parties stick to an economic philosophy. In a pooling equilibrium, political parties base their policy on different models.

Fourth, partisan views lead to diverging partisan policies. The effects of model uncertainty on partisan policies are therefore the opposite of the effects of uncertainty about policy makers' preferences, which leads to converging partisan policies.

One shortcoming of the paper is that the action set of the policy maker is restricted to two actions. Our approach is similar to a case where a policy maker has a continuous action space and voters cannot discriminate between subtle differences of policies. In this case, voters' beliefs are determined by whether or not the policy variable exceeds a threshold. The problem with this type of model is the precise location of the threshold. As long as this benchmark is intermediate (between policy based on model 1 and policy based on model 2) political parties will be more inclined to base policy on the wrong model than in the present analysis. The reason for this is that the cost of doing so is even less than in our model.

Another important shortcoming of the paper is that in the model only one election is considered. As a consequence, our analysis disregards two reasons for why a policy maker may wish to build a reputation for always basing policy on the appropriate economic model. The first reason is the possibility of repeated interaction between political parties. The second reason of why a policy maker may wish to always base policy on the correct model is that voters may punish a party in a multi-period setting if they can learn about the appropriate description of economic reality and parties deliberately cheat on the model. However, this requires that voters act collectively in strategic behaviour. Since voters are atomistic and each of them therefore disregards the effect of his vote on policy, strategic behaviour forcing parties always to base policy on the correct model seems unrealistic.

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