Which Type of Central Bank Smooths the Political Business Cycle?

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January 2002

This paper develops a dynamic model of Rational Partisan Business Cycles, wherein wage contracts overlap elections and wage setters have to make a prediction about the election result. Uncertainty leads to pre- and post-election date output fluctuations. Election result probabilities are imputed and then used to construct variables in electoral uncertainty. Using data from 20 OECD countries over the period 1960-1998 left wing incumbents are found to increase output, but the increased expectation of a left wing regime reduces it. These political effects are found to be offset by Central Bank Independence and in particular, objective independence.

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We would like to thank participants in seminars at the Universities of Bath and Bristol and are grateful to Iman van Lelyveld and David Mayes for their data on Central Bank Independence.

1. Introduction

Economists distinguish between two kinds of Political Business Cycle (PBC). *Opportunistic* PBC's are generated by politicians manipulating the business cycle to get themselves re-elected (Nordhaus, 1975). *Partisan* PBC's result from systematic differences between left– and right-wing governments (Alesina, 1987), and wage contracts that overlap elections. Alesina, Roubini and Cohen (1997) find no evidence for opportunistic PBCs. The hypothesis also implies irrational behaviour unless voters are badly informed about the competence of politicians (Rogoff and Sibert, 1988). However, the evidence for rational partisan cycles when applied to a panel of OECD countries was more promising, if never resounding (Alesina, RC, 1997).

According to the 'rational partisan' theory, the economy is affected not just by the timing of elections, but also by the electors' anticipation of the result. Thus a group of workers may negotiate a year-long wage deal knowing that it will straddle an election, and the contending parties have 2% and 10% monetary growth in mind respectively. Rational workers will go for an intermediate pay rise. Hence, if the more anti-inflationary of the two parties gets in, it kicks off with a rise in unemployment; if the "wetter" alternative wins, it starts its term with a minor boom.

But what the workers go for will depend on who they expect to win. If, for example, they felt certain that an incumbent government was going to be re-elected, they would behave exactly as if there were to be no election, and the election itself (assuming the government *did* get back) would have no effect on output. In general, the more likely a party seems to get in, the closer workers will pitch their pay claims to matching its expected monetary policy. Post-electoral shocks to output will thus be largest when the election result was least expected.

Similarly, pre-electoral fluctuations will occur given that wage-setters anticipate electoral changes at some time during their wage contract (Cohen, 1993). The fluctuation increases with the likelihood of a change of regime. For instance if the incumbent right-wing party were expected to lose an impending election, there would be a pre-electoral recession as real wages increased. The stronger the expectation, the bigger the wage rise and the bigger the recession.

Most research so far has ignored the question of the degree of ex ante uncertainty associated with the elections, e.g. Paldam (1991), Alesina and Roubini (1992 and 1997) and Hadri, Lockwood and Maloney (1998). An exception is Carlsen and Pedersen (1999), who estimate three series of election result probabilities for seven countries over mixed time horizons, all of which require time series of opinion poll data. The first two series take the date of the election as fixed and the third makes it endogenous. One contribution of this paper is to derive these alternative probabilities of election results for 20 countries over the period 1960-1998. Our approach is similar to Carlsen and Pedersen but we extend their work in a number of important directions. Firstly, the estimable equation is formally derived from the incumbent government's loss-minimisation problem. Secondly, 13 additional countries are analysed, and because we estimate probabilities for circumstances where opinion poll data is not available, our probability series cover the full sample period. Third, our theoretically derived output equation is shown to depend on two political variables – the colour of the incumbent, and a measure of the average expectation of the election result, whereas CP utilise a single composite term. Finally we also test the hypothesis that monetary policy constraints due to Central Bank Independence (CBI) reduce RPBC induced volatility. Using the recently developed data set of Kilponen, Mayes and Vilmonen (2000) we also identify if and how successful different 'types' of independent central banks are at reducing politically induced macroeconomic volatility.

In section 2 the dynamic rational partisan model is developed, culminating in an estimable output equation incorporating both economic and political variables. In section 3 we explain how we estimate the electoral probability series. In section 4 the data set is applied to the model. In section 5 we test the hypothesis that monetary policy constraints reduced the effects of political variables on output. Section 6 concludes.

2. The Model

The government dislikes deviation in output (y_s) from the full employment level (y), and deviation in inflation (π_s) from its own (partisan) preferred inflation rate (π^i). This can be characterised within a standard loss function,

$$L_s^i = 0.5(y - y_s)^2 + 0.5\alpha(\pi^i - \pi_s)^2 \quad (1)$$

for i = L,R depending on the colour of the incumbent and a time subscript s. At time t the government therefore wants choose the inflation rate[1], now and in the future to minimise

$$E_t\left[\sum_{s=t}^{\infty}\delta^{s-t}L_s^i\right]. \tag{2}$$

Minimisation of (2) is subject to a dynamic supply function,

$$y_t = \rho y_{t-1} + \theta\left(\pi_t - \hat{W}_t\right) + z_t\,, \tag{3}$$

where $0 < \rho < 1$, z_t is a supply shock with expected value zero, and $\hat{W}_t$ is average nominal wage growth at time t. Output is measured in logs, and then passed through the Hodrick-Prescott (1997) filter so that the (log) natural rate is zero. Differentiation of (2) yields

$$\frac{d\left(E_t\left[\sum_{s=t}^{\infty}\delta^{s-t}L_s^i\right]\right)}{d\pi_t} = \alpha\left(\pi_t - \pi^i\right) + \sum_{s=t}^{\infty}\delta^{s-t}\left(E\left[y_s - y\right]\right)\frac{dy_s}{d\pi_t}\,, \tag{4}$$

where

$$\frac{dy_s}{d\pi_t} = \frac{dy_s}{dy_t}\frac{dy_t}{d\pi_t} = \rho^{s-t}\theta^2,$$

hence

$$\begin{aligned}\frac{d\left(E_t\left[\sum_{s=t}^{\infty}\delta^{s-t}L_s^i\right]\right)}{d\pi_t} &= \alpha\left(\pi_t - \pi^i\right) + \theta\sum_{s=t}^{\infty}\rho^{s-t}\delta^{s-t}\left(E\left[y_s - y\right]\right)\\ &= \alpha\left(\pi_t - \pi^i\right) + \theta\sum_{s=t+1}^{\infty}\rho^{s-t}\delta^{s-t}\left(E\left[y_s - y\right]\right) + \theta\left(y_t - y\right),\end{aligned} \tag{5}$$

and similarly,

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[1] In this formulation parties care equally about economic outcomes whether in office or not, and do not adjust policies in the light of what they think successors might do.

[2] Where ρ^{s-t} is the derivative of output in time s with respect to output in time t from equation (3).

$$\frac{d\left(E_t\left[\sum_{s=t}^{\infty}\delta^{s-t}L^i{}_s\right]\right)}{dE_t[\pi_{t+1}]} = \delta\alpha E_t\left(\pi_{t+1}-\pi^i\right)+\theta\sum_{s=t+1}^{\infty}\rho^{s-t-1}\delta^{s-t}\left(E[y_s-y]\right). \tag{6}$$

Combining (5) and (6) at the optimum gives

$$\frac{d\left(E_t\left[\sum_{s=t}^{\infty}\delta^{s-t}L^i{}_s\right]\right)}{d\pi_t} - \rho\frac{d\left(E_t\left[\sum_{s=t}^{\infty}\delta^{s-t}L^i{}_s\right]\right)}{dE_t[\pi_{t+1}]}$$

$$= \alpha\left(\pi_t-\pi^i\right)+\theta\left(y_t-y\right)-\delta\rho\alpha E_t\left(\pi_{t+1}-\pi^i\right)=0. \tag{7}$$

We assume that expectations of inflation are formed rationally, i.e. $\pi_{t+1} = E_t[\pi_{t+1}] + v_{t+1}$ where v_{t+1} is a random error with expectation zero. Solving (7) for inflation gives

$$\pi_t = \delta\rho\pi_{t+1} - \delta\rho v_{t+1} + (1-\delta\rho)\pi^i + \frac{\theta}{\alpha}\left(y-y_t\right), \tag{8}$$

and substituting (8) into aggregate supply (3),

$$y_t = \rho y_{t-1} + \theta\delta\rho\pi_{t+1} + \theta(1-\delta\rho)\pi^i + \frac{\theta^2}{\alpha}\left(y-y_t\right) - \theta\hat{W}_t + z_t - \theta\delta\rho v_{t+1},$$

and then solving this for y_t gives

$$y_t = \frac{\alpha}{\alpha+\theta^2}\left[\rho y_{t-1} - \theta\hat{W}_t + \theta(1-\delta\rho)\pi^i + \frac{\theta^2}{\alpha}y + \theta\delta\rho\pi_{t+1} + z_t - \theta\delta\rho v_{t+1}\right]. \tag{9}$$

In a Barro-Gordon inflationary equilibrium, it must be the case that:

$\pi_t^i = \pi_{t+1} = \hat{W}_t$ and $y_t = y_{t-1} = z_t = v_{t+1} = 0$.

Putting these into (9) gives:

$$\pi_t^i = \pi^i + \frac{\theta y}{\alpha(1-\delta\rho)}. \tag{10}$$

We denote this equilibrium rate in future by $\pi^i *$. Thus the Barro-Gordon inflationary equilibrium for either a left- or a right-wing government is $\theta y/\alpha(1-\delta\rho)$ above its "bliss" inflation rate.

2.2 Private Sector inflation expectations

These determine the wage inflation rate. We initially follow Carlsen and Pedersen (1999), who propose a cost function for the private sector:

$$E_t\left\{\sum_{\tau=t}^{t+N-1}\delta^{\tau-t}\left(\pi_t-W_t\right)^2\right\}, \tag{11}$$

where wage contracts last N periods and the quadratic loss from inflation (π_t) failing to match nominal wage growth in that quarter (W_t) is discounted at some positive rate (δ). But when the contracts even just potentially overlap an election the wage setters will not be certain of the inflation rate. When the electoral terms are variable they write the cost function as

$$\sum_{t'=t}^{t+N-2}\left[\left(P_{tt'}^L+P_{tt'}^R\right)\sum_{\tau=t}^{t'}\delta^{\tau-t}\left(\pi_t^i *-W_t\right)^2+P_{tt'}^L\sum_{\tau=t'+1}^{t+N-1}\delta^{\tau-t}\left(\pi^L *-W_t\right)^2+P_{tt'}^R\sum_{\tau=t'+1}^{t+N-1}\delta^{\tau-t}\left(\pi^R *-W_t\right)^2\right]$$
$$+\left[1-\sum_{t'=t}^{t+N-2}\left(P_{tt'}^L+P_{tt'}^R\right)\right]\sum_{\tau=t}^{t+N-1}\delta^{\tau-t}\left(\pi_t^i *-W_t\right)^2 . \tag{12}$$

Where t' is the (unknown) quarter in which the election takes place, $P_{tt'}^L$ ($P_{tt'}^R$) is the probability formed in period t of a left (right) wing victory in that quarter. Differentiation of this expression with respect to W_t and setting the resulting expression equal to zero yields

$$W_t = \pi^R * + \left(\pi^L * - \pi^R *\right)\left\{L_t\left[1 - \sum_{t'=t}^{t+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)\left(P_{tt'}^L + P_{tt'}^R\right)\right] + \sum_{t'=t}^{t+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)P_{tt'}^L\right\}, \qquad (13)$$

where L_t is a dummy variable set equal to one when there is a left wing incumbent. Since

((11)) $\pi_t^i = \pi^i + \frac{\theta y}{\alpha(1-\delta\rho)}$, and $\pi^L * - \pi^R * = \pi^L - \pi^R$, (13) becomes

$$W_t = \pi^R + \frac{\theta y}{\alpha(1-\delta\rho)} + \left(\pi^L - \pi^R\right)\left\{L_t\left[1 - \sum_{t'=t}^{t+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)\left(P_{tt'}^L + P_{tt'}^R\right)\right] + \sum_{t'=t}^{t+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)P_{tt'}^L\right\}.$$

(14)

This reduces to

$$W_t = \pi^R + \frac{\theta y}{\alpha(1-\delta\rho)} + \left(\pi^L - \pi^R\right)\left\{L_t\left[1-\delta *\right] + \delta * P_{tT}^L\right\}, \qquad (15)$$

in the case of a fixed election date

where $\delta * = \begin{cases} 0, & \text{if } T \geq t+N-1 \\ \frac{\delta^{T-t+1} - \delta^N}{1-\delta^N}, & \text{if } T \leq t+N-1 \end{cases}$

and T is the fixed election date.

A last step is to describe an expression for average nominal wage growth.

$$\hat{W}_t = \sum_{\tau=t-N+1}^{t} f_t W_t \ , \qquad (16)$$

where W_τ is described in (14) or (15) and f_τ is the fraction of wage contracts signed in period τ. If contracts are uniform, then $f_\tau = 1/N$ for all τ.

Expressions (14) and (15) give the wage growth rate for the two cases of variable and fixed election dates. Equation (16) gives the average wage growth rate. The Carlsen and

Pedersen formulation allows for varying probabilities of left wing and right wing victories, and indeed of election dates. They also allow for a variable wage contract length, N and a positive discount rate. Putting (14) and (15) into (16), we get nominal wage growth for endogenous and fixed election dates respectively:

$$\hat{W}_t = \pi^R + \frac{\theta y}{\alpha(1-\delta\rho)}$$
$$+\left(\pi^L - \pi^R\right)\left\{\sum_{\tau=t-N+1}^{t} f_\tau\left[L_\tau\left(1-\sum_{t'=\tau}^{\tau+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)\left(P_{\pi'}^L + P_{\pi'}^R\right)\right)+\sum_{t'=\tau}^{\tau+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)\left(P_{\pi'}^L\right)\right]\right\}; \quad (17)$$

$$\hat{W}_t = \pi^R + \frac{\theta y}{\alpha(1-\delta\rho)} + \left(\pi^L - \pi^R\right)\left\{\sum_{\tau=t-N+1}^{t} f_\tau\left[L_\tau\left(1-\frac{\delta^{T-t+1}-\delta^N}{1-\delta^N}\right)+P_{\tau T}^L\left(\frac{\delta^{T-t+1}-\delta^N}{1-\delta^N}\right)\right]\right\}. \quad (18)$$

For the case of a uniform wage contract distribution we define a variable E_t,

$$E_t = \frac{1}{N}\left\{\sum_{\tau=t-N+1}^{t}\left[\begin{array}{l} L_\tau\left(1-\sum_{t'=\tau}^{\tau+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)\left(P_{\pi'}^L + P_{\pi'}^R\right)\right) \\ +\sum_{t'=\tau}^{\tau+N-2}\left(\frac{1-\delta^{t'-t+1}}{1-\delta^N}\right)\left(P_{\pi'}^L\right)\end{array}\right]\right\}, \quad (19)$$

in the case of the variable (unknown) elections, and

$$E_t = \frac{1}{N}\left\{\sum_{\tau=t-N+1}^{t}\left[L_\tau\left(1-\left(\frac{\delta^{T-t+1}-\delta^N}{1-\delta^N}\right)\right)+\left(\frac{\delta^{T-t+1}-\delta^N}{1-\delta^N}\right)\left(P_{tT}^L\right)\right]\right\}, \quad (20)$$

in the case of the fixed election dates. The E_t variable is composed of observable variables (N and L_t), our estimated probabilities, and the quarterly discount rate which following Carlsen and Pedersen we set to 0.99. (Section 3 explains how the probabilities are estimated.) Note that E_t can only take values between zero and unity, which means average wage growth will in general be somewhere between the respective inflationary equilibria of the two parties. When a left (right) wing incumbent is expected to stay in office for the duration for all of the contracts drawn up in the last N quarters, E_t = 1(0), and points of uncertainty lie between these two limits. The variable thus measures the electoral uncertainty contained within the set of wage contracts that overlap a particular quarter. This new variable simplifies the notation of (17) and (18) considerably. In both cases:

$$\hat{W}_t = \pi^R + \frac{\theta y}{\alpha(1-\delta\rho)} + (\pi^L - \pi^R)E_t .$$

In order to derive an estimable equation for output we return to equation (9), and replace $\hat{W}_t$ with (17) or (18) and rearrange to yield:

$$y_t = \frac{-\delta\rho\theta\left(\alpha\pi^R + \theta y/(1-\delta\rho)\right) + \alpha\rho y_{t-1} + \alpha\theta\delta\rho\pi_{t+1} + \alpha(1-\delta\rho)\theta\left(\pi^L - \pi^R\right)L_t - \theta\alpha\left(\pi^L - \pi^R\right)E_t + \alpha z_t - \alpha\theta\delta\rho v_{t+1}}{\alpha + \theta^2} . \quad (21)$$

The reduced form of this estimable equation can be written as

$$y_t = b_0 + b_1 y_{t-1} + b_2\pi_{t+1} + b_3 L_t + b_4 E_t + u_t . \quad (22)$$

Henceforth we refer to π_t and y_t as the 'economic variables' and L_t and E_t as the 'political variables'. The reduced form parameters of the VAR are described as follows:

$$b_0 = \frac{-\delta\rho\theta\left(\alpha\pi^R + \theta y/(1-\delta\rho)\right)}{\theta^2 + \alpha}, \quad b_1 = \frac{\theta\rho}{\theta^2 + \alpha}, \quad b_2 = \frac{\alpha\theta\delta\rho}{\theta^2 + \alpha}, \quad b_3 = \frac{\alpha\theta(1-\delta\rho)\left(\pi^L - \pi^R\right)}{\theta^2 + \alpha},$$

$$b_4 = -\frac{\alpha\theta\left(\pi^L - \pi^R\right)}{\theta^2 + \alpha}, \; u_t = \frac{\alpha z_t - \alpha\theta\delta\rho v_{t+1}}{\theta^2 + \alpha}.$$

Tests of the rational political business cycle model under electoral uncertainty can be performed by inference from the reduced form parameters b_3 and b_4. In particular, we expect the following restrictions to hold for our reduced form parameters:

$b_0 < 0$; $b_1 > 0$; $b_2 > 0$; $b_3 > 0$; $b_4 < 0$.

3. Computation of Election Win Probabilities

Constructing the E_t variable means calculating prior election probabilities for all the t-N+1 quarters for which period t lies within the wage contract. (In each of these quarters, a possible change of government during the life span of the contract will affect the wage agreement.) Carlsen and Pedersen (1999) describe three alternative measures of election result probabilities. We have extended their work to include 20 countries with varying political frameworks and derive probability even where there is no opinion poll data, so that a full series for all countries from 1960 onwards is estimated. In this section we concisely describe the methodology for computing these three probability measures. For a much larger discussion see Maloney and Pickering (2000a).

3.1 Political Issues

The first issue is whom to classify as left or right. Castles and Mair (1984), Huber and Inglehart (1995), the World Values Survey and Eurobarometer all provide numerical scores on a left/right continuum from 1 to 10. Alesina and Roubini (1997) define actual governments along similar lines as do Hadri, Lockwood and Maloney (1998). We follow the latter for our definitions, and then combine them with out measures of election result probabilities (see above) to make probability estimates of whether there will be a left wing or right-wing government. In some cases this is straightforward. In others, assumptions have to be made about who is most likely to coalesce with who in the event of no party getting an absolute majority. We explain in more detail in the appendix, but in all 20 cases we take the probability of a right (left) government as the probability that the right-wing parties will win more (fewer) seats than the left-wing ones.

3.2 Computation of Electoral Probabilities

We compare three methods. Type A is the regression based probability series suggested by Chappell and Keech (1988) (CK). Where opinion poll data exists we follow Carlsen and Pedersen and regress the incumbent seat shares in our sequence of elections against recent historical opinion polls and macroeconomic data[3]. This gives us "predictions" of the seats each party would have picked up in each quarter had there been a general election then ($\hat{S}_{T-\kappa}$). We then use the preferred prediction[4] for each pre-electoral quarter to compute the probability, estimated from the standpoint of that particular quarter, of the incumbent party or coalition getting more than half the seats at the forthcoming actual election. If we denote this as $P^{A}_{T-\kappa}$, then:

$$P^{A}_{T-\kappa} = t\left(\frac{\hat{S}_{T-\kappa} - 0.5}{s_{\kappa}}\right), \tag{23}$$

where t (.) is the standard cumulative t distribution, and $\hat{S}_{T-\kappa}$ the preferred seat share prediction using data available κ quarters prior to the election, and s_{κ} is the standard error of the regression. The election quarter is represented by 'T' and probabilities are derived for all pre-electoral quarters wherein wage contracts overlap the election date. Where opinion poll data was not available we regressed the *change* in incumbent seat share

[3] The macroeconomic data were output, inflation, unemployment, interest rates and first differences in all of these. The full output of these regressions is available on request (Maloney & Pickering, 2000a).
[4] Selected on the basis of highest R^2.

against macroeconomic variables. This allowed for the existing size of the majority to be taken into account. We then summed the existing incumbent share and the swing for the government to obtain a fitted seat share and derived probabilities as above.

The second approach follows Cohen (1993). Here the probabilities are derived directly and solely from the poll data:

$$P^{B}_{T-\kappa} = \Phi\left[\frac{\hat{P}_{T-\kappa-1} - 0.5}{\sigma\sqrt{\kappa+1}}\right], \tag{24}$$

where Φ is the cumulative standard normal distribution. Alesina, Roubini and Cohen (1997) find the poll data follow a random walk with zero mean, and we use this as an assumption. The poll data have been transformed (monotonically) into projected seat shares via a preferred Votes Into Seats function estimated by OLS from actual election results (see Maloney, Pearson and Pickering, 2001). The country specific estimate of the random walk's standard deviation is represented by σ_i.

The third probability series is proposed by Carlsen and Pedersen and allows for variability in the date of the election. This applies to most of the countries in the sample. At any time t, the incumbent has a probability of winning (P_t^I), modelled using either technique from above, so this element can easily be estimated. There is also a probability distribution for whether or not the election will actually occur within a particular quarter (P_t^E). Following CP we estimate P_t^E using a probit model where the dependent variable is whether or not an election is called. Given the increased constitutional diversity in our sample we augment the CP regressors (length of time since last election and the poll lead) with additional political explanatory variables to account for the cases of minority governments and a proxy for coalition stability. Algebraically, the probability of the incumbent winning at a particular quarter, t', in the future is written as

$$P_{tt'}^{C} = \left(1 - P_{t,t}^{E}\right)\left(1 - P_{t,t+1}^{E}\right)\ldots\left(1 - P_{t,t'-1}^{E}\right)P_{tt'}^{E}P_{tt'}^{I}\,. \qquad (25)$$

Fitted probability estimates for the sets of P_t^I and P_t^E are substituted into (25) to derive the variable election dates probability series. P_t^E comes from the probit model, and P_t^I is estimated from the best performing fixed election probability series ($P_{T-\kappa}^{A}$ or $P_{T-\kappa}^{B}$) where the 'best performer' is the series, which gets the most predictions 'right' in the sense of being the right side of 50-50.

Having computed the three probability series[5], we can construct our E_t variable using equations (19) and (20), hence capturing the essence of electoral uncertainty. The two dimensions of wage contract length (4, 6 or 8) and probability series chosen (types A, B or C) yield nine alternative series for E_t. Table 1 details the Pearson correlations between the series and reveals that the alternative methods lead to measures that contain similar information.

Table 1 Correlation between alternative series for E_t

	EA8	*EA6*	*EA4*	*EB8*	*EB6*	*EB4*	*EC8*	*EC6*	*EC4*
EA8	1	0.991638	0.967472	0.966593	0.968374	0.956804	0.916332	0.929595	0.925136
EA6		1	0.988628	0.963281	0.976771	0.974727	0.917182	0.945047	0.951877
EA4			1	0.94923	0.971966	0.986449	0.903427	0.942568	0.968055
EB8				1	0.992064	0.969181	0.950493	0.952905	0.945344
EB6					1	0.989226	0.946141	0.963148	0.966581
EB4						1	0.928057	0.956973	0.977472
EC8							1	0.976103	0.923764
EC6								1	0.972005
EC4									1

[5] Also available on request.

4. Estimation

4.1 Introduction

We use a two-stage approach. In this section we test for the presence of rational partisan business cycles as described by our model (equation 22) on a country-by-country basis and within a panel[6]. In the next section we test whether and what type of central bank independence reduces the RPBC[7].

4.2 Testing For The Rational Partisan Political Business Cycle

Here we investigate whether the identity of the incumbent and the probability of its re-election affect output in the way that the RPBC theory suggests. The fact that equation (22) is under-identified, with 10 reduced form parameters and only 6 structural form parameters, therefore does not matter. We are interested purely in the sign and significance of the reduced form parameters pertaining to our political variables L_t and E_t.

Our macroeconomic data comes from the OECD database and covers 20 countries: Australia, Austria, Belgium Canada, Denmark, Finland, France, Germany, Greece,

[6] Alesina, Roubini and Cohen (1997) who study RPBCs within 18 countries (our sample minus Greece and Spain) undertake comparative work for the period 1960-1993. This work does not address the probability of the election result and uses partisan dummies (set equal to one for a right wing incumbent and equal to minus for a left wing incumbent) to test for the RPBC. Using a fixed effects model they find a significant RPBC in output (ibid. ch.6).

[7] Alesina, Roubini and Cohen (ibid. ch.8) describes the issue but in this case, they do not empirically address the question. Hadri, Lockwood and Maloney (1998) test for the effects of central bank independence upon inflation and find some evidence in favour of the proposition that independent central banks limit political effects.

Ireland, Italy, Japan, The Netherlands, New Zealand, Norway, Spain, Sweden Switzerland, the United Kingdom and the United States. The output data is passed through a Hodrick-Prescott (1997) filter. This removes the long-term trend in GDP but leaves intact the cyclical component. We are thus analysing deviations from the long-term trend that are potentially induced by rational partisan variables.

As well as the regressors in (22) we employed dummy variables for the high oil price era (1973-1986) (DO) and for the 1990s recession (D90).

There are nine (albeit highly correlated) alternative series of E_t and nineteen[8] individual countries. The E_t series generated by the probability measures proposed by Alesina, Roubini and Cohen (ibid ch.5) (type B) in general gave less predictive power than the other two measures for all three contract lengths, although this is likely to be largely due to the smaller samples for which we had opinion poll data. The evidence does not provide clear-cut support for one contract length over another, although given the way average explicit and implicit contract length varies from country to country this is to be expected. We select particular E_t series on the basis of explanatory power, although the results are robust to alternative series (unsurprising given table 1). In table 2 the regression[9] results using the preferred E_t series for all the countries are presented.

[8] Omitting Switzerland, for which the same coalition has been in power throughout the sample period.
[9] In estimating the output equation (22) we need to take into account the possible correlation that exists between the regressor, π_{t+1} and the disturbance term. In view of this, estimation is performed using instrumental variables, with oil prices, narrow money growth, interest rates, lagged inflation and output as the instruments.

Table 2 Individual Regression Results[10]

Country	Preferred E_t Series.	b_3	b_4	ARCH test[11]	SC test[12]
Australia	C4	-0.0029 (0.0054)	0.0051 (0.0075)	5.89 {0.015}	9.41 {0.052}
Austria	A4	0.022 (0.013)	-0.023 (0.015)	5.31 {0.021}	19.1 {0.000}
Belgium	A8	0.0093 (0.0027)	-0.0069 (0.0044)	48.2 {0.000}	110 {0.000}
Canada	C6	0.0076 (0.0035)	-0.012 (0.0046)	4.31 {0.038}	7.31 {0.12}
Denmark	B8	0.0028 (0.0032)	0.0004 (0.005)	11.53 {0.001}	16.14 {0.003}
Finland	A8	0.0022 (0.0053)	0.0006 (0.007)	1.67 {0.196}	14.61 {0.006}
France	A8	0.013 (0.0052)	-0.013 (0.0063)	6.84 {0.009}	12.6 {0.014}
Germany	B8	-0.0086 (0.010)	0.013 (0.013)	0.030 {0.86}	18.9 {0.001}
Greece	C8	0.015 (0.003)	-0.024 (0.005)	39.6 {0.000}	98.6 {0.000}
Ireland	A8	0.017 (0.012)	-0.054 (0.016)	45.2 {0.000}	98.1 {0.000}
Italy	C8	0.0012 (0.003)	-0.011 (0.006)	14.9 {0.000}	24.2 {0.000}
Japan	C6	-0.0026 (0.006)	-0.013 (0.010)	0.498 {0.480}	12.7 {0.012}
The Netherlands	C4	0.0036 (0.0035)	-0.009 (0.004)	22.4 {0.000}	3.46 {0.484}
New Zealand	A4	0.012 (0.025)	0.005 (0.029)	7.70 {0.006}	13.51 {0.009}
Norway	A4	0.0084 (0.007)	-0.0053 (0.008)	6.95 {0.008}	9.95 {0.041}
Spain[13]	C4	0.011 (0.010)	-0.014 (0.011)	3.56 {0.059}	39.5 {0.000}
Sweden	A6	-0.0023 (0.007)	0.011 (0.009)	3.85 {0.050}	11.7 {0.019}
United Kingdom	A4	0.0068 (0.007}	-0.0052 (0.0077)	0.024 {0.876}	8.90 {0.064}
United States	A8	0.0011 (0.004)	-0.00005 (0.005)	0.680 {0.41}	18.6 {0.001}

The signs of both political parameter estimates are correct in twelve out of nineteen cases[14]. Of these twelve, in eight cases at least one of the parameter estimates was significant at the 5% level. Of the seven that exhibited incorrectly signed parameter estimates, none were significant even at the 10% level. However, the diagnostic tests indicate the presence of both ARCH and serial correlation. The finding of serial correlation (in 14/19 cases) is of particular concern because in the presence of a lagged

[10] Values in (.) denote standard errors, values in {.} denote p-values here and in what follows.

[11] The Lagrange multiplier test for ARCH (Engle, 1982), based on an auxiliary regression of $\hat{u}_t^2$ on a constant and the lag of $\hat{u}_t^2$. TR^2 (where T is the number of observations) from this regression is distributed asymptotically $\chi^2(1)$.

[12] The Breusch-Godfrey Lagrange multiplier test for serial correlation, based on an auxiliary regression of $\hat{u}_t$ on the explanatory variables and four lags of $\hat{u}_t$. TR^2 from this regression is distributed asymptotically $\chi^2(4)$.

[13] Estimation over the period 1977(1)-1998(4), the period during which democratic elections took place in Spain.

dependent variable this may bias the political parameter estimates. To correct for serial correlation generalised differencing is employed, depending on significance levels in the autoregressive error process. The resulting equations were estimated using non-linear instrumental variables and the corrected results are presented in table 3.

Table 3 Regression results from output equation, correcting for Serial Correlation.

Country	b_3	b_4	ARCH test	SC test	Correction[15]	L_t-E_t correlation
Australia	-0.0029 (0.0058)	0.0043 (0.0098)	0.184 {0.67}	5.07 {0.28}	SC(3)	0.91
Austria	0.011 (0.015)	-0.011 (0.016)	0.880 {0.35}	7.26 {0.12}	SC(6,8)	0.97
Belgium	-0.0028 (0.0066)	0.0073 (0.0098)	0.094 {0.76}	31.6 {0.00}	SC(1,4,5)	0.78
Canada	0.0052 (0.0046)	-0.013 (0.006)	1.636 {0.20}	10.1 {0.04}	SC(1,8)	0.89
Denmark	0.0042 (0.0055)	-0.0067 (0.010)	3.28 {0.070}	5.02 {0.28}	SC(1,3,8)	0.81
Finland	0.0079 (0.0074)	0.0065 (0.017)	0.373 {0.54}	7.97 {0.093}	SC(2,3)	0.87
France	0.059 (0.023)	-0.020 (0.16)	2.46 {0.12}	10.64 {0.031}	SC(1)	0.91
Germany	-0.010 (0.011)	0.014 (0.017	0.06 {0.81}	12.65 {0.013}	SC(3)	0.95
Greece	0.015 (0.018)	-0.025 (0.028)	23.8 {0.000}	13.1 {0.011}	SC(2,3)	0.87
Ireland	-0.0036 (0.0031)	0.0039 (0.0046)	0.23 {0.63}	18.8 {0.001}	SC(1,4,5)	0.90
Italy	0.0049 (0.0044)	-0.022 (0.012)	8.54 {0.003}	7.54 {0.101}	SC(1)	0.64
Japan	0.0061 (0.0066)	-0.034 (0.020)	0.15 {0.70}	5.03 {0.28}	SC(2,3)	0.51
The Netherlands	0.0036 (0.0035)	-0.009 (0.004)	22.4 {0.000}	3.46 {0.484}	–	0.88
New Zealand	-0.027 (0.080)	0.083 (0.16)	0.83 {0.36}	3.56 {0.468}	SC(3)	0.96
Norway	0.0013 (0.010)	0.014 (0.023)	1.85 {0.17}	8.19 {0.085}	SC(3,8)	0.90
Spain	0.0057 (0.0078)	-0.0051 (0.0089)	6.02 {0.014}	23.4 {0.000}	SC(1,6)	0.98
Sweden	-0.007 (0.008)	0.020 (0.012)	6.47 {0.010}	5.66 {0.23}	SC(4)	0.93
United Kingdom	0.0068 (0.007}	-0.0052 (0.0077)	0.024 {0.876}	8.90 {0.064}	–	0.96
United States	-0.0006 (0.005)	0.0033 (0.006)	0.80 {0.37}	11.36 {0.023}	SC(1)	0.93

In table 3 left wing governments positively affect output in 12/19 cases, and E_t negatively affects output in 10/19 cases. Of the incorrect cases, none are significant at the 5% level.

[14] Switzerland is omitted because there was no change of government over the sample period.
[15] SC denotes non-linear estimation of equation (22) with AR errors, i.e. $u_t = e_t + \rho_1 u_{t-1} + \rho_2 u_{t-2} + \dots \rho_j u_{t-j}$. The number in parentheses following SC indicate which of the ρ_j were allowed to be non-zero in the final estimation.

A number of econometric issues arise out of estimation on a country-by-country basis. Firstly the consistent finding of serial correlation points towards dynamic effects outside the context of our model, i.e. higher orders of autocorrelation. To overcome this we include additional endogenous variable lags in subsequent estimation. Secondly, the estimates of the political parameters are insignificant in most cases. There are a number of possible explanations for this. One is that there really is no rational partisan business cycle, although this contradicts the previous work by Alesina, Roubini and Cohen (1997) and Carlsen and Pedersen (1999). Alternatively the large standard errors may be attributable to collinearity between L_t and E_t. Suppose, for example, that it is 6 quarters before an election, and contracts last 8 quarters. Then for 6/8 of the life of contracts now being signed, E_t will equal L_t. Much of the information contained in one variable is contained in the other. Individual correlation coefficients are reported in the last column of table 3 and in most cases are very high. Consequently, we should expect lower levels of significance than in previous studies that only use one variable to capture PBC type effects. Nonetheless, where significance levels are high, then we may argue along *a fortiori* lines that the expectation variable does have an impact upon the RPBC. When we pool across countries, a much sharper picture emerges (table 4):

Table 4 Output panel

Summary of panel estimation		Estimate (Std Error)
Political Variables	**L_t**	$\hat{b}_3$ = 0.0019 (0.0012) {0.11}
	E_t	$\hat{b}_4$ = -0.0029 (0.0015) {0.055}
Fixed Effects	None significant at 10%	
Output lags	Lags 1-4, 6, 8-9, 11, 14 & 16 significant at the 5% level	
Degrees of Freedom	2540	
$\bar{R}^2$	0.91	
Diagnostic Statistics	ARCH	432.5 {0.000}
	Serial Correlation	3.73 {0.44}
Maximum Likelihood Estimation after ARCH(1-4) correction		**Estimate (Std Error)**
Political Variables	**L_t**	$\hat{b}_3$ = 0.0011 (0.0002) {0.000}
	E_t	$\hat{b}_4$ = -0.0018 (0.0003) {0.000}
Hypothesis test: H_0: $\hat{b}_3 = \hat{b}_4 = 0$		χ^2 = 18.32 {0.000}

Our initial regression (top half of table) gives emphatic evidence of the presence of ARCH under which the estimators are not the most efficient available. After correction for fourth order ARCH we find both political parameters correctly signed and significant at the 1% level; furthermore $|b_4| > b_3$ as predicted by the theory. In no cases are the fixed effects significant, but a considerable number of lagged observations of the endogenous variable are. Inclusion of these extra lags is endorsed by the improved serial correlation statistic, which is insignificant at the 5% level. The joint hypothesis that both political variables do not influence the macroeconomic variable in question can be strongly rejected.

As a test of our methodology, the model is also estimated for a reduced sample of countries where the left-right distinction is arguably less ambiguous. This reduced sample omits Belgium, Finland, Ireland, Italy, Japan, The Netherlands and Switzerland. The results are presented in table 5.

Table 5 Output panel, Reduced Sample

Summary of panel estimation		**Estimate (Std Error)**
Political Variables	**L_t**	$\hat{b}_3$ = 0.0022 (0.0013) {0.107}
	E_t	$\hat{b}_4$ = -0.0010 (0.0016) {0.52}
Fixed Effects	**None significant at 10%**	
Output lags	**Lags 1-4, 6, 8-9, 14 & 16 significant at the 5% level**	
Degrees of Freedom	**1625**	
$\overline{R}^2$	**0.88**	
Diagnostic Statistics	**ARCH**	**195.2**
	Serial Correlation	**1.60**
Maximum Likelihood Estimation after ARCH (1-4) correction		**Estimate (Std Error)**
Political Variables	**L_t**	$\hat{b}_3$ = 0.0011 (0.0008) {0.111}
	E_t	$\hat{b}_4$ = -0.0002 (0.0007) {0.59}
Hypothesis test: H_0: $\hat{b}_3 = \hat{b}_4 = 0$		χ^2 = 6.549 {0.010}

The results of the reduced sample mirror those of the full sample; the parameter estimates are robust to the smaller sample size, although in the smaller sample there is a deterioration in significance levels. However, the joint hypothesis confirms that the political variables influence the macroeconomic variables in the same way as in the full sample.

The RPBC theory described in section two suggests a number of testable hypotheses. First, following an election output will be higher (lower) when a left (right) wing party is elected. In common with previous studies we find this to be true. Second, this effect is stronger the more surprising that result; and third, before an election the more expected an incumbent victory the smaller the fluctuation, the more expected an opposition victory the greater the fluctuation. The second and third hypotheses are jointly tested by the reduced form parameter on E_t: they imply that b_4 will be negative. So it is: significantly so. This is an important new result and a major refinement of the rational partisan political business cycle theory. As a test of the theory, and also as an important policy issue the focus now switches to the question of whether or not monetary policy constraints, and in particular independent central banks, can reduce the political volatility.

5. Monetary Policy Constraints

A government's ability to run the economy in a partisan way depends on its ability to manipulate monetary policy. We focus on two monetary policy constraints, Central Bank Independence (CBI) and fixed exchange rates. Economists have looked long and hard at CBI as a restraint on damaging, politically determined macroeconomic policy[16], while fixed exchange rates render monetary policy ineffective in the Mundell-Fleming model[17].

[16] Rogoff (1985) finds that delegation of policy to a credible independent central bank increases economic welfare. Relevant empirical work includes that of Alesina (1988), Alesina and Summers (1993), Grilli et al (1991) and Cukierman (1992).
[17] Mundell (1968) and Fleming (1962).

We therefore augment the RPBC model in equation (22) with additional variables for central bank independence, fixed exchange rates and 'interaction terms' where for example the degree of central bank independence influences the effect of political factors upon the macro variables. Because the legislature of central banks does not tend to change much through time, it is especially important to focus on panel estimation; banks vary across countries, but not across time.

For our measures of CBI we use the Cukierman unweighted legal index (LVAU) and a new data set developed by Kilponen, Mayes and Vilmonen (2000) (KMV). The LVAU index is the most widely known index and was recently updated[18] by Schrijner and van Lelyveld (2000). The KMV dataset contains the component parts of the original Cukierman index, defined as 'Personnel Independence' (PERI), 'Political Independence' (POLI), 'Objective Independence' (OBJE) and 'Financial Independence' (FINI) and extends it throughout the 1990s[19]. These are individually constructed from updated responses to the Cukierman questionnaire[20]. These specific measures of CBI are all in turn used in subsequent analysis in order to overcome one of the objections to measures of independence that the aggregated measures incorrectly weight variables. A final index, which we denote as KMV is constructed as an unweighted average of PERI, POLI, OBJE and FINI. All measures take values between 0 (no independence) and 1 (complete independence).

[18] Cukierman's original index ends in 1992.
[19] Data for financial independence was unavailable for the case of Ireland.
[20] We refer the reader to Cukierman (1992) Appendix A for more details on the coding procedure, and Kilponen, Mayes and Vilmonen for details on their specific measures.

Some have doubted whether CBI can ever be measured accurately (for example see Forder 1998), but we argue that whilst measurement has its problems, refusal to measure is much worse (Maloney and Pickering, 2000b). Furthermore, our analysis uses several alternative measures and in doing this we can or at least try to establish which 'types' of CBI reduce the RPBC (or, if independence is thought to be indefinable, simply which types of central bank.)

The monetary policy constraint augmented model for estimation is written as

$$y_{it} = \quad b_0 + b_{0i} + b_1\pi_{it-1} + \sum_{k=1} b_{2k} y_{it-k} + b_3 L_{it} + b_4 E_{it} + b_5 DO_t + b_6 D90_t + b_7 CBI_{it}$$

$$+ b_8 DF_{it} + b_9 L_{it} CBI_{it} + b_{10} E_{it} CBI_{it} + b_{11} L_{it} DF_{it} + b_{12} E_{it} DF_{it} + u_t \,, \qquad (26)$$

where the i subscript refers to individual countries, CBI_{it} is the degree to which a central bank is independent and DF_{it} is a dummy variable set equal to one when there is a fixed exchange rate. The country specific intercept terms, b_{0i} capture the fixed effects. There are k lags for output in order to capture dynamic effects and to reduce serial correlation. The CBI measure and the fixed exchange rate dummy are used as regressors in their own right. There are four interaction terms, which are the products of the two political variables and the two monetary policy constraints.

If the theory is correct, and if the measures of CBI are sufficiently accurate, then the estimated coefficients of these interaction terms ought to be the opposite sign of the estimated parameter of the relevant political variable. That is, given $b_3 > 0$ and $b_4 < 0$ then, if increasingly independent central banks and fixed exchange rates reduce these political effects, b_9, $b_{11} < 0$, and b_{10}, $b_{12} > 0$. Equation (26) was estimated[21] using the alternative measures of Central Bank Independence, omitting Ireland, for which our set of measures is incomplete. Table 6 presents the estimation results for the parameters corresponding to the political and institutional variables, first for the full sample, then for the reduced sample of 13.

[21] Again, via maximum likelihood following a correction for fourth order ARCH.

Table 6a Estimation of equation (26), full sample excepting Ireland.

Output Equation	Regression coefficients (standard errors) {p-values}								Joint Hypothesis Tests[22] (p-values)							Likelihood Function Value
CBI Measure	b_3	b_4	b_7	b_8	b_9	b_{10}	b_{11}	b_{12}	A_y	B_y	C_y	D_y	E_y	F_y	G_y	
LVAU	0.0046 (0.00056) {0.000}	-0.0020 (0.00048) {0.000}	0.0033 (0.00065) {0.000}	-0.00025 (0.00025) {0.324}	-0.0097 (0.0017) {0.000}	0.0019 (0.0018) {0.299}	-0.00090 (0.00074) {0.227}	0.00004 (0.0009) {0.966}	0.000	0.000	0.000	0.000	0.000	0.170	0.000	9895.35
PERI	0.0027 (0.00083) {0.001}	-0.0013 (0.00068) {0.05}	0.0012 (0.0009) {0.163}	-0.00052 (0.00031) {0.095}	-0.0041 (0.0016) {0.010}	0.0018 (0.0017) {0.290}	0.00006 (0.0009) {0.951}	-0.0007 (0.0011) {0.541}	0.032	0.017	0.013	0.078	0.005	0.556	0.037	9885.15
POLI	0.0016 (0.0005) {0.002}	-0.0015 (0.0005) {0.002}	0.0026 (0.0013) {0.040}	-0.00076 (0.00026) {0.004}	-0.0104 (0.0050) {0.039}	0.0133 (0.0058) {0.022}	-0.00007 (0.0008) {0.935}	-0.0005 (0.0010) {0.597}	0.000	0.004	0.000	0.000	0.001	0.059	0.000	9887.94
OBJE	0.0040 (0.00042) {0.000}	-0.0024 (0.00042) {0.000}	0.0020 (0.00033) {0.000}	0.0002 (0.0003) {0.356}	-0.0056 (0.00097) {0.000}	0.00056 (0.0011) {0.604}	-0.0017 (0.0012) {0.181}	-0.00002 (0.0007) {0.968}	0.000	0.000	0.000	0.000	0.000	0.025	0.000	9909.54
FINI	0.0024 (0.0005) {0.000}	-0.0014 (0.00054) {0.009}	0.00045 (0.00036) {0.216}	-0.00028 (0.00030) {0.361}	-0.0041 (0.0011) {0.000}	0.0026 (0.0013) {0.05}	-0.00055 (0.00084) {0.517}	-0.00056 (0.0010) {0.576}	0.000	0.000	0.001	0.032	0.000	0.095	0.090	9890.93
KMV	0.0042 (0.00052) {0.000}	-0.0016 (0.00046) {0.000}	0.0030 (0.00066) {0.000}	-0.00023 (0.00025) {0.365}	-0.0091 (0.0016) {0.000}	0.0011 (0.0018) {0.514}	-0.0012 (0.0007) {0.109}	0.00004 (0.0009) {0.966}	0.000	0.000	0.000	0.000	0.000	0.161	0.000	9900.45

[22] Joint Hypothesis A_π is defined as H_0:b_7=b_8=b_9=b_{10}=b_{11}=b_{12}=0; joint hypothesis B_π is defined as H_0: b_9=b_{10}=b_{11}=b_{12}=0; joint hypothesis C_π is defined as H_0: b_7=b_8=b_9=b_{10}=0; joint hypothesis D_π is defined as H_0: b_7=b_8=b_{11}=b_{12}=0; joint hypothesis E_π is defined as H_0: b_9=b_{10}=0; joint hypothesis F_π is defined as H_0: b_{11}=b_{12}=0 joint hypothesis G_π is defined as H_0: b_7=b_8=0.

Table 6b Parameter Estimates – Reduced sample

Output Equation	Regression coefficients								Joint Hypothesis Tests (p-values)							Likelihood Function Value
CBI Measure	b_3	b_4	b_7	b_8	b_9	b_{10}	b_{11}	b_{12}	A_y	B_y	C_y	D_y	E_y	F_y	G_y	
LVAU	0.0062 (0.00098) {0.000}	-0.0017 (0.00090) {0.056}	0.0079 (0.0012) {0.000}	-0.0016 (0.00048) {0.001}	-0.014 (0.0029) {0.000}	0.0035 (0.0033) {0.283}	-0.00057 (0.0017) {0.740}	0.0020 (0.0020 (0.329}	0.000	0.000	0.000	0.000	0.000	0.434	0.000	6543.32
PERI	0.0027 (0.0013) {0.040}	-0.0012 (0.0011) {0.271}	0.0031 (0.0014) {0.0030}	-0.0024 (0.00050) {0.000}	-0.0050 (0.0025 {0.042}	0.0026 (0.0028) {0.361}	-0.00036 (0.0016) {0.829}	0.0028 (0.0019) {0.139}	0.000	0.000	0.000	0.001	0.000	0.612	0.000	6531.09
POLI	0.0020 (0.00090) {0.0028}	-0.0015 (0.00091) {0.090}	0.0074 (0.0025) {0.003}	-0.0029 (0.00048) {0.000}	-0.017 (0.0087) {0.054}	0.014 (0.010) {0.181}	0.0007 (0.002) {0.707}	0.0018 (0.0024) {0.463}	0.000	0.000	0.000	0.000	0.000	0.376	0.000	6535.50
OBJE	0.0046 (0.00074) {0.000}	-0.0011 (0.00072) {0.134}	0.0039 (0.00063) {0.000}	-0.0020 (0.00046) {0.000}	-0.0074 (0.0018) {0.000}	-0.00066 (0.0021) {0.748}	-0.0012 (0.0015) {0.449}	0.0031 (0.0018) {0.092}	0.000	0.000	0.000	0.000	0.000	0.740	0.000	6551.59
FINI	0.0028 (0.00086) {0.001}	-0.0014 (0.00091) {0.140}	0.0013 (0.00060) {0.036}	-0.0023 (0.00048) {0.000}	-0.0053 (0.0017) {0.002}	0.0034 (0.0021) {0.113}	-0.0007 (0.0018) {0.692}	0.0027 (0.0021) {0.183}	0.000	0.000	0.000	0.001	0.000	0.212	0.002	6535.41
KMV	0.0056 (0.00093) {0.000}	-0.00085 (0.00087) {0.329}	0.0064 (0.0012) {0.000}	-0.0019 (0.00047) {0.000}	-0.013 (0.0027) {0.000}	0.0007 (0.0030) {0.815}	-0.00094 (0.0016) {0.567}	0.0027 (0.0019) {0.151}	0.000	0.000	0.000	0.000	0.000	0.790	0.000	6544.95

In both samples, the original political parameters (b_3 and b_4) retain their sign and (especially within the reduced sample) increase their significance. This one might expect given that the previous estimation made no distinction between regimes that were policy constrained and those that were not. In the full sample both these political parameters are significant at the 1% level for all CBI measures except personnel independence (PERI)[23].

A considerable result in the full sample is that in every case the CBI interactive terms exhibit the 'correct' sign, offsetting the expansionary effects of a left wing incumbent and contracting effect of the E_t variable, and in many cases significantly. In both samples the parameter estimate for b_9 (corresponding to the L-CBI interactive term) was negative and significant[24] at the 5% level for all measures of CBI. This provides significant evidence that independent central banks offset the expansionary tendency of left wing governments. This effect was most pronounced in the cases of the two composite CBI terms, LVAU and KMV, and the objective independence measure (OBJE), although was present for all measures. The evidence was less strong that independent central banks dampen the political effects as captured by the E_t variable,

[23] The significant positive coefficient on b_7 (in all cases except PERI and FINI in the full sample), and significant negative coefficient on b_8 are intriguing. Remember that the data has gone through a Hodrick-Prescott filter, so that b_7 is measuring not whether CBI raises output but whether it raises output above trend. Given that, across the majority of business cycles in the majority of countries, the status of the central bank stayed the same, the significant parameter suggests a particularly strong effect in the minority of cases where there was a change. Why should making a central bank more independent intensify a cyclical boom or mitigate a cyclical slump? Perhaps the causality is the other way: governments have a particular propensity to give a bank more free rein when an economy has recently come out of a recession but the ensuing boom has not yet begun to give trouble. This is, after all, likely to be the stage of the cycle where the government and the bank have least to disagree about. A similar story might explain the negative coefficient on b_8 (particularly marked in the reduced sample). Governments may be more inclined to enter fixed exchange rate regimes at the cusp of a recession, and/or perhaps more relevantly inclined to liberate their currencies at the end of one, although future research is required for verification of such stories.

[24] The estimated coefficients for b_9 are often greater than those for b_3. This does not mean that central banks exert an 'anti' politically cyclic influence because in most cases the CBI measures are substantially less than unity.

but in the full sample b_{10} exhibited the correct sign in all cases and in the reduced sample was incorrect, but highly insignificant in only one case.

The interactive terms on the fixed exchange rate dummy fared less impressively – the estimates for b_{11} and b_{12} are insignificant in all cases. However, the policy constraint that fixed exchange rates impose is of course limited to monetary policy, and within the Mundell-Fleming model renders fiscal policy particularly effective. It is therefore not really surprising that this monetary policy constraint does not reduce politically induced macroeconomic fluctuations.

The likelihood function values supported the use of the objective independence measure. The composite measures, LVAU, and KMV also scored quite well, although this presumably is on account of their inclusion of the factors represented by objective independence. Personnel independence, policy independence and financial independence, whilst still individually apparently mitigating the PBC[25] fare less successfully. Objective independence might be expected to be the best measure of the effects of CBI, as the delegation type arguments rely upon Central Banks having precisely this characteristic. Ability to appoint your own board of governors, for example, is useless if inflation objectives are still set by politicians. Even the ability to set the interest rates may have little stabilising effect if politicians have set the target inflation rate. On the other hand, if the central bank is allowed to prioritise macroeconomic objectives, then there is a real potential for reduced political macroeconomic volatility.

[25] That these measures reduce the PBC by themselves may be a spurious inference. Increases in personnel, policy and financial independence tend to accompany increases in objective independence.

6. Conclusions

In this paper a model of rational partisan political business cycles was derived and estimated for 20 OECD democracies. With a RPBC, output depends not just on who wins an election, but by how surprising its victory was – wage-setters' political expectations will affect output both before and after the election. The more inflation-averse the actual government, the lower the output after an election. But the more inflation averse the *expected* government is, the higher the output on *both* sides of the election. We estimate all these predicted effects and find all the relevant parameters significant and correctly signed. However, we also find central bank independence significantly reduces each one of these effects. The exact result depended on the exact measure of CBI – of which we tried out six. As might have been expected, the measure of CBI that gave the best likelihood was that measure which captured objective independence.

APPENDIX

ESTIMATING THE PROBABILTIES OF LEFT- AND RIGHT-WING GOVERNMENTS

The most common political system (type 1), characterising 15 of our 20 countries, is one where two large parties, or coalitions of parties, alternate in office, with one party or coalition unambiguously to the left of the other. Here successive governments are easy to classify as Left or Right. The second most common system (Belgium and the Netherlands) is where there is a large Centrist party, which spends all or most of the time in power, either by itself, or in coalition with a left- or a right-wing party or grouping. Each of the three remaining countries (Italy, Ireland and Switzerland) has idiosyncratic political systems that we treat on an ad hoc basis.

In type 1 countries, we classify the two large parties, or coalitions, as left and right. Centre governments come about only when the two big players unite in a grand coalition (e.g. Germany from 1966-9). Parties which have only held office as part of the left (right) coalition we classify as left (right). Parties which have been part of both left-wing and right-wing coalitions we classify as centre. Parties which have never been in office we classify as Centre unless there is evidence to the effect that they would contemplate joining one, but only one, of the major parties/blocs. Thus, e.g. the UK Liberals (latterly Liberal Democrats) are counted as centre until after the 1992 election, at which point they made it clear that in a hung parliament they would not keep the Conservatives in power. One rather paradoxical result of this is that parties so extreme that all other parties would shun or be shunned by them count as Centre! But Centre, here, merely means neutral, for *practical* purposes, between the main Left and Right groupings. We assume that voters in these countries always expect either a left or right government (i.e. centre governments are a complete surprise.) The probability of a left (right) government is thus simply the probability that the parties classified left will have more (fewer) seats than those classified right. When Centre governments do occur, we give the L dummy a value of 0.5.

For Belgium and the Netherlands, we assume that the only possible results voters consider are the Centre governing on its own, a centre-left coalition and a centre-right coalition. We classify the last two as Left and Right respectively, given that they are most left- and right-wing regimes of which voters entertain any possibility. Voters expect the centre to govern on its own if and only if it wins an absolute majority of seats. The probability that it will fail to do this is thus the combined probability of a centre-left and a centre-right coalition. But how do voters split up this combined probability? We assume that they do so on the basis of the centre party's history of choosing coalition partners. In Belgium we assume that voters assume that the (Centrist) Christian Social Party will choose the larger of the (Right wing) Liberal and (Left Wing) Socialist Parties as coalition partners. In fact, the Liberals have polled less than the Socialists at every election, but nonetheless partnered the Christian Social Party on three of the twelve occasions. However, closer examination of the pattern of coalition choice does not reveal any better alternative to our assumption. In the Netherlands, the centre party (Christian Democratic Appeal), until 1997, always chose the Liberals as coalition partners unless it was the case that only the Socialists would give them a combined majority. We thus take the probability of the CDA and Liberals getting (not getting) an absolute majority as the probability of a right (left) wing government, conditional on the probability of the centre not governing alone.

In Ireland, three of the four main parties (Fianna Fail, Fine Gael and the Progressive Democrats) are of much the same ideological ilk on economic issues, with the fourth party, Labour, well to their left. Since Labour has never governed alone, we classify governments in which it shares power as left and governments excluding it as right. So how might Irish voters forecast whether Labour will be in the post-election government? Again, we assume they go on past history. Labour has got into power when, and only when, its vote has exceeded or equalled[26] the difference between the Fianna Fail and Fine Gael votes, and latterly the difference between the sum of the larger of these two parties and the Progressive Democrats and the smaller party[27]. The probability of this situation occurring we thus take as the probability of a left-wing government.

Italy is a difficult case due to the large number of changes of government between elections. In addition, for most of the sample period the makeup of the governing coalition has little relationship with the seat shares of the parties. Italy has fluctuated between Christian Democrat minority governments, coalitions where the Christian Democrats are supported by relatively centrist of the minor left wing parties, and what we might term Quasi-Grand Coalitions (with clear electoral majorities) where these parties have also been supported by more distinctly left-wing parties, in particular the Socialists (but never the Communists). Which of these materialises does not have a

[26] As in the 1992 election.

[27] In practice the Fianna Fail party has always been the larger. We hesitate to formally state that the Progressive Democrats are always allies of Fianna Fail, indeed the Progressive Democrats have worked with Fine Gael on occasion, for example opposing the calling of the early 1989 election. For the purposes of deriving expectations of government formation we are effectively asking if the Fine Gael plus the Labour vote will be sufficiently great to prevent Fianna Fail or Fianna Fail and the Progressive Democrats from forming a government. Thus, in 1992, even though the actual government was formed by Fianna Fail and the Labour party, we are assuming that it was the above condition that led to this result.

clear relationship with the outcome of elections. Here we resort to 50-50 election result probabilities in the absence of alternatives.

If Italy is the hardest case, Switzerland is the easiest. The same four parties have been in the same coalition since 1959 and we thus treat it as if it never has elections.

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