

**ON THE MODELLING OF POLITICO-ECONOMIC
INTERDEPENDENCE***

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ABSTRACT

Various analytic and simulation models designed to integrate the political and economic sectors are surveyed, stressing the interacting links going from the economy to the polity through the popularity function and in the reverse direction through the government's reaction function. Partial politico-economic models concentrate on a particular trade-off between goals, in particular between inflation and unemployment. The models of total politico-economic interdependence study the interrelationship of the economy as a whole with the polity. They are studied theoretically and by simulation techniques. Ongoing research by the authors indicates that such models can be applied empirically; as an example an already existing econometric model of the German economy is extended by an endogenous government sector.

“Models of politico-economic interdependence” are understood here as formalized and empirically oriented analyses in which the economic and the political sectors of society are interrelated by interaction equations describing how the economic sector influences the political one, and how the political sector influences the economic one. It is clear, of course, that in the strict sense there is neither a “political” nor an “economic” sector. For practical purposes, however, these sectors can be identified along the lines of what political scientists and economists

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traditionally study. The construction of politico-economic models is an attempt to close this gap and to study what impact economic magnitudes (e.g. unemployment and the rate of inflation) have on the polity, and how political forces (e.g. the interest of a government to seek reelection) influence the economy.

The purpose of this paper is to present recent and ongoing research in this area. An attempt is made to provide a general understanding, and not to deal with theoretical and formal intricacies. With respect to content, politico-economic models are truly integrative; contributions are made both by political scientists and economists, in the latter case adherents of the "New Political Economy" or, as it is also called, "The Economic Theory of Politics" (see Barry, 1970; Riker and Ordeshook, 1973). No methodological discussion is intended here; the stress lies on actual or potential future contributions to substantive problems. Various models developed by other scholars are presented in some detail, but space is also devoted to our own current research.

There are a great many ways in which politico-economic models can be classified. With respect to *formal* aspects one can, for instance, distinguish static and dynamic; partial and total; abstract and applied; analytic, simulated and empirically estimated models. A purely *historical* account would be less fruitful as the research on formalized politico-economic models is quite recent, most contributions being of the 70s. This paper discusses the research according to the following current (and expected future) main areas of study:

1. Party competition;
2. Popularity and election functions;
3. Reaction functions;
4. Partial politico-economic models;
5. Models of total politico-economic interdependence.

Most space is allocated to parts 4 and 5 as they combine the building-blocks developed in the previous parts.

1. Models of Party Competition

The basic idea is the analogy between economic and political competition in which parties are substituted for firms, and voters for consumers. All actors are assumed to maximize utility which in the case of parties boils down to vote maximization as this guarantees that the parties come into, or remain in, power. A voter supports that party which offers a program nearest to his wishes. Schematically, the model

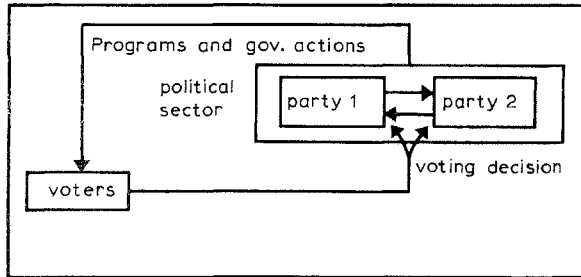


Fig. 1. The model of party competition.

can be pictured as in Fig. 1. As can be seen there is no *explicit* economic sector in the model; it is only implicitly contained in the programs of the parties, and in the actions of the government (i.e. the winning party) which must be feasible.

Two variants of the model can usefully be distinguished:

(a) *Pure party competition* which abstracts from all transactions costs and assumes perfect information of voters and parties. This variant goes back to Hotelling (1929) and Downs (1957), and is the object of extensive mathematical formulations (see ch. 11 and 12 of Riker and Ordeshook, 1973). For quite a wide set of assumptions (especially concerning the distribution of voters' preferences) definite results follow: In *equilibrium* the two parties offer identical programs in the median of voters' preferences and a Pareto-optimal allocation is reached for *all* goods; i.e. nobody's position can be improved without hurting somebody else. This applies to both private and public goods. The equilibrium of political competition is in this sense superior to the one reached by economic competition which is unable to allocate public goods optimally.

(b) *The applied models of party competition* take account of differences in information and group influences. It is, for instance shown why producers are politically stronger than consumers (Downs, 1957; Bernholz, 1966) and it is speculated whether the government budget is larger or smaller than (Pareto-)optimal (Downs, 1960). Thus, part of the application consists of a specification of the economic sector.

Both variants of the model are confronted with various difficulties into which there is no space to go here (see Barry, 1970). It must suffice to point to the theoretical problems that arise when there are more than two parties competing (see e.g. Selten, 1971). There is always a danger, moreover, to apply concepts of a science, here the notion of general economic equilibrium, to another subject. It is not clear whether the idea of competition provides as useful insights into the working of the political system as it does in economics. A real

danger lies in the concomitant tendency to construct more and more abstract pure models (as e.g. Ordeshook, 1974) and thereby to lose contact with reality. It should not be overlooked that the model of perfect economic competition has recently been severely attacked even by competent insiders (e.g. Kornai, 1971).

There can be no doubt, however, that the model of party competition has made an important contribution by showing that there are direct relationships between citizens' preferences and party programs and that the government's actions are bounded by competition, a force beyond ethical or legal restrictions.

2. Popularity and Election Functions

Popularity functions seek to establish a regular relationship between the state of the economy – reflected by variables such as the rates of unemployment, inflation and growth – and the popularity figures of parties and the government as collected by Gallup and national opinion polls. Election functions describe the relationship between economic variables and actual election results. Compared to the monthly popularity series there are, of course, much less data available; to receive statistically significant results it is therefore necessary to take very long time series or cross sections. The relationship has been studied for the United Kingdom (Goodhart and Bhansali, 1970; Miller and Mackie, 1973), the United States (Kramer, 1971; Stigler, 1973) and Germany (Frey and Garbers, 1972; Kirchgässner, 1974).

Popularity and election functions only consider one part of the interdependent relationship between the economy and the polity (see Fig. 2). They do not take into account that the government may in turn react to actual or expected changes in popularity figures and election

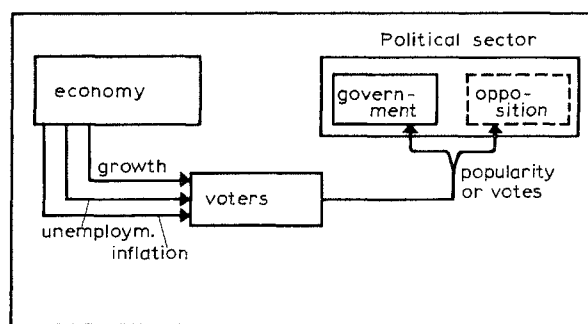


Fig. 2. Popularity and election functions.

results by influencing the economy. As must be expected, the various studies do not come to the same conclusion as to whether there exists any meaningful relationship at all, whether there are thresholds beyond which there is a statistically significant reaction of voters only, what economic variables are determinants, how monthly popularity series are connected with actual election outcome, and what relationship there is between government and opposition popularity. As indicated in Fig. 2, the idea of competition between parties only plays a minor role.

An interesting study is concerned with the influence of political advertising expenditures on election results (Palda, 1973, for Quebec). The votes received by the competitors for seats in the assembly depend on various ecological variables (such as being an incumbent or not) and on individual campaign outlays. Both sets of variables are statistically significant. To give an idea of the magnitudes involved, in the study indicated, a \$1 increase of advertising expenditures brings (on the average) an increase of one third of a vote.

3. Reaction Functions

Reaction functions stress the opposite loop of politico-economic interdependence: they study the political determinants of government actions. Starting from assumptions about government behaviour (such as vote maximization) optimal policies with respect to economic variables are derived. As Fig. 3 shows, the lower loop dealing with the influence of economic conditions on government popularity or votes, and the political process leading to actions, is (so far) treated only superficially. The structure of the economy is also scarcely specified.

A good example of a study of a reaction function is provided by Wright's (1974) cross section analysis of central government expenditures for US states during the economic depression of 1933–40. The

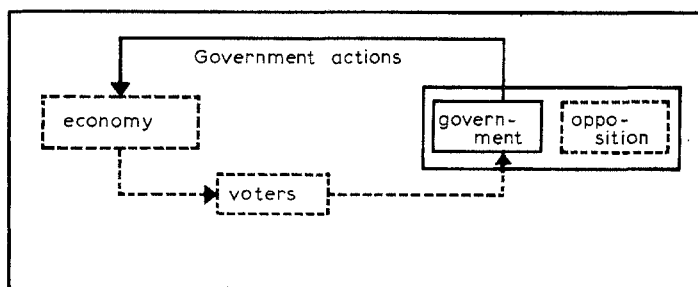


Fig. 3. Reaction functions.

“value” of every state to the central government depends upon the comparison of the traditional vote share (V_{i0}) of the president’s party (then the Democrats) with the vote share attainable (V_i) by generating income per capita in state i through appropriate public expenditures:

$$V_i = V_{i0} + bY_i, \quad (1)$$

where b indicates the effectiveness of additional income generation Y_i upon the vote share received V_i . A state has no “value” (in this sense) if the Democrats expect to receive a majority anyway ($V_{i0} > 50\%$), or if it is impossible to bring the actual vote share over 50% by income generation. Based on this idea, a priority index can be constructed which takes into account the ease with which any state can be won. It is hypothesized that the central government allocates public expenditures according to this priority index, i.e. not according to the “needs” of the individual states, but rather to the partisan interest of the administration in power. Statistical estimation shows indeed a significant effect of this priority index; the particular reaction function is not falsified.

4. Partial Politico-Economic Models

These models analyse the complete loop of interdependence between the political and economic sectors but are *partial* with respect to the economic system in which only one aspect – typically a *trade-off* between competing variables – is considered. This is shown in Fig. 4, where the well-known phenomenon that a reduction of inflation requires an increase of unemployment is chosen as a particular example of a trade-off – further pursued in the following subsection.

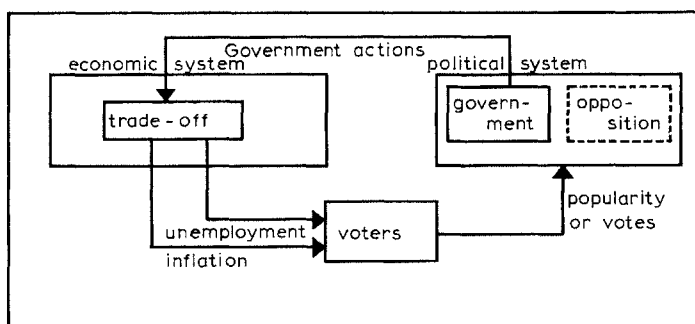


Fig. 4. Politico-economic model with a particular trade-off.

4.1. THE INFLATION-UNEMPLOYMENT TRADE-OFF

The economic model is

$$\pi = f(u) + \lambda\pi_E \quad (2)$$

where π = proportional rate of inflation,

u = rate of unemployment,

π_E = *expected* rate of inflation.

Empirical studies show that $f'(u) < 0$ and $0 < \lambda < 1$.

Inflation expectations adapt to actual inflation according to

$$\dot{\pi}_E = \psi[\pi - \pi_E] \quad (3)$$

where $\dot{\pi}_E \equiv d\pi_E/dt$ = change of inflation expectation over time.

If actual inflation is higher than expected inflation ($\pi > \pi_E$), there is an upward revision of inflation expectations, i.e. $\psi' > 0$. From (2) and (3) it follows that the *short-run* trade-off between inflation and unemployment is

$$\frac{d\pi}{du} = f'(u), \quad (4a)$$

and the *long-run* trade-off (when expected inflation is equal to actual inflation)

$$\left. \frac{d\pi}{du} \right|_{\pi=\pi_E} = \frac{f'(u)}{1-\lambda} \quad (4b)$$

Fig. 5a shows that the short-run trade-off is less steep and hence more severe. The short-run trade-off shifts over time due to the induced changes in expectations: when unemployment increases, the rate of inflation falls, and inflation expectations adapt downwards yielding a new short-run trade-off lying nearer to the origin (and conversely for a decrease in unemployment). The relationship between inflation and unemployment is thus a time-consuming process. A voter would prefer a state of both less unemployment and less inflation; his preference function (on which he bases his voting decision)

$$g(\pi, u)_i; \quad \frac{\partial g}{\partial \pi} < 0, \quad \frac{\partial g}{\partial u} < 0 \quad (5)$$

yields indifference curves indicating that he is less and less willing to substitute one ill against the other (increasing marginal disutility of

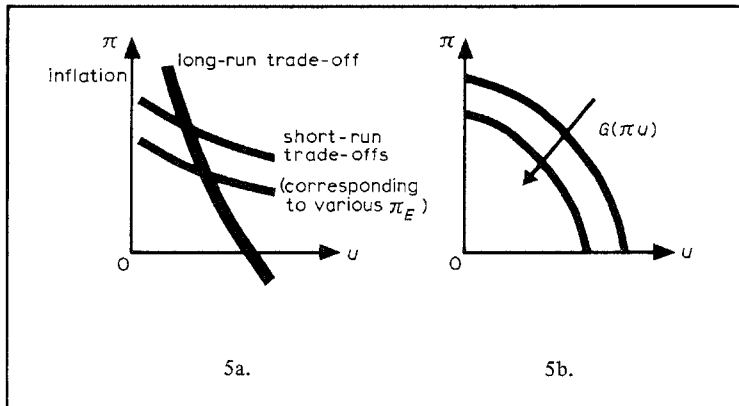


Fig. 5a. Short-run and long-run trade-offs.

Fig. 5b. Voters' preferences concerning inflation and unemployment.

inflation and unemployment). Under suitable conditions this individual voting function can be summed to an aggregate voting function $G(\pi, u)$ with the same properties (pictured in Fig. 5b).

Now assumptions about the *political sector* are made (see the models by Nordhaus, 1972, and MacRae, 1974). The government is assumed to maximize current votes in order to win elections:

$$\max V = G(\pi, u), \quad (6)$$

where $V = \text{votes}$.

At any given time it may choose only points on the short-run trade-off. The optimal point for the government is attained where the voting function (6) is tangent to the short-run trade-off. As has been noted above, this short-run curve shifts over time if inflation expectations differ from actual inflation rates. A *long-run equilibrium* or steady state is attained only if the point chosen by the government is also located on the long-run trade-off. This point is indicated by A in Fig. 6. (For the sake of simplicity, the movement to this long-run equilibrium is not shown).

The inflation/unemployment configuration chosen by a democratically elected government is now compared to the *general welfare optimum* which is derived by maximizing the welfare function of the society W which is the integral of the utility derived from all future combinations of unemployment and inflation, with the future discount-

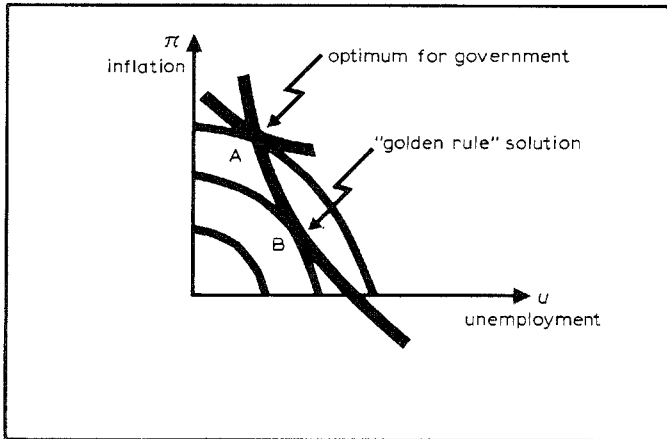


Fig. 6. Optimum for government and golden rule solution.

ed by the rate $\rho \geq 0$.

$$\max W = \int_{t=0}^{\infty} G[\pi(t), u(t)] e^{-\rho t} dt \quad (7)$$

If the future is not discounted at all – as many serious scholars think appropriate for society as a whole – it follows that $\rho = 0$ and the welfare optimum is located at point B in Fig. 6. This solution may be called the “Golden Rule”. If the future is weighted less heavily than the present, $\rho > 0$, the general welfare optimum lies in between points A and B. It can be shown that the point actually chosen by the government (point A) *implies* an infinitely high rate of discount of the future ($\rho = \infty$).

Nordhaus interprets the result in the following way: Democratically elected governments choose *higher inflation* and *lower unemployment* than socially optimal (for $\rho < \infty$); their choice corresponds to a *purely myopic* policy. According to this model, democracies thus have an inherent weakness because due to their desire to stay in power, governments pursue extremely short-sighted policies.

Nordhaus and MacRae have also studied the politico-economic *dynamics within an electoral period*. The objective of the government is taken to be the maximization of votes at the election date T . The total number of votes received $V(T)$ depends on the utility derived by citizens according to formula (5) summed over the whole electoral period.¹ The government's objective function thus is

$$\max V(T) = \int_{t=0}^T G[u(t), \pi(t)] dt \quad (8)$$

With the help of the methods of optimal control theory, it can be derived that immediately after the elections unemployment is strongly raised (in order to dampen inflation expectations in future periods and to therewith ease future trade-offs), and thereafter slowly lowered. In period 4 in which the elections are assumed to take place, the lowest rate of unemployment together with the highest rate of inflation is brought about as an optimal policy. Using discrete formulations for the model just developed, and giving equal weights to inflation and unemployment in the voters' aggregate preference function $G(u, \pi)$, it has been statistically estimated for the United States over the period 1954–69 that considering only this particular influence, in the first year of a new electoral period inflation is 3.7% with a rate of unemployment of 5.8%, in the second year inflation is slightly lowered to 3.5% with unemployment at 5.0%, in the third year unemployment is decreased to 4.2% with inflation rising again to 3.7%, and in the election year unemployment is at its minimum of only 2.8% yielding a rate of inflation of 4.8% (MacRae, 1974, 13). This is shown in Fig. 7.

Such paths are of great interest as it is a theoretical model of the *political business cycle*, which has been observed in reality (see e.g. Prest, 1968; Lindbeck, 1970; Averch, Koehler and Denton, 1971). It is stable and (if there are no external shocks) repeats itself every electoral

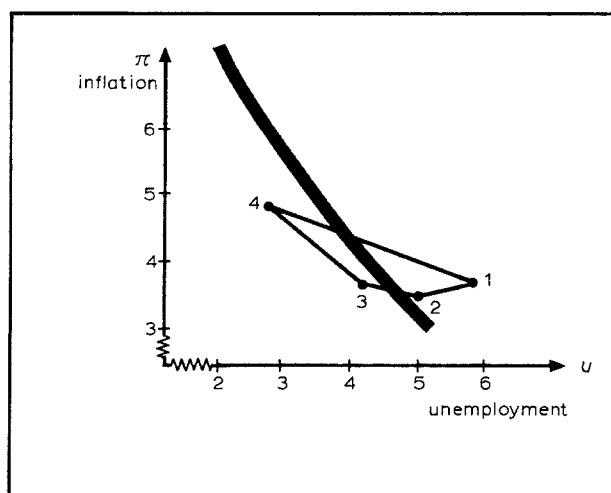


Fig. 7. The government's optimal policy during the electoral period.

period. Fluctuations in economic variables are shown not to originate solely from the economic sphere; they may be the result of politico-economic interaction.

4.2. THE INTERTEMPORAL TRADE-OFF

A partial politico-economic model has also been derived with respect to the intertemporal allocation of resources (Frey and Ramser, 1974). The higher present consumption, the lower is present investment, which means that the future capital stock and therewith future consumption is lower than with lower present consumption. In accordance with economic growth theory (see e.g. Solow, 1970; Wan, 1971) the economic system can be formalized as

$$\dot{k} = \frac{dk}{dt} = f(k) - \gamma k - c \quad (9)$$

where k = capital stock,
 $f(k)$ = income (as a function of capital),
 c = consumption,

all variables taken per head. γ expresses the constant underlying growth rate of the system.

The *political system* has been formulated in a quite different way than in the previous model. It is assumed that the government desires to maximize the length of the time period during which it is in power. This depends essentially on the government's re-election probability $p(\tau)$ which measures the chance with which the government wins yet another election in period τ (with $0 < p(\tau) < 1$). The chance to stay uninterruptedly in power over n electoral periods can be shown to be equal to

$$p(1) \cdot p(2) \cdot p(3) \dots p(n) = \prod_{\tau=1}^n p(\tau)$$

The sum of the length of every uninterrupted period in power 1,2,3... weighted by the probability of becoming true is to be maximized by the government

$$\max \int_{t=1}^{\infty} \left[\prod_{\tau=1}^t p(\tau) \right] dt \quad (10)$$

The influence of the economic upon the political sector is pictured by the re-election probability $p(\tau)$ depending on per capita consumption of

the electorate,

$$p(\tau) = p[c(\tau)], \quad (11)$$

which is a simplified election function.

Using again optimal control theory it can be shown that in long-run equilibrium (steady state)

$$f'(k^*) = [1 - p(c^*)] + \gamma, \quad (12)$$

where the stars indicate optimal values. This result is amenable to straightforward intuitive interpretation. The left-hand side of (12) gives the marginal productivity of capital which is inversely related to the rate of investment. The first component of the right hand side $[1 - p]$ indicates the probability for the government of *not* being re-elected, the second component is the overall growth rate, an exogenously given constant. Formula (12) thus says that *ceteris paribus* the lower the probability of re-election, the lower will be the optimal rate of investment. This makes sense: the government is unwilling to invest much in the future if the chance of still being in power is low.

The policy a democratically elected government (with the stated objective function) pursues may again be compared to the *welfare optimum of society* which is derived from

$$\max W = \int_{t=1}^{\infty} u[c(\tau)] e^{-\rho t} dt, \quad (13)$$

where $u(c)$ is current utility derived from consumption and ρ is again the exogenously given rate of discount. The well-known result from growth theory is

$$f'(k^{**}) = \rho + \gamma. \quad (14)$$

Comparing (12) with (14) shows immediately that the *government's probability of not being re-elected* corresponds to the *rate of time preference per electoral period*

$$\rho = (1 - p). \quad (15)$$

A government which is confident of re-election discounts the future little, while if it is quite certain to lose the next elections it discounts the future heavily. As the re-election probability p is a function of c^* , it may not *a priori* be said whether a democratically elected government discounts the future more than socially optimal. The size of $p(c^*)$ and hence of the *implied* rate of discount $\rho = 1 - p$ depends both on economic conditions and the form of the election function and can be

empirically evaluated. This result deviates from the model of section 4.1 in which the government's discount rate turned out to be infinite and is therefore *always* higher than socially optimal.

5. Models of Total Politico-Economic Interdependence

In these models not a particular trade-off, but the economy as a whole is studied in its interrelationship with the political sector (Fig. 8). Such an approach, of course, does not exclude the possibility that some aspect of the economy is stressed.

5.1. A GENERAL FORMULATION

At this point, only the new aspects are discussed. One of the early politico-economic models (Frey and Lau, 1968) introduced a much more general governmental objective function than used in the studies so far dealt with. The government is assumed to *maximize utility* u over all future periods, suitably discounted by the rate ρ :

$$\max \int_{t=1}^{\infty} u(t)e^{-\rho t} dt \quad (16)$$

Utility is derived both by putting ideological conceptions (*IDEOL*) in practice and to be popular with the voters (*POP*)

$$u = u(\text{IDEOL}, \text{POP}). \quad (17)$$

This model thus acknowledges that the government is not simply a machine to get to power, but that politicians also want to pursue ideological ends.

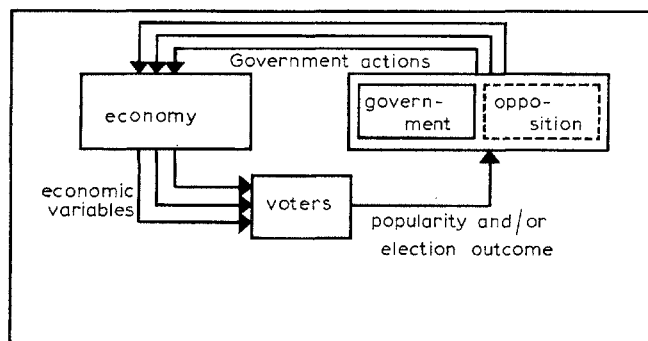


Fig. 8. The total politico-economic model.

Ideology and popularity in turn depend on all economic goal variables $y_1 \dots y_n$:

$$IDEOL = f(y_1 \dots y_n), \quad (18)$$

$$POP = h(y_1 \dots y_n). \quad (19)$$

The government politicians are only able to pursue their goals as given by (16) if they stay in power at the elections occurring at dates T ($T = 4, 8, 12, \dots$). The *re-election constraint* is

$$V(T) \geq VMIN \quad (20)$$

which says that the government must then receive at least the minimum vote share $VMIN$. The minimum vote necessary to stay in office depends on the number of parties competing, the coalition probabilities, and institutional provisions. In the model discussed (as in the following ones) it is for simplicity's sake taken to be exogenously determined. At a later stage the theories of coalition formation (Taylor and Laver, 1973; De Swaan, 1973) should be explicitly introduced.

The vote share received by the government depends on the *political capital stock* PK , which gives the citizens' *long run* evaluation of the government's performance

$$V(T) = \phi[PK(T)]. \quad (21)$$

The political capital stock is constructed analogously to the economic capital stock: it is increased by current (short-run) popularity POP and decreased by political depreciation PD , indicating the rate with which voters forget the government's past performance:

$$\dot{PK} \equiv \frac{dPK}{dt} = POP(t) - PD(t) \quad (22)$$

The second major constraint upon government behaviour is exerted by the economic structure which only allows certain combinations of economic variables $y_1, y_2 \dots y_n$. This is best written as an implicit function

$$H(y_1, y_2 \dots y_n) = 0. \quad (23)$$

The model allows the derivation of a *political business cycle* regularly occurring between the election dates. Its main use, however, is to serve as a theoretical background to the simulation and politometric models subsequently discussed, which differ substantially from the models of the Downsian tradition. Only little attention is paid to the aspect of competition; it is visible only in the re-election constraint. This allows

the consideration of government ideology which is supposed to be of significant importance in real political life. The economic set-up in which the government must act is explicitly stated, and will be specifically formulated in the following models.

5.2. SIMULATION MODELS

As the foregoing general model is not amenable to a complete analytic solution, the characteristics of total politico-economic models have been studied with the help of computer simulation. A first model has been constructed (Frey, 1974) in which special emphasis is put upon the explicit formulation of the government's *reaction function* and the voters' *popularity function*. For simplicity's sake, the government is assumed to have only part of investment ("political investment", PI) as an instrument available with which to steer the economy. The voters evaluate the government's performance according to consumption only (see Fig. 9).

The reaction function reflects the government's desire to stay in power as long as possible and is thus closely related to the model discussed in section 4.2. If the vote share V received is smaller than necessary for re-election at the upcoming election ($V < VMIN$), the government reduces political investment in order to lift popularity by a short run increase of consumption. If the government expects to receive more than the necessary vote share ($V > VMIN$), it can allow to take future election periods into account; therefore it is interested to have a high national income in the future which is achieved by raising investment now. A simple formulation of the reaction function is

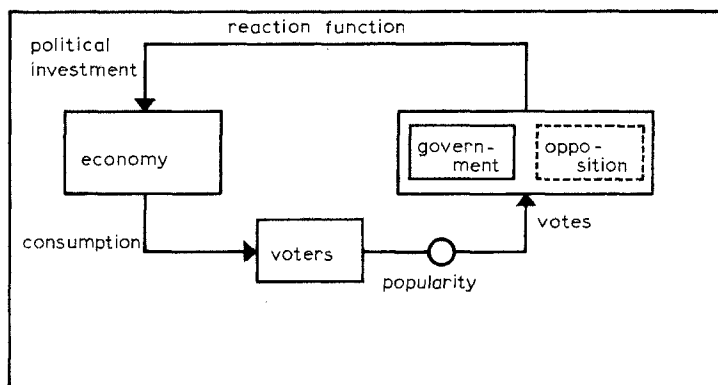


Fig. 9. A simple simulation model with one decision and one evaluation variable.

$$PI(t) = PI(t - 1) + \beta[V(t - 1) - VMIN], \quad (24)$$

with $\beta > 0$. The popularity function takes into account that voters' political reaction can be expected to depend not simply on the absolute level of an economic variable but rather on its actual compared to its expected level. Popularity thus rises if actual consumption C is higher than expected consumption EC :

$$POP(t) = POP(t - 1) + \pi[C(t) - EC(t)], \quad (25)$$

with $\pi > 0$. EC can be computed as a weighted mean of past consumption. As has been pointed out (Flemming, 1973) this formulation has weaknesses, because at certain steady growth rates expectations always lag behind performance. For this reason the popularity function used in empirical models (see e.g. (26) below) has been changed.

The introduction of the specific reaction and popularity functions into an economic and political structure as outlined in the previous section yields a closed model whose time sequence can be traced by simulation. It is assumed that an initial stationary equilibrium is set into motion by exogenous shocks upon the popularity function of various positive and negative amounts. They may be interpreted as non-economic internal influences; such as political scandals, or as all influences coming from outside the country.

The simulation runs give indications about the conditions under which the government is able to manage re-election through an appropriate economic policy, if it is affected by adverse exogenous popularity shocks, and how and to what extent a favourable exogenous popularity gain can be conserved into the future. As in the purely analytical models, the appearance of a "political business cycle" is again well visible, but due to the higher complexity of the model it is of an irregular shape between any two elections. The simulation runs also allow inferences about the mutual interdependence of economic and political *stability*. (For the *present* purpose political instability is interpreted as a rapid change of government.) It turns out that under some conditions, political instability contributes to economic stability, while sometimes it strongly accentuates economic instability. Inversely, the production of marked economic fluctuations is sometimes a precondition for a government to achieve re-election.

With a modest augmentation of the economic sector and the introduction of additional policy instruments for the government, combined with random shocks upon the popularity function (which may well be the appropriate representation of political scandals and foreign policy influences) the politico-economic model can be shown to produce quite

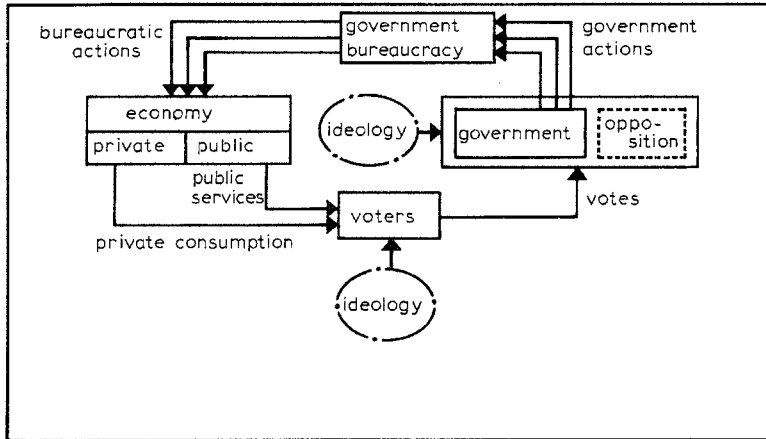


Fig. 10. An extended politico-economic simulation model.

realistic sequences of popularity figures (Schneider, 1974).

Another extension splits the economy up into a private and public sector which provides the public services (Frey, 1975). The government disposes of several short, medium and long-run policy instruments. Its aim is to *maximize utility* subject to a re-election constraint, i.e. the approach of the general analytic model is used. According to whether a left-wing or a right-wing party is in power, it has an ideological preference for the supply of public services or private consumption. The optimal policy for the government is derived by applying dynamic programming. Due to the incomplete state of information, this "as if" behaviour of the government is undertaken within the context of the simplified economic structure the government perceives. The simulation runs are performed within several "environments" given by varying ideological preferences of the electorate. Finally, the government bureaucracy is introduced assuming that it acts incrementally (see Wildavsky, 1964) and that public officials tend to be budget-maximizers (Niskanen, 1971). The complete model is sketched in Fig. 10.

5.3. POLITICO-ECONOMETRIC MODELS

The *empirical estimation* of politico-econometric models may in analogy to econometrics be termed politico-econometrics or for short *politometrics*.² Conceptually, the step from theoretical and simulated models of total politico-economic interdependence to politometrics is but a relatively small one though there are a great many practical problems involved.

The two present authors are currently undertaking research in this direction. The economy is taken to be represented by an accepted yearly econometric model such as by Krelle (1969) for Germany. With the theoretical background of the various politico-econometric models already developed, the research proceeds in the following steps:

(a) The *instruments* available to the government are tested as to their effect on the main economic variables. At the same time it is studied in what period(s) the main effect arises. Thus, for instance, government expenditures have a strong positive effect on employment and the growth rate of (nominal) wages both in the short (i.e. over one year) and medium (i.e. over two years) run. An increase of taxes on work income, affects the growth rate of (nominal) wages and the budget balance negatively in the short run; in the medium and long run (i.e. over three years) only the budget balance is affected. This part is a simple multiplier analysis.

(b) The *popularity function* is estimated. At this stage, the simplest version available is taken, i.e. the possible existence of perception thresholds, etc., is disregarded. The parameters have been estimated with values for the period 1950–1972 (annual observations):

$$\begin{aligned} POP(t) = & POP(t - 1) - 104.4 \text{ (rate of inflation)} \\ & + 0.38 \text{ (total employment)} \\ & + 16.14 \text{ (growth rate of per capita consumption)} \\ & + 45.34 \text{ (growth rate of nominal wage rates)} \end{aligned} \quad (26)$$

The *t*-values and the correlation coefficients are not shown as they are biased due to the lagged endogenous variable. The parameters have the expected sign.

(c) The *reaction functions* of the government are estimated. Their general form is

$$INSTR(t) = \alpha INSTR(t - 1) + \beta [POP(t - 1) - POPMIN] \cdot TBE(t) \quad (27)$$

where *INSTR* = any of the instruments previously identified. The parameter reflects the influence of the incrementally acting bureaucracy, the parameter β the more narrowly political influences.

For simplicity, popularity figures are in this model taken as indicators of expected election outcome, thus *POPMIN* indicates the minimal approval of the government in order to stay in power. It is in the following assumed to be at a "security level" of 52%. *TBE* is a dummy variable to be explained presently.

Now two cases are distinguished:

(i) If the government is *less popular than necessary for re-election*,

$POP < POPMIN$, it must make an effort to increase popularity with the voters. If this deficit occurs four or three years before the next election, the government uses long-run instruments to that effect; if the deficit occurs in the pre-election year, it can, of course, use short run instruments only. $TBE(t)$ are the dummy variables (with value 0 or 1) indicating whether an instrument is used or not. In a pre-election year the government with $POP < POPMIN$ increases government expenditure and public employment, and decreases wage taxes.

(ii) If the government is *more popular than necessary for survival*, $POP > POPMIN$, it engages in the pursuit of ideological goals. These goals can be deduced by the examination of party programs, or through interviews such as collected by Kirschen (1964).

Three types of ideologies are distinguished:

- “*Right-wing* governments” who value price stability and an equilibrium in the balance of payments and the budget;
- “Governments of the *centre*” who have the preference order: price stability, then growth of income, and then employment;
- “*Left wing* governments” who have a strong preference for full employment and equity in income distribution.

In the case of the Federal Republic of Germany, the Christian Democratic Union (CDU) is identified as “right wing,” the Social Democrats (SPD) as “left wing”. Thus for the period 1950–66 the government ideology is taken to be “right wing”; in 1967–69 there was the Grand Coalition between CDU and SPD and the resulting “aggregate” ideology is “centre”; and for 1969–72 the ideology of the coalition between the SPD and the Free Democrats is taken to be “left wing”.

With these assumptions, the reaction functions e.g. for *government expenditures* for goods and services have been estimated (for the same period as the popularity function):

$$GEX(t) = 1.13 GEX(t-1) + 0.89 [POP(t-1) - PMIN] \cdot TBE(t), \quad (28)$$

and, e.g. for *government transfers*

$$GTR(t) = 1.09 GTR(t-1) + 0.20 [POP(t-1) - PMIN] \cdot TBE(t). \quad (29)$$

As the t and R^2 values are biased due to the lagged endogenous variable, they are not shown. The estimations indicate that the bureaucracy incrementally increases government expenditures by 13% per year. Expenditures for goods and services are changed much more strongly when popularity is lower than necessary for re-election or if the government can pursue ideological goals (0.89 compared to 0.20).

In order to study the predictive power of the model, ex-post fore-

casts have been undertaken for two subsequent election periods, 1958–61 and 1962–65, in which there was a “right wing” government, in that the Christian Democrats were either the only or at least the clearly dominating party in government. The various ex-post predictions with the politico-econometric model have for almost all years given results closer to actual values than the corresponding forecasts with the “pure” econometric model without endogenous government sector. For predictions covering one year ahead, for instance, the politometric model yields superior forecasts in 6 vs 1 years for government expenditures, and in 5 vs 0 years for national income. (The detailed quantitative results will be presented elsewhere.)

The empirical tests undertaken seem to allow the tentative conclusion that the formulation of an integrated politico-econometric model represents a progress over the “pure” econometric models disregarding any political influence. The politometric systems developed so far are, of course, only preliminary and partial attempts to capture the main interrelationships between the economy and the polity. At a later stage, such factors as the influence of pressure groups and the federal structure must obviously be taken into account.

Notes

- 1 Nordhaus assumes that voters have a decaying memory of the *past* state of the economy. While in the welfare approach (eq. 7) the *future* is discounted by the rate ρ , now the *past* is discounted by the rate μ . This aspect is not considered in the exposition, as the fundamental politico-economic dynamics of the inflation-unemployment trade-off is unaffected by it.
- 2 Note that this differs from what Gurr (1972) calls “politometrics” which is identified as any quantitative study of politics, even if no formal statistical estimation is involved.

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