

Political Competition in a Model of Economic Growth: An Experimental Study

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1. Introduction

We report here on a series of experiments on a one-sector model of economic growth in which decisions on consumption and capital accumulation are made by politicians elected in a competitive political process. The basic question we want to study is how political systems, in which candidates have limited tenures, make decisions on issues that involve capital investment planning. There has been much work investigating the one-sector growth model from the point of view of an economic planner. But not much has been done to study the types of consumption-investment paths that would be generated by political processes in this framework. We are concerned with two aspects of the paths that are generated. First, we want to see how the paths generated by a political process compare with so called optimal paths that would be chosen by an economic planner. Second, we want to see if there is any evidence of political business cycles in the data.

When one leaves the setting of growth theory, there is a fair amount of work that has attempted to characterize the type of fiscal and monetary policy that would be generated by political processes. A recurrent theme in this literature is that if politicians are allowed to make economic decisions, it will generate “political business cycles”—business cycles coinciding with the term of office of the politicians. Nordhaus (1975) originally derives such results in a model in which the incumbent office holder must choose among different points along a Phillips curve. He also presents some empirical evidence that supports the existence of political business cycles in some countries. Nordhaus’s theoretical argument depends crucially on voter myopia.

Support for this research was provided, in part, by NSF grant #SES-8604348 to the California Institute of Technology.

Subsequent papers by Rogoff (1990) (see also Rogoff and Sibert 1988) and Alesina (1987) have derived political business cycles without having to assume voter myopia. Rogoff and Rogoff and Sibert show that the introduction of asymmetric information over the competency of political candidates can generate a political business cycle. In this model, a business cycle emerges as a signaling equilibrium in which the size of the cycle is used, by the candidate, to signal its competency to the voters. Alesina assumes that different political parties have different preferences over the trade-off between inflation and unemployment levels. He then gets political business cycles emerging even when voters have rational expectations, due to the fact that the election provides a random shock. Both of the above models are partial equilibrium models. Rogoff's economy does not have the capability of real growth, while Alesina's political parties have exogenously given policy positions.

A second theme that emerges in the literature is that political candidates have short time-horizons, since they are only concerned with the performance of the economy while they are in office. Consequently, they make decisions that are not optimal in the long run. In Nordhaus's model, for example, the candidates pick a higher level of inflation and lower level of unemployment than is optimal for the voters. If candidates are really shortsighted, then, in a model that allows for savings and investment, one might expect that politicians would invest less than would be socially optimal.

We began this study with these questions in mind. The simplest possible framework in which to study them seems to us to be the one-sector model of economic growth, where decisions are made by candidates who compete in a two-candidate electoral process. In this article, we study these questions from an experimental point of view.

In a related paper (Boylan et al. 1990), we study the same questions addressed here, but from a theoretical point of view. We summarize some of those results here. First we present the basic model.

2. The Model

We consider the simplest possible framework—a one-sector model with two-candidate competition. The economy is one in which there is one good that can be consumed or invested (for example, corn, which can be planted or eaten). Following the classical economic model, the technology of growth and production is as follows:

Let y_t be the per capita output on date t , let k_t be the per capita capital stock at the beginning of date t , let i_t be the per capita investment on date t , let c_t be the per capita consumption on date t , and let λ be the rate of depreciation of the capital stock. At time t , output y_t is determined by the capital stock k_t ,

$$y_t = f(k_t), \tag{2.1}$$

where f is the production function.¹ The output y_t in any period can be either consumed or saved (invested). Thus,

$$y_t = i_t + c_t. \tag{2.2}$$

The capital stock at time $t + 1$, k_{t+1} , equals the capital stock at time t , minus depreciation, plus the output invested at time t . That is,

$$k_{t+1} = i_t + (1 - \lambda)k_t. \tag{2.3}$$

We write $F(k_t) = f(k_t) + (1 - \lambda)k_t$. The technology can be summarized in the fundamental equation of growth theory: we are given $\bar{k} > 0$, and for $t = 0, 1, 2, \dots$,

$$c_t + k_{t+1} = f(k_t) + (1 - \lambda)k_t = F(k_t), \tag{2.4}$$

where

$$k_0 = \bar{k}, k_t \geq 0, c_t \geq 0. \tag{2.5}$$

Any path $z = \{(c_t, k_t)\}_{0 < t < \infty}$ satisfying equations 2.4 and 2.5 is a *feasible consumption-investment path*. Let Z represent the set of feasible consumption-investment paths. For any $z \in Z$, write $z = (c, k)$, where $c = \{c_t\}_{0 < t < \infty}$ is the corresponding consumption path, and $k = \{k_t\}_{0 < t < \infty}$ is the corresponding capital path. Since k_t is determined from c_{t-1} and k_{t-1} by equation 2.4, a consumption-investment path is determined completely by the corresponding consumption path. Let \mathcal{C} denote the set of feasible consumption paths.

Letting $N = \{1, \dots, n\}$ denote the set of n voters (consumers), we assume that for each voter $i \in N$, one period preferences over consumption are represented by a concave function $u_i: \mathcal{R}_+ \rightarrow \mathcal{R}$ satisfying $u_i'(c) > 0$, $u_i'(0) = \infty$ and $u_i''(c) < 0$ for all $c \in \mathcal{R}$. Further, for each voter, there is a positive real number $\delta_i < 1$ representing the voter's discount factor. The voter's utility function $U_i: \mathcal{C} \rightarrow \mathcal{R}$ over consumption paths is then given by

$$U_i(c) = \sum_{0 < t < \infty} \delta_i^t u_i(c_t). \tag{2}$$

1. We assume throughout that f is twice continuously differentiable, with $f' > 0$, $f'' < 0$, $f(0) = 0$, $f'(0) = +\infty$, and $f'(\infty) = 0$.

2. One might worry about the distribution of c_t across voters, but for simplicity we will treat this as a public good. That is, the elected candidate will pick c_t , the amount of y_t to be consumed, yielding voter i a utility level of $u_i(c_t)$ for that period.

This economic growth model has been studied extensively in the case where a particular social welfare function is defined. This approach amounts to assuming that there is just one voter, so that we can solve for a feasible consumption-investment path that maximizes the welfare function for that one voter. That is, for any $c \in \mathcal{C}$, $U(c) = \sum_{t=0}^{\infty} \delta^t u(c_t)$, where $u: \mathcal{R}_+ \rightarrow \mathcal{R}$ satisfies $u'(c) > 0$, $u'(0) = \infty$, and $u''(c) < 0$ for all $c \in \mathcal{R}_+$.

The solution $[(c_t^*, k_t^*)]_{0 < t < \infty}$ can be characterized by a pair of functions $g(k)$ and $h(k)$ for the optimal consumption and capital, respectively, such that $k_0^* = \bar{k}$, $k_{t+1}^* = h(k_t^*)$, and $c_t^* = g(k_t^*)$. The functions g and h satisfy $g(k) = F(k) - h(k)$, and $\delta u'\{g[h(k)]\} = u'[g(k)]/F'[h(k)]$, where h satisfies $h' > 0$ and $h(k) < k^*$ for $k < k^*$, and $h(k) > k^*$ for $k > k^*$, and k^* is defined by

$$f'(k^*) = \lambda + r, \quad (2.6)$$

where $r = 1/\delta - 1$.³ This result means that $k_{t+1}^* = F(k_t^*) - c_t^*$, and $\delta u'(c_{t+1}^*) = u'(c_t^*)/F'(k_{t+1}^*)$. The optimal path of capital begins at k_0 and converges monotonically to k^* . Similarly, the optimal path of consumption converges monotonically to $c^* = f(k^*) - \lambda k^*$.

Boylan et al. (1990) offer a theoretical analysis of political processes within the framework of the one-sector model of economic growth described here. There, decisions about the consumption-investment path are decided by a two-candidate political system in which the candidates compete for office through the consumption paths that they propose to the voters. They consider two different models: In the first, candidates are able to commit to a path of consumption over their entire term of office. In the second model, they are only able to commit themselves for the current period.

In the first model, where candidates can commit to consumption streams, under very mild conditions on the heterogeneity of voter preferences, there is no majority-rule equilibrium.⁴ More specifically, if different voters have dif-

3. To see this, let $v^*(k) = \max_c \{u(c) + \delta v^*[F(k) - c]\} = \max_h \{u[F(k) - h] + \delta v^*(h)\}$ be the value of being at state k . Then $v^*(k) = u[F(k) - h(k)] + \delta v^*[h(k)]$, where for all k , $h(k)$ satisfies $\frac{\partial v^*}{\partial h} = 0 \Rightarrow u'[F(k) - h(k)] = \delta v^{*'}[h(k)]$. Now, by the Envelope theorem, $v^{*'}(k) = \frac{\partial v^*}{\partial k} = u'[F(k) - h(k)]F'(k)$. Hence $u'[F(k) - h(k)] = \delta v^{*'}[h(k)] = \delta u'\{F[h(k)] - h[h(k)]\}/F'[h(k)] \Rightarrow u'[g(k)] = \delta u'\{g[h(k)]\}/F'[h(k)]$. Note that if $h(k) = k$, then $\delta u'[g(k)] = u'[g(k)]/F'(k) \Rightarrow F'(k) = 1/\delta \Rightarrow f'(k) = \lambda + r$. The value function, v^* , is continuous, differentiable, strictly increasing, and strictly concave. That is, $v^{*'}(k) > 0$, and $v^{*''}(k) < 0$. For more details, the reader can consult Harris 1987.

4. A feasible path $c \in \mathcal{C}$ is said to be a *majority-rule equilibrium*, or *majority core* if there is no other feasible path, $c' \in \mathcal{C}$ such that a majority of voters prefer c' over c . That is, $|\{i \in N: U_i(c') > U_i(c)\}| > n/2$.

ferent discount rates, then, even if their one-period utility functions are the same (i.e., $u_i = u$ for all i), there is no majority-rule core equilibrium. One might expect that in the case where voters differ only by their discount rates, there would be an equilibrium at the optimal path for the voter with a median discount factor. However, this path can be defeated by a coalition of voters with higher and lower discount rates as follows. Perturb the path to increase consumption slightly in the current period, reduce consumption considerably in the second period, and raise consumption even more in the third period. The second period reduction in consumption can be used to finance the third period rise in consumption in such a way that one returns to the original path in the fourth period. This perturbation is preferred by voters with lower discount factors since they get more immediate consumption in the long run, and it is preferred by voters with higher discount factors because they get larger total consumption. In the case where there is variation in the utility functions, but no variation in discount factors, the optimal path for every voter converges to the same steady state level of consumption. It follows that a path that starts at this level and stays there forever will be a majority core. However, if one takes into account the initial constraint, then generically there will be no core in this case either.

In the second model, where candidates can commit only to the policy to be adopted for the current period, Boylan et al. find different results. The instability in the first model depends on the ability of candidates to commit to policies. But multiple-period commitment may not be credible in political processes, where candidates have limited terms of office. Since policies must be implemented over time, coalitions such as ones between voters of high and low discount factors may unravel: once policies that help one part of the coalition are implemented, those individuals no longer have incentives to support the remaining portion of the proposed policy. Thus, if one assumes that candidates cannot commit to future policies, but only to the policies that are adopted in the current period, then Boylan et al. find that there is a unique, subgame-perfect, stationary, symmetric (for the candidates) equilibrium. The equilibrium follows the optimal consumption path of the voter with the median discount rate.

In all of our experiments, voters have the same discount factors, but different utility functions. Thus, in our experiments, there is no majority equilibrium if multiperiod commitment is allowed. However, if the path ever reaches the optimal steady state for the voters, then even with multiperiod commitment, that steady state is a majority rule equilibrium. It is not clear what the implications of the nonexistence of a majority core are for our data, since we do not know the nature of the majority cycles, and if for example, the Pareto set or uncovered set are small. Presumably, nonexistence of a core would lead to consumption paths that are different from experiment to experiment, and which do not show any specific patterns. On the other hand, in our

experiments, while we allow candidates to specify multiperiod plans, we do not provide any means of commitment. In the case of no commitment, there is an equilibrium at the optimal path of the median voter. So in the analysis of our results, we will compare our outcomes with the optimal path for the median voter.

3. Experimental Design

In this article, we look at the behavior of voters and candidates in an experimental laboratory setting so that we might learn some of the factors that influence policy selection by candidates in the one-sector growth model. We ran two versions of the basic experiment. Version *A* incorporates features that go beyond the confines of preexisting theoretical models but which make the experiment "realistic." This version includes polls, incomplete information, and ambiguous message spaces. In version *B*, we eliminate several of these features. The version *B* experiments try to isolate the source of cyclical economic behavior that we observe in the more realistic version *A* experiments. We first describe the version *B* experiments, and then describe the version *A* experiments by indicating the ways in which they differ from the version *B* experiments.

Version B

Each experiment consists of a series of elections in which two candidates compete for a four-period term of office. Prior to each election, candidates make a campaign promise indicating the consumption levels they plan to select in each of the four periods of their term of office. After observing the campaign promises of both candidates, the voters vote for one of the two candidates. The candidate who obtains a majority of the votes becomes the incumbent for the next four periods.

During each period of the term of office, the incumbent observes the current total real income, $y_t = f(k_t)$, and must choose how to divide this between investment, ι_t , and consumption, c_t .⁵ After the incumbent makes a policy choice, all voters are told the decision, and for each voter, i , the payoff $u_i(c_t)$ is computed and reported to that voter. Given the incumbent's policy choice, we use equations 2.1–2.3 to compute the total real income, y_{t+1} , available for the next period. All participants observe this figure, and the process described above continues for the remaining three periods of the incumbent's term of office. Thus, in each period, the incumbent divides the current real income

5. One important fact for the interpretation of the data is that not only was $c_t \geq 0$ required but also $\iota_t \geq 0$. Thus, candidates could not run a deficit and borrow against the future.

into investment and consumption, and the voters observe that policy choice and their own payoffs from this choice. After the fourth period there is a new election. Both candidates make new campaign promises, indicating the consumption levels they plan to achieve during each of the four periods of their term of office, and the voters select the incumbent for the next four periods.

In our experiments, we use the production function

$$f(k_t) = a(1 - e^{-bk_t}),$$

and utility functions of the form

$$U_i(c) = \sum_{t=0}^{\infty} \delta^t d_i c_i^e.$$

The values of the parameters k_0 , λ , a , and b in the production function, as well as the parameters d_i and e_i in the utility functions, are given in table 1. These parameters are chosen so that all voters are risk averse, and have a payoff of $v_i(100) = 10$. The discount rates are equal across voters, with $\delta_i = \delta = .97$ for all i . The discounting is imposed by having a probabilistic end to the experiment. Thus, after each period, a random number between 0 and 1 is selected, and if it is greater than .97, the experiment is terminated. If it is less than or equal to .97, then the experiment continues to the next period, with all voters accumulating the additional payoff from the decision of that period.

With the preceding specification of the problem, we can solve for the optimal steady state consumption level for the voters using equation 2.6:

$$f'(k^*) = \lambda + r \Rightarrow abe^{-bk^*} = \lambda + r \Rightarrow k^* = \frac{1}{b} \ln \left(\frac{ab}{\lambda + r} \right).^6 \quad (3.1)$$

Thus,

$$y^* = f(k^*) = a \left(1 - e^{\ln \left(\frac{\lambda + r}{ab} \right)} \right) = a \left(1 - \frac{\lambda + r}{ab} \right), \quad (3.2)$$

$$i^* = \lambda k^*, \quad (3.3)$$

and

$$c^* = y^* - i^*. \quad (3.4)$$

6. Note that since $\delta_i = \delta$ for all i , the optimal steady state consumption level is the same for all i .

TABLE 1. Experimental Parameters

	Production Function		Voter i	Utility Function	
	1	2		d_i	e_i
a	300	400	1	1.00	.50
b	.003	.004	2,6,10	0.79	.45
λ	.3	.4	3,7,11	1.26	.55
k_0	100	13	4,8	0.63	.60
y_0	77	20	5,9	1.58	.40

Table 2 reports the values of y^* , i^* , and c^* for our experiments, both for the value of $\delta = .97$ induced in the version *B* experiments, and for the value $\delta = 1.00$, corresponding to the solution that maximizes the long-run value of consumption.

Notice that we can suppress the role of capital in the model, and simply write real income at time $t + 1$ as a function of real income and investment at time t . From equations 2.1–2.3 it follows that

$$y_{t+1} = f(k_{t+1}) = f[l_t + (1 - \lambda)k_t] = f[l_t + (1 - \lambda)f^{-1}(y_t)]. \quad (3.5)$$

So, setting $y_t = f(k_t) = a(1 - e^{-bk_t})$, it follows that $f^{-1}(y_t) = -\frac{1}{b} \ln(1 - \frac{y_t}{a})$. So

$$y_{t+1} = a(1 - e^{-[by_t - (1 - \lambda)\ln(1 - \frac{y_t}{a})]}) \equiv G(y_t, y_t). \quad (3.6)$$

Thus, in each experiment, subjects are given a plot of the function $y_{t+1} = G(y_t, y_t)$, with representative contours on a two-dimensional grid. Figure 1

TABLE 2. Optimal Steady State Values

	Production Function 1		Production Function 2	
	$\delta = .97$	$\delta = 1.00$	$\delta = .97$	$\delta = 1.00$
k^*	333.50	336.20	327.95	346.57
y^*	189.69	200.00	292.26	300.00
i^*	100.05	109.86	131.18	138.63
c^*	89.64	90.14	161.08	161.37

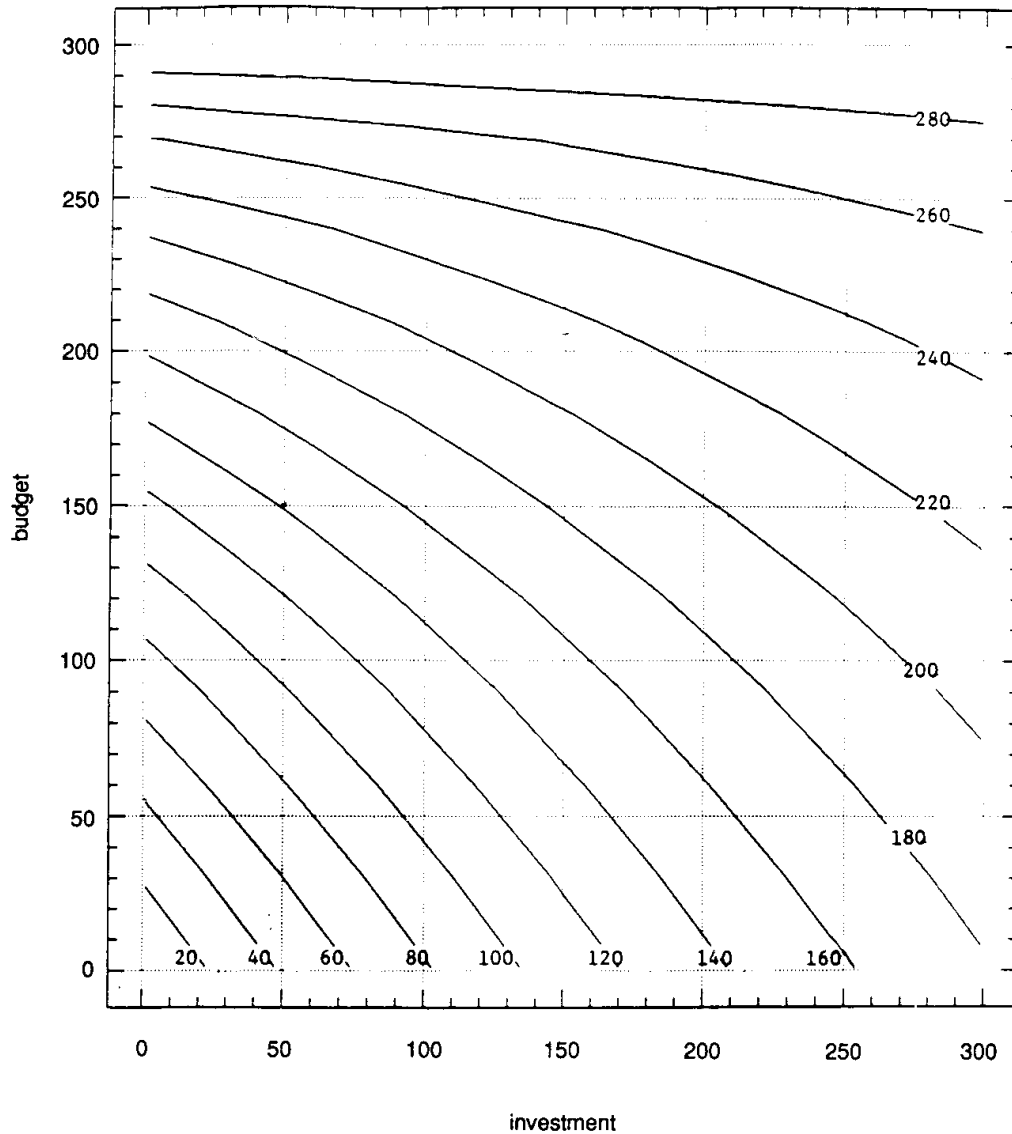


Fig. 1. Plot of production function 1 given to subjects

illustrates the plot of G given to the subjects for experiments 1–7. (A similar plot, using the payoff function generated by the parameters of column 2 of table 1 is used in experiments 8–9.) Thus, in a given period, the incumbent candidate has a budget, y_t , which must be split between investment and consumption. Using function G , a candidate can determine what the next period budget will be, given y_t and the investment choice ι_t , by reading the appropriate contour for the point (y_t, ι_t) off figure 1.

Version A

The version *A* experiments differed from the version *B* experiments in four ways. First, the voters and candidates are not told the functional form of the voter utility functions. They are only told that the utility functions are increasing with consumption, but not that they increase at a decreasing rate. Second, the candidates do not make a promise for a consumption path over the entire four-period term of office. Rather, they make a consumption-investment promise only for the last period of the term of office. Third, the voters are polled between each period of the term of office about their approval or disapproval of the incumbent's performance while in office. Fourth, the discounting is done somewhat differently in the version *A* experiments than in the version *B* experiments. Rather than having a fixed discount rate over the course of the experiment, we have a discount rate that declines in time. Thus, $\delta_{it} = \delta_t = \rho^t \delta$, where $0 < \rho < 1$. This procedure gives us somewhat greater control over the length of the experiment.

4. Data

We ran a total of sixteen experiments using undergraduates at the California Institute of Technology as subjects—ten version *A* experiments, with six groups of subjects, and six version *B* experiments, with four groups of sub-

TABLE 3. Experimental Design

Experiment	Group	Version	Production Function	Number of Voters	Number of Periods
1A	1	A	1	7	32
2A	2	A	1	9	31
3A	2	A	1	7	40
4A	3	A	1	7	24
5A	3	A	1	7	14
6A	4	A	1	9	40
7A	4	A	1	9	40
8A	5	A	2	11	40
9A	5	A	2	11	38
10A	6	A	2	11	40
1B	7	B	1	9	40
2B	8	B	1	9	40
3B	8	B	1	7	40
4B	9	B	2	9	29
5B	9	B	1	9	40
6B	10	B	2	9	88

jects. Because of the way in which the discounting was implemented, we had no control over the length of the experiment. Thus, with those groups in which time permitted, we ran two experiments. With this procedure, we obtained two experiments with six of the groups, and one with the other four groups.⁷ Table 3 describes the experiments we ran.

5. Candidate Behavior

Figures 4–19 show candidate behavior in each of the experiments. These figures plot the path of consumption and investment chosen by the incumbent candidates. The lower path represents the consumption chosen in each period, while the upper path represents the corresponding total budget. The investment in period t can then be computed as the difference in the consumption and budget in period t . The left axis of each figure shows the number of units of consumption and the total budget that the paths refer to. The upper horizontal line represents the equilibrium value for total budget, which was obtained using equation 2.2 and is displayed in table 1, while the lower horizontal line represents the corresponding equilibrium value for consumption, from equation 2.4. Figures 2 and 3 summarize the data for all of the experiments, giving average values across experiments of the consumption and total budget. Figure 2 gives summaries for the experiments run with production function 1, and figure 3 gives a summary of the data for experiments with production function 2.

Version A

The results of the Version A experiments are given in figures 4–13. As is clear from these figures, candidates tend to converge toward values that are near the long-run equilibrium values of consumption and budget. However, there is a tendency in many of the experiments to overinvest, even when the path is compared to the optimal values generated by $\delta = 1.00$. In some of the experiments, the overinvestment disappears with time, as in experiment 6A (fig. 9), but in others it seems to persist. The tendency to overinvest is curious, especially in light of the fact that the effects of discounting and risk would be to lead to lower levels of investment than that which sustains optimal consumption.

7. We chose λ to give an expected length of around ten elections. In addition, for all but the last experiment, we imposed a maximum length of forty periods, or ten elections. This explains the large number of experiments that ended at forty periods. Neither subjects nor experimenters were aware of the maximum length. With those groups in which time permitted, we ran two experiments.

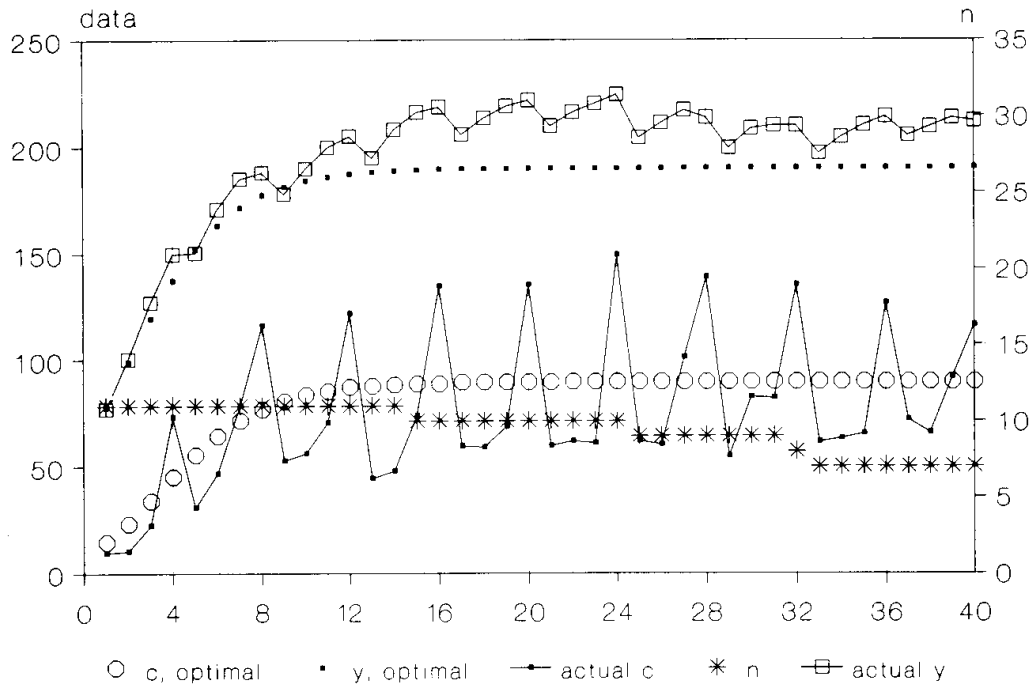


Fig. 2. Optimal and actual (average) behavior for production function 1

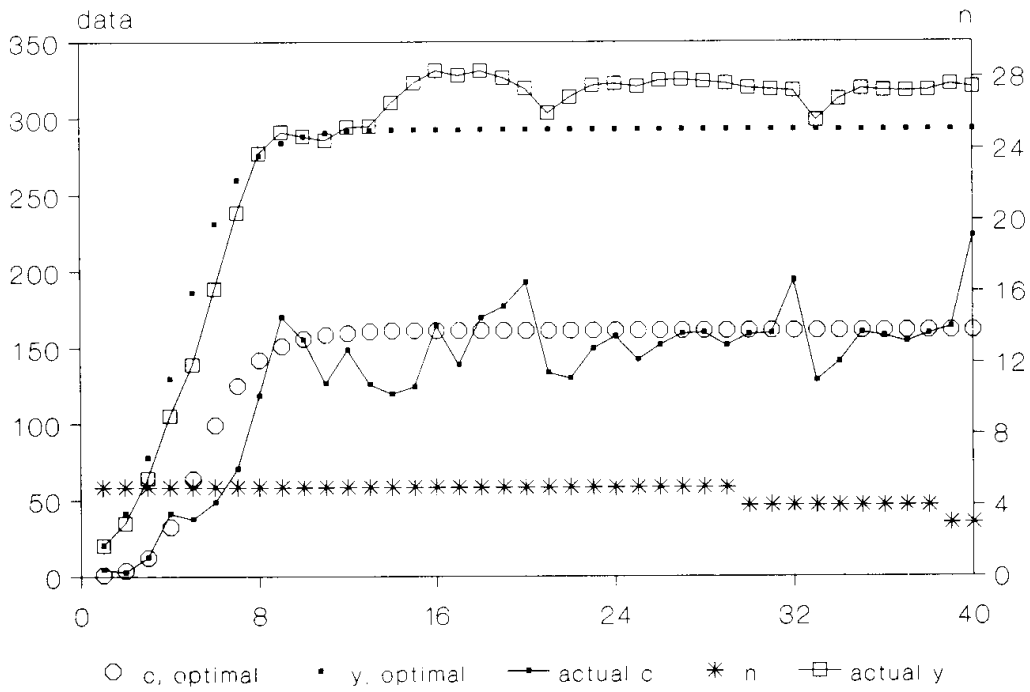


Fig. 3. Optimal and actual (average) behavior for production function 2

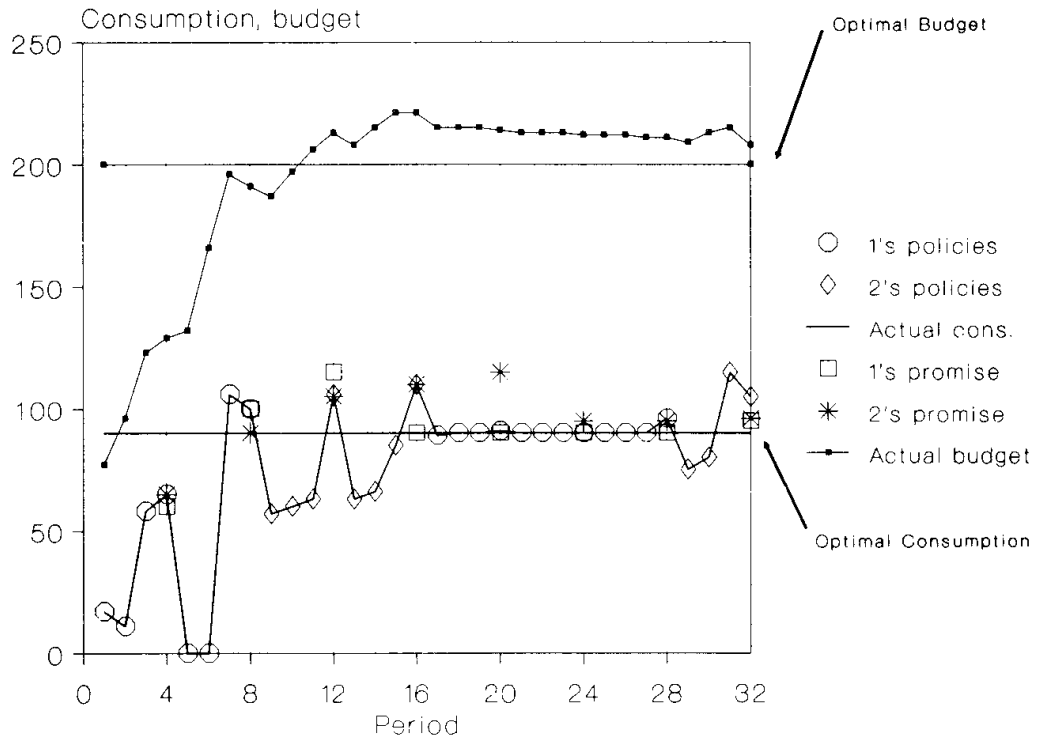


Fig. 4. Growth experiment 1A

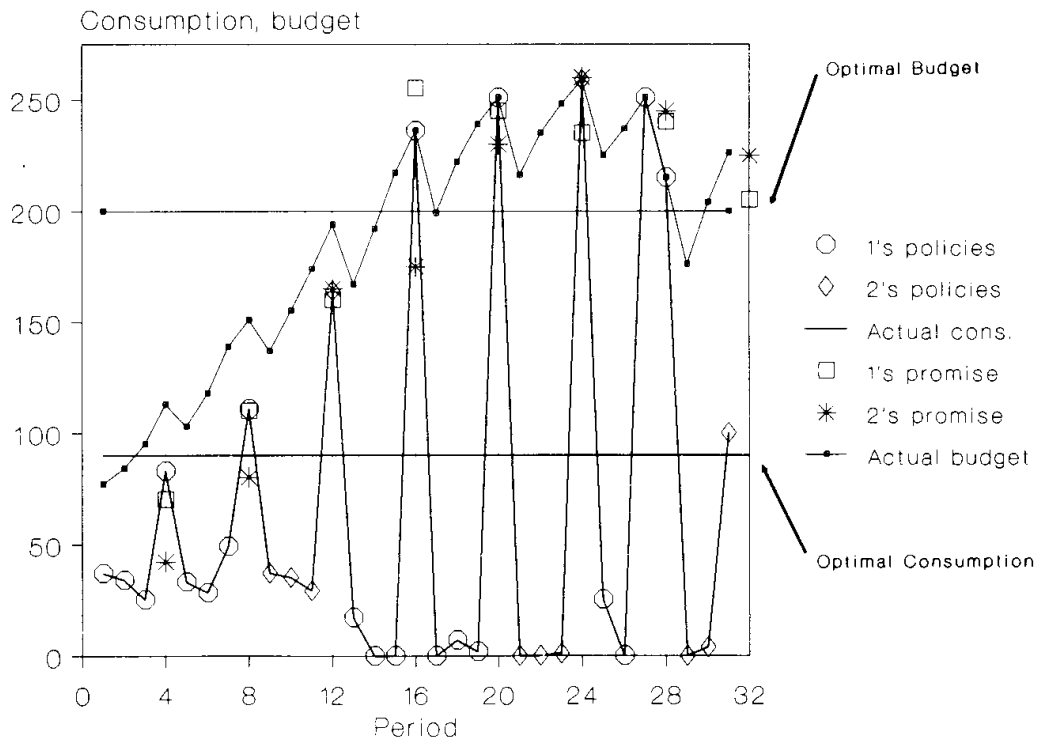


Fig. 5. Growth experiment 2A

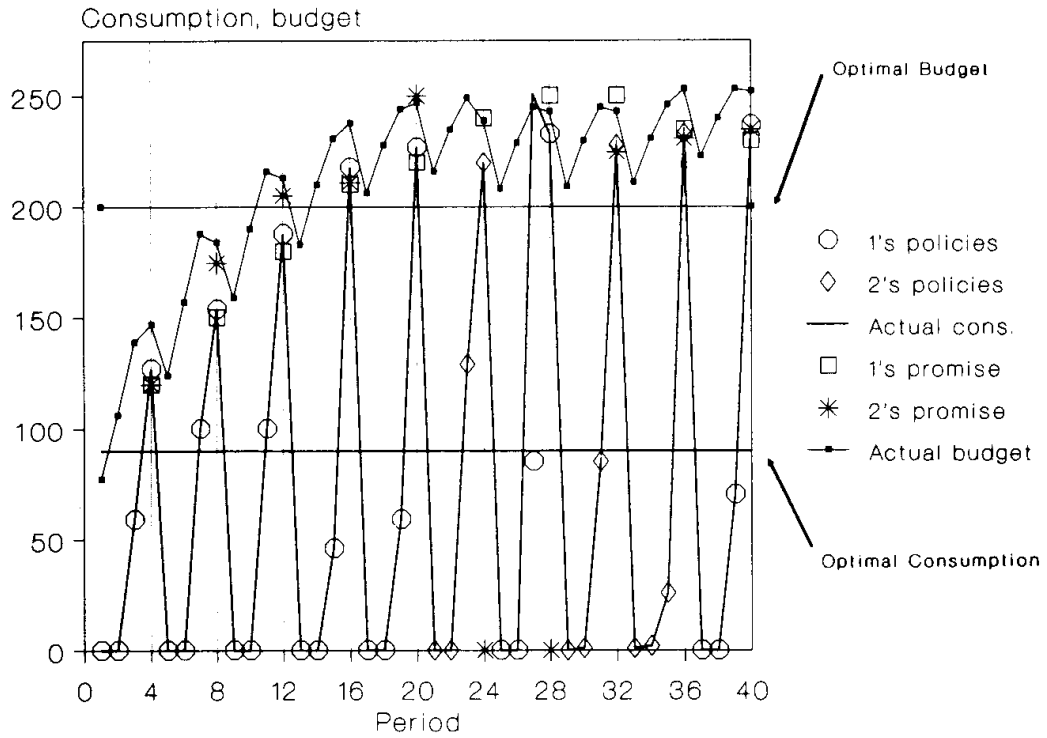


Fig. 6. Growth experiment 3A

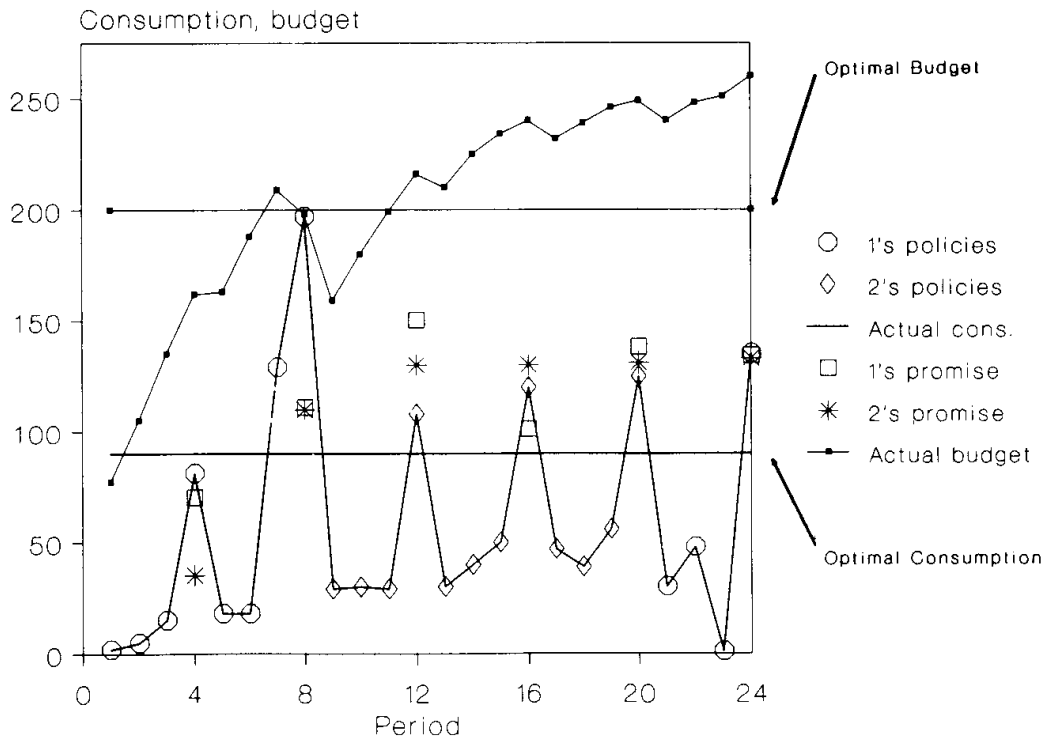


Fig. 7. Growth experiment 4A

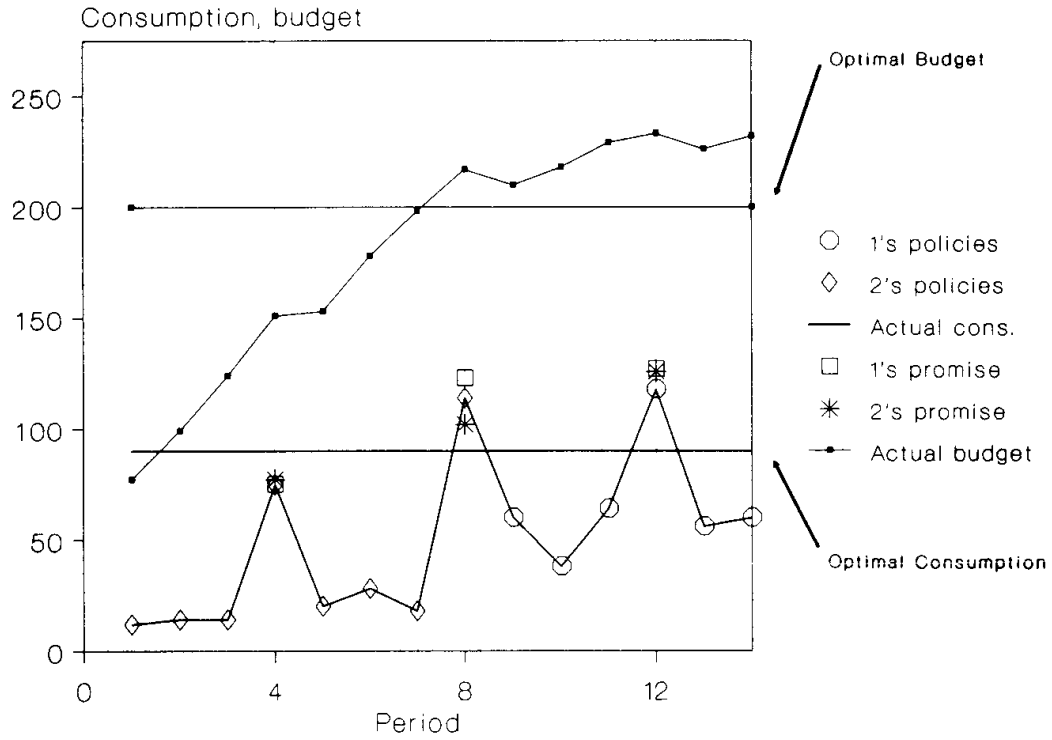


Fig. 8. Growth experiment 5A

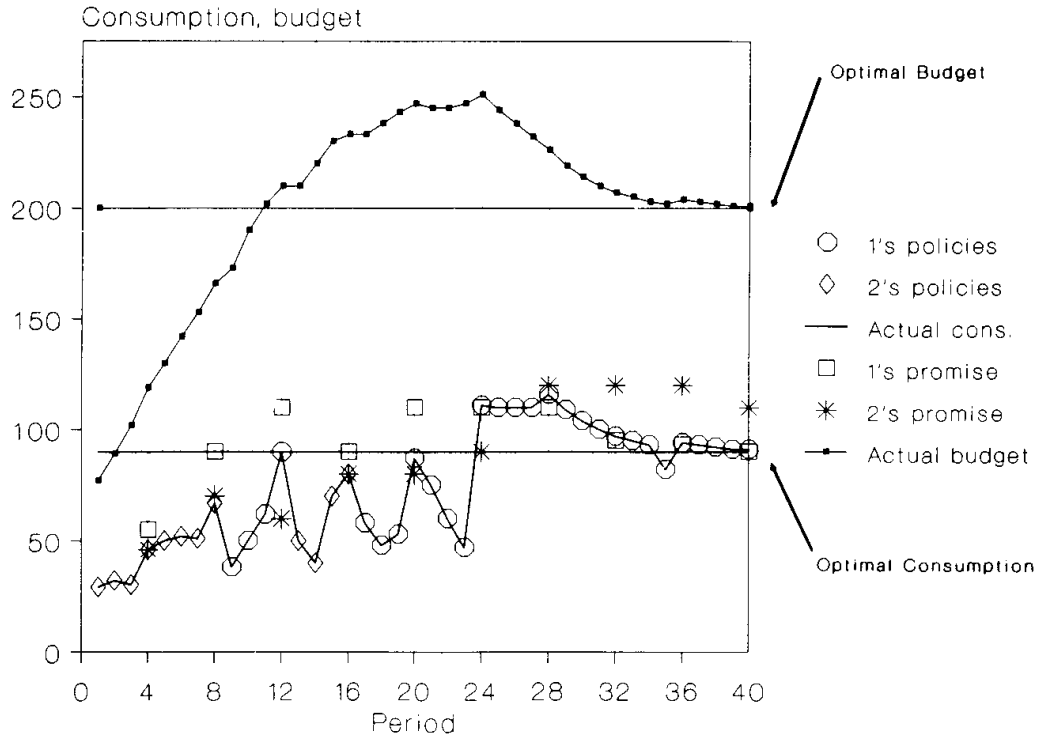


Fig. 9. Growth experiment 6A

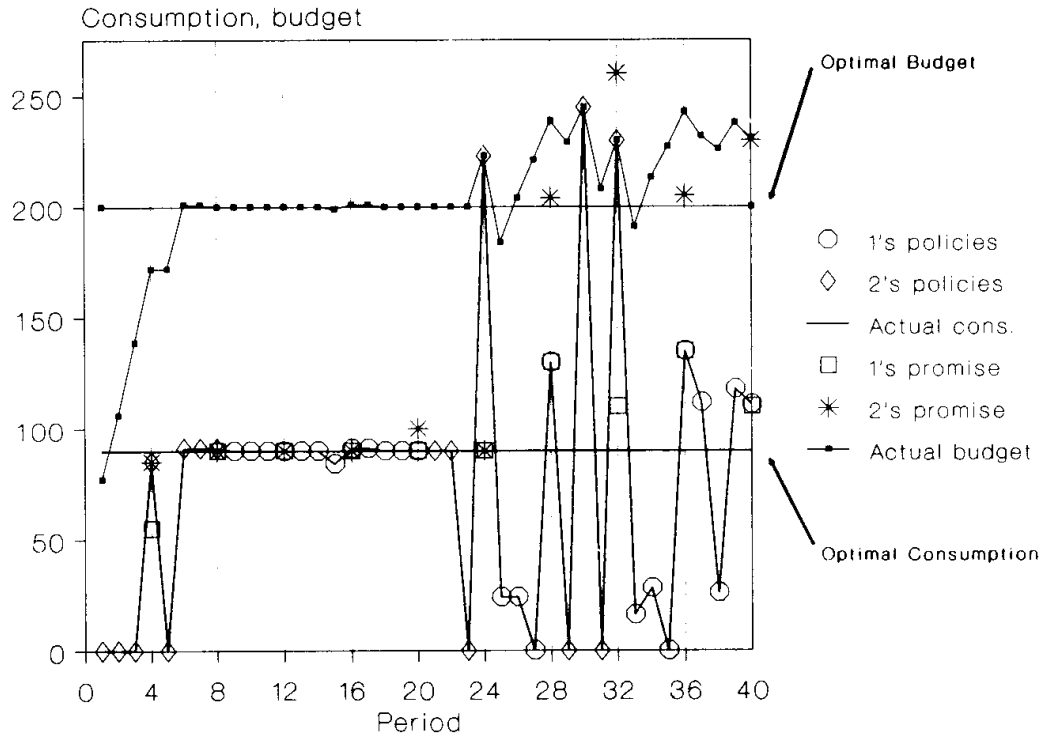


Fig. 10. Growth experiment 7A

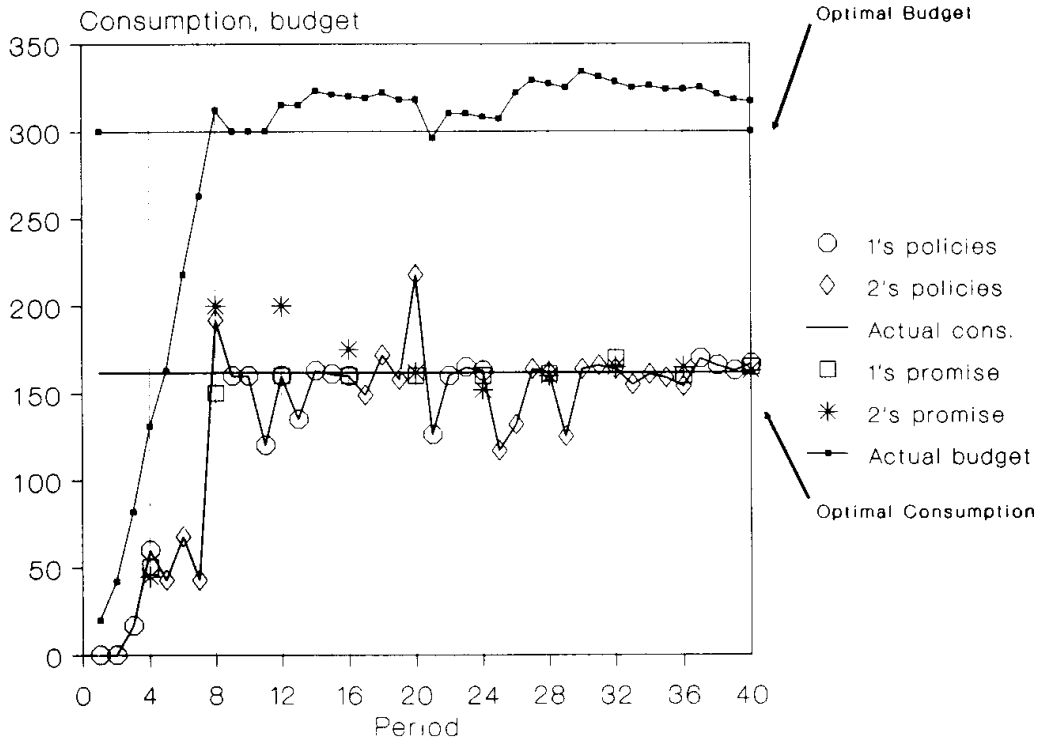


Fig. 11. Growth experiment 8A

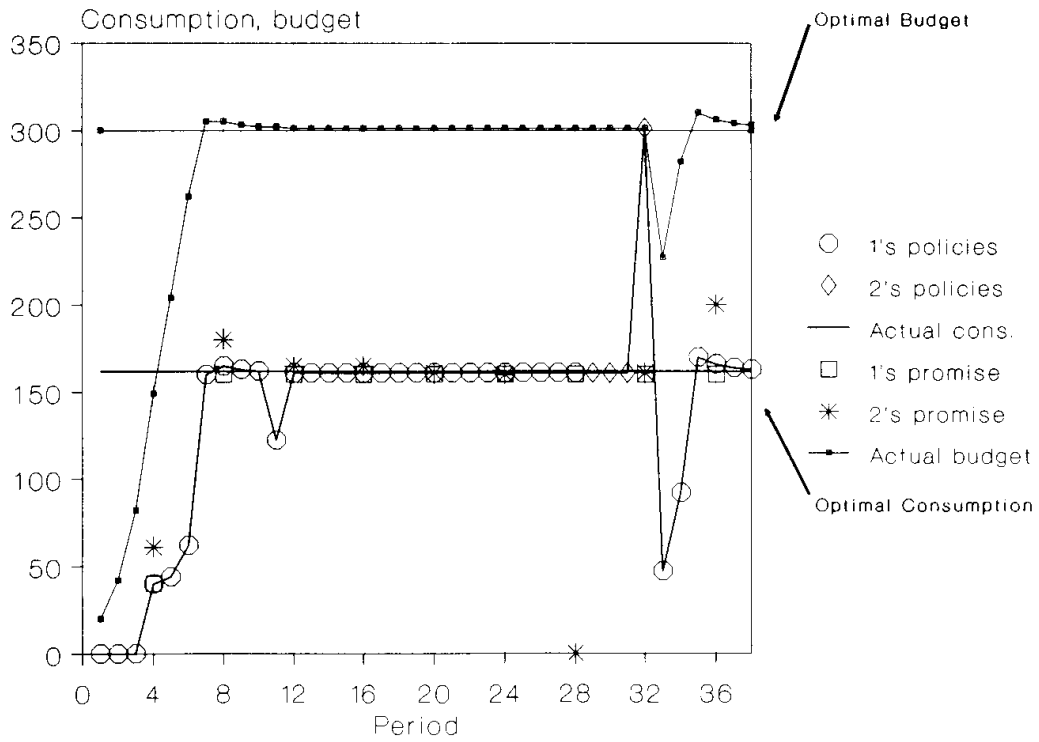


Fig. 12. Growth experiment 9A

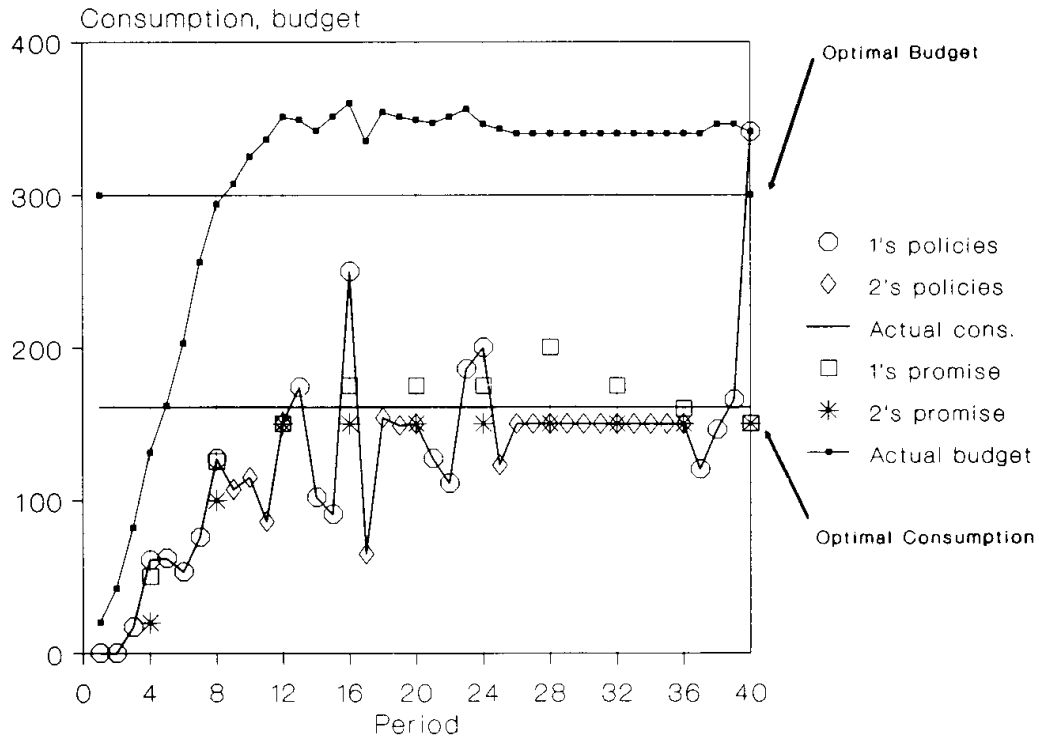


Fig. 13. Growth experiment 10A

A second feature of the data is that many of the experiments exhibit a political business cycle, in which the candidate overinvests in the first few periods of his or her term in office, and overconsumes in the last few periods. We attribute this cycle, in part, to the role of the candidates' promises. In some of the experiments, voters tend to vote for candidates who promise the higher value of consumption. This behavior provides incentives for the candidates to make promises that are higher than can be met without running a business cycle. If candidates fear retribution at the polls for not keeping their promises, they will deliver a business cycle rather than not keep the promise. Since the voters do not initially know (in the version A experiments) whether or not they are risk averse, it can initially be rational behavior for the voters to behave in this way. And, once such a pattern is established, it can be difficult to get rid of it. This type of behavior is evident in experiments 2A and 3A (figs. 5 and 6). In these experiments, which use the same group of subjects, the voters in experiment 2A consistently vote for the candidate making the higher promise on consumption (66.7 percent or 30 of 45 votes) through the first six elections. In the second experiment, having seemingly learned that the cycle is not good for them, the voters vote in every election except election 7 for the candidate making the *lower* promise on consumption (73.2 percent or 41 of 56 votes). However, since the incumbent consistently promises less, there is no turnover in incumbency until election 6, when the challenger promises 0, and subsequently delivers a cycle just like their opponent. With the candidates seemingly unable to interpret the signals being sent by the voters, the cycles continue unabated.

A third feature of the data concerns the tendency of the candidates to keep their promises (see table 4). We say that a candidate keeps a promise when he or she delivers at least as much investment and consumption as had been promised in the last period of his or her term of office. By this measure, the winning candidate only keeps his or her promise 55 percent of the time. On the other hand, notice that the winning candidate keeps his or her promise

TABLE 4. Frequency with which Candidates Keep Promise and the Probability of Reelection (version A)

Keep Promise		Frequency	Proportion Relected
Investment	Consumption		
Yes	Yes	.554 (46)	.619 (26/42)
No	Yes	.253 (21)	.294 (5/17)
Yes	No	.048 (4)	.250 (1/4)
No	No	.145 (12)	.500 (5/10)
		83	.507 (37/73)

on consumption at least 80 percent of the time. The voters do seem to punish candidates for not keeping their promises, with an average of 62 percent reelection if candidates keep their promises versus 35 (11/31) reelection if they do not.

Version B

The version *B* experiments differ from the version *A* experiments in that there is less cyclical behavior by the candidates. Experiment 1B (fig. 14) is an exception to this pattern. Both experiments from the second group of subjects, experiments 2B and 3B (figs. 15 and 16), show rapid convergence to the equilibrium, with virtually no consumption in the first couple of periods, and then with the experiment sitting at the long-run equilibrium. Experiment 4B (fig. 17) shows a pattern of severe oscillations that does not coincide in period with the length of a term of office. Unfortunately, this experiment ended too quickly for us to determine if the policy proposals would have eventually stabilized around the equilibrium. This expectation of convergence is due to the fact that a second experiment with the same group, 5B (fig. 18), shows convergence to the optimal consumption level. The budget (and hence invest-

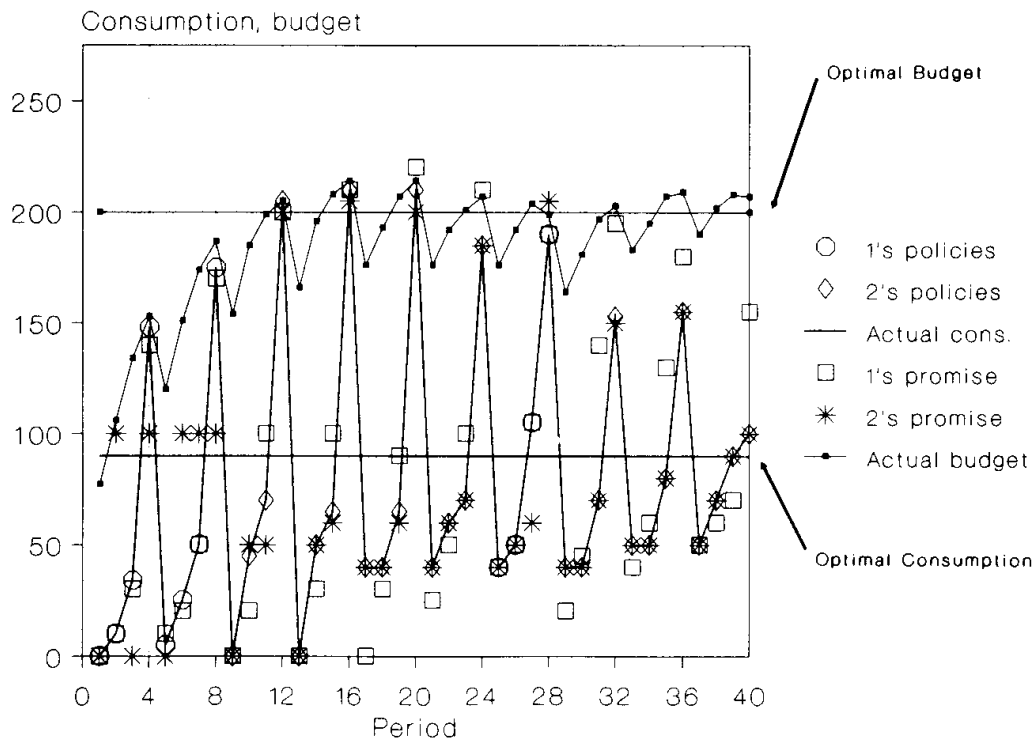


Fig. 14. Growth experiment 1B

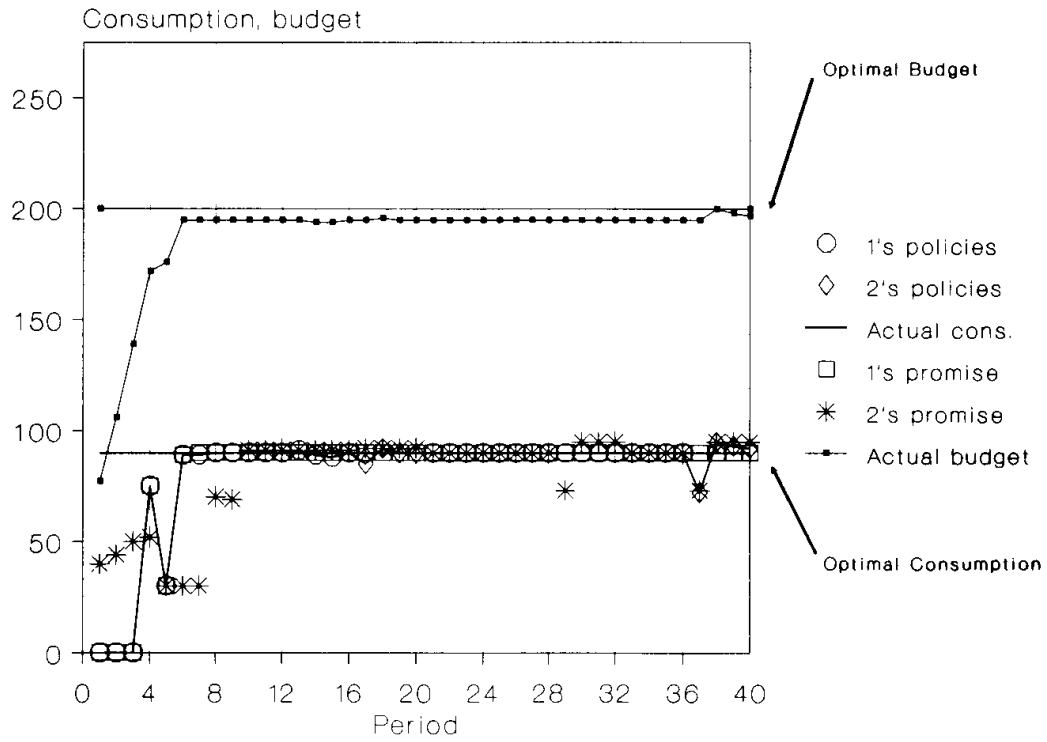


Fig. 15. Growth experiment 2B

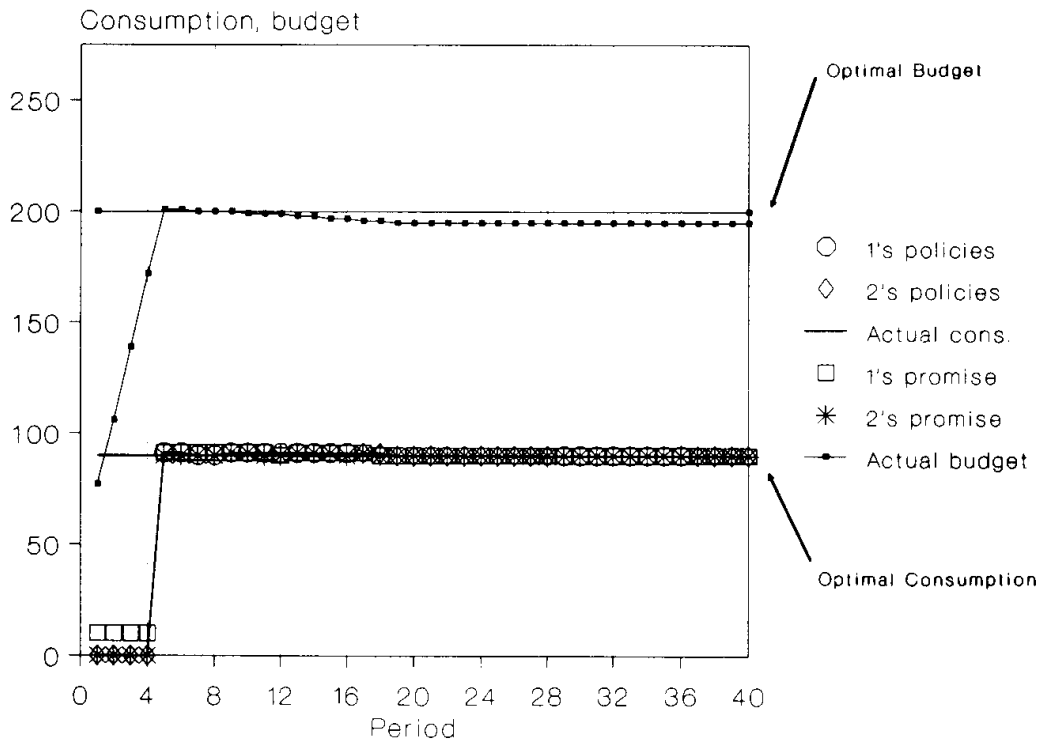


Fig. 16. Growth experiment 3B

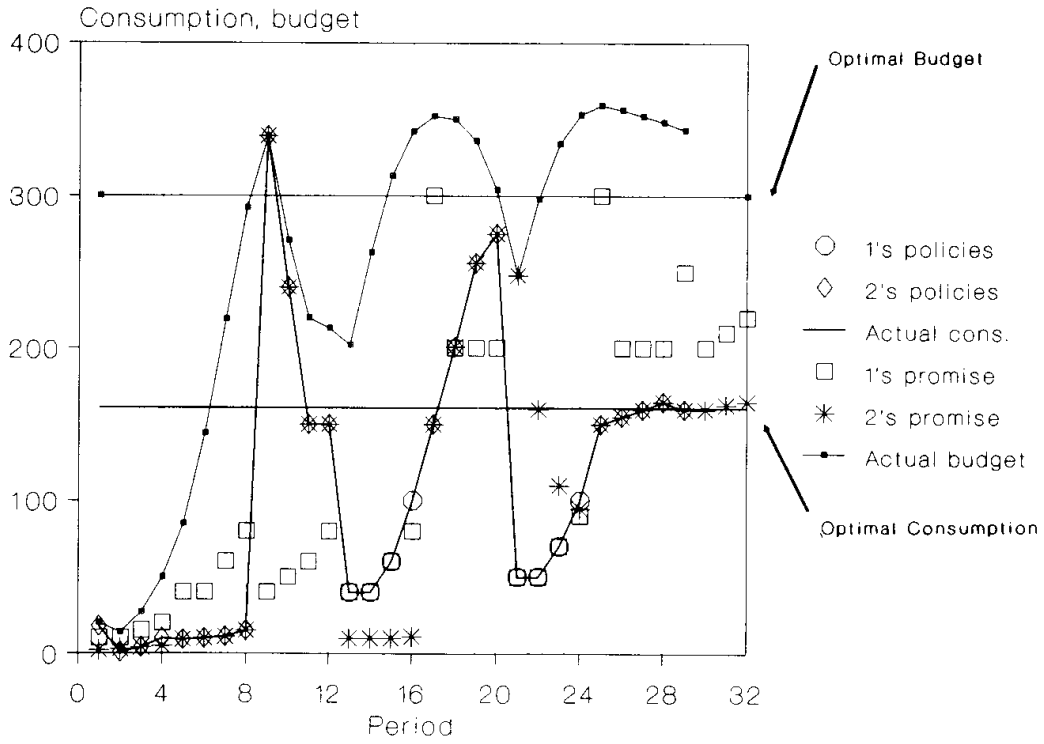


Fig. 17. Growth experiment 4B

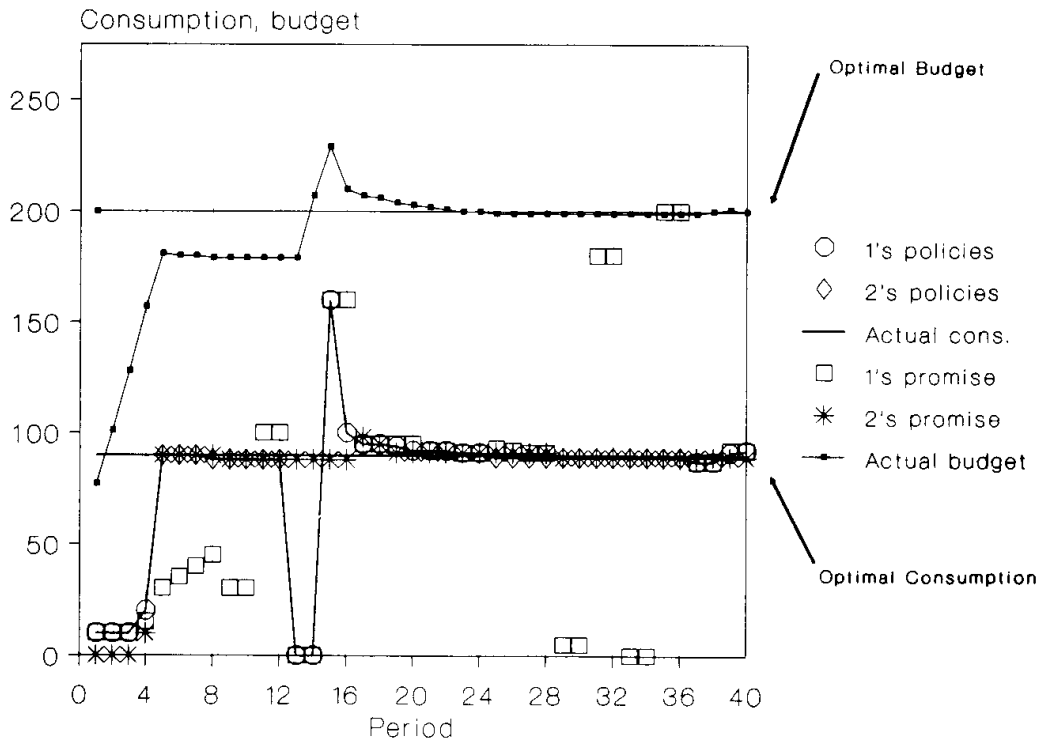


Fig. 18. Growth experiment 5B

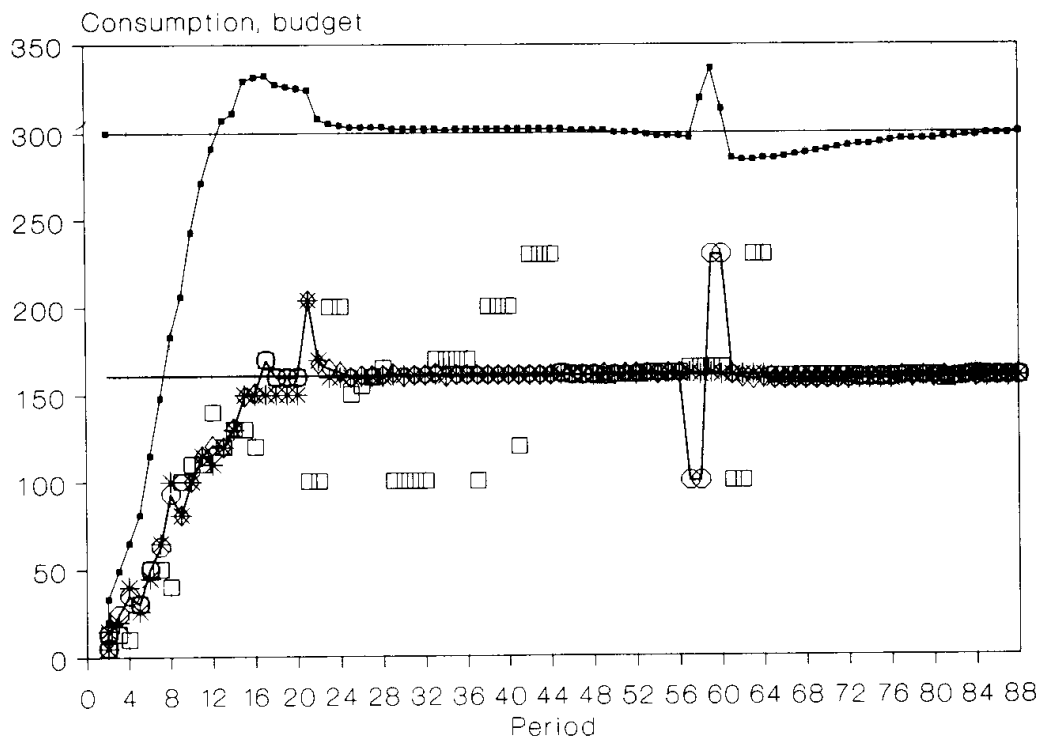


Fig. 19. Growth experiment 6B

ment) is initially below the predicted level, then stabilizing, after period 16, to a level above the predicted value. Finally, in the last experiment, 6B (fig. 19), we see convergence to the optimal consumption. There is one election in which the incumbent deviates from the optimal path and delivers a business cycle. But after this brief shock, the incumbent is thrown out of office, and the challenger begins building up the capital stock again to a level that sustains a budget above the optimal level.

Despite these different patterns, the notable feature of the version *B* experiments is that there is only one experiment that exhibits a business cycle.

TABLE 5. Frequency with which Candidates Keep Promises and the Probability of Reelection (version *B*)

	Frequency	Proportion Reelected
Keep	.725 (50)	.533 (24/45)
Break	.275 (19)	.611 (11/18)
	69	.556 (35/63)

Thus, overall, these experiments follow the optimal path more closely than the version *A* experiments. In addition, we see a greater tendency to keep promises in the version *B* experiments than in the version *A* experiments (see table 5). Promises are broken only 19 out of 69 times, and in only two cases is the total deviation from the promised consumption over the four periods of the term in office greater than ten units of consumption. There also does not seem to be any tendency of voters to punish candidates for breaking promises.

6. Voter Behavior

While the candidates' behavior seems to exhibit considerable regularity, that of the voters seems much less susceptible to a simply described pattern. Recalling that each experiment consists of a finite number of terms of office, where a term consists of four periods followed by an election, we call the j^{th} period of term t period (j, t) , and refer to the election at the end of term t as election t . Let $i(t)$ be the incumbent during term t , and $c(t)$ be the challenger (the losing candidate in election $t - 1$). For $1 \leq j \leq 4$, let $Z_{ij} = (C_{ij}, I_{ij})$ be the policy adopted by the incumbent in period j of term t , and $Y_{ij} = C_{ij} + I_{ij}$ be the real income, or budget, in that period. $Z_{ij}^k = (C_{ij}^k, I_{ij}^k)$ denotes the campaign promise made by candidate k in period j of election t . The type of promises differ in the version *A* and version *B* experiments. In the version *A* experiments, the candidates make promises about the level of consumption and investment they will deliver in the fourth period of their term of office, while in the version *B* experiments, the candidates make promises about the consumption stream they will deliver over their entire term of office. So for the version *A* experiments, promises in election t are of the form $Z_{i4}^k = (C_{i4}^k, I_{i4}^k)$. This is the campaign promise made by candidate j about what that candidate plans to accomplish by period 4 of term $t + 1$. For the version *B* experiments, on the other hand, promises are of the form $(C_{i1}^k, C_{i2}^k, C_{i3}^k, C_{i4}^k)$.

To evaluate the promises from the version *A* experiments, we must determine an associated consumption path. Unfortunately, if the promise is feasible, there are typically multiple paths that can support it. A particular consumption path that supports it can be constructed as follows: The candidate attempts to achieve the implied total output $Y_{i4}^{*k} = C_{i4}^k + I_{i4}^k$ as quickly as possible. If this occurs before the fourth period, this output is maintained until the fourth period, after which the candidate delivers the promised value of consumption and investment in the fourth period. If the promise is not feasible, we assume that the candidate chooses a consumption path that gets as close as possible: In the first three periods the candidate attempts to get the output as close as possible to Y_{i4}^k . Since equality cannot be achieved in the fourth period, and in all our data the consumption promise is infeasible, we assume that the candidate keeps his or her investment promise, and violates

the consumption promise (in our data this always leads to a feasible path). More specifically, we invert G in equation 2.6 to obtain I_{tj}^k as a function of Y_{tj}^k and the desired $Y_{t(j+1)}^k$. Thus, we set

$$G^{-1}(y_t, y_{t+1}) = \frac{1}{b} \left[(1 - \lambda) \ln \left(1 - \frac{1}{a} y_t \right) - \ln \left(1 - \frac{1}{a} y_{t+1} \right) \right].$$

For $0 \leq j \leq 3$, we set

$$I_{tj}^k = \max\{0, \min[Y_{tj}^k, G^{-1}(Y_{tj}^k, Y_{t4}^{*k})]\},$$

$$C_{tj}^k = Y_{tj}^k - I_{tj}^k,$$

and

$$Y_{t(j+1)}^k = G(I_{tj}^k, Y_{tj}^k).$$

For $j = 4$, we set I_{tj}^k to be the promised value, and $C_{tj}^k = Y_{tj}^k - I_{tj}^k$.

Using this procedure, we can construct an implied consumption path in the version *A* experiments that has the same form as the consumption promises in the version *B* experiments. For our econometric analysis of the version *A* experiments, we assume that all voters assess the promise according to this consumption path.

We now describe how utility is assigned to a given four-period consumption promise. Let $C_t^k = (C_{t1}^k, C_{t2}^k, C_{t3}^k, C_{t4}^k)$ denote a four-period promise by candidate k , and let $K(C_t^k)$ be the capital that is implied by this promise in period 1 of election $t + 1$. This can be computed by successive application of equations 2.1–2.3. Let $C_t^{k*} = (C_{t1}^{*k}, C_{t2}^{*k}, C_{t3}^{*k}, \dots)$ be the optimal path of consumption for the median voter starting from an initial capital stock of $K(C_t^k)$. Next, define

$$UC_{kt}^i = \sum_{j=1}^4 \delta^{t-1} u_i(C_{tj}^k)$$

$$UK_{kt}^i = \delta^4 \sum_{j=1}^{\infty} \delta^{t-1} u_i(C_{tj}^{*k})$$

$$U_{kt}^i = UC_{kt}^i + UK_{kt}^i$$

$$DUC_t^i = UC_{1t}^i - UC_{2t}^i$$

$$DUK_t^i = UK_{1t}^i - UK_{2t}^i$$

$$DU_t^i = U_{1t}^i - U_{2t}^i.$$

Thus, UC_{kt}^i is the present value of the utility obtained by the median voter during the t^{th} term if k is elected and keeps his or her promise.

UK_{kt}^i is the present value of the capital stock that will be left by candidate k if that candidate keeps his or her promise for term t , and then in all successive terms, the incumbent reverts to the optimal path of consumption for the voter with median discount rate.

U_{kt}^i is the expected utility of candidate k 's promise.

DUC_t^i , DUK_t^i , and DU_t^i are simply the differences between the two candidates of the corresponding components of the utility of the promises.

In addition to these variables, let V_t^i be the vote of voter i in election t , defined to be 1 if the voter votes for candidate 1, and 0 otherwise. Table 6 shows an analysis of this data using a probit model of voter decision making:

$$Pr(V_t^i = 1) = 1 - \Phi(\beta_1 DU_t^i), \tag{6.1}$$

where $\Phi(x)$ is the cumulative normal density function $N(0, 1)$. We analyse the aggregate data, thus forcing all voters to have the same coefficients. Note that if voters pay attention only to promises, and vote based on the basis of the best promise, then in cases where the candidates promises are different, our statistical model should explain all of the voting behavior in the version *B* experiments. Errors could be expected in the version *A* experiments due to the ambiguity of the promises, and the artificial way we construct a consumption path from the promise. Despite these theoretical expectations, the model explains less than 50.0 percent of the voting behavior in the version *A* experiments and only 55.6 percent of the voting behavior in the version *B* experiments.

There are at least two explanations for our model's poor performance. First, even though we attempt to induce the same discount rate for all voters, it

TABLE 6. Estimates of Equation 6.1

	Version A	Version B
β_1	-.000774 (.000563)	.000978 (.00148)
<i>N</i> of observations	704	541
Percent predicted	49.4	55.63

Note: Standard errors in parentheses.

is possible that we are not successful, and voters actually have different subjective values of δ_i . To get a rough indication of whether this is a factor, we can proceed as follows. With individualized discount rates, the utility U_{kt}^i would be

$$U_{kt}^i = \sum_{j=1}^4 \delta_i^{t-1} u_i(C_{ij}^k) + \delta_i^4 \sum_{j=1}^{\infty} \delta_i^{t-1} u_i(C_{ij}^{*k}).$$

If we are close to equilibrium, so that the consumption streams $(C_{i1}^k, C_{i2}^k, C_{i3}^k, C_{i4}^k)$ $(C_{i1}^{*k}, C_{i2}^{*k}, C_{i3}^{*k}, \dots)$ are each approximately constant, then we can rewrite

$$\begin{aligned} U_{kt}^i &\approx u_i(C_{i1}^k) \sum_{j=1}^4 \delta_i^{t-1} + u_i(C_{i1}^{*k}) \delta_i^4 \sum_{j=1}^{\infty} \delta_i^{t-1} \\ &= \frac{1 - \delta_i^4}{1 - \delta_i} u_i(C_{i1}^k) + \frac{\delta_i^4}{1 - \delta_i} u_i(C_{i1}^{*k}) \\ &= \left(\frac{1 - \delta_i^4}{1 - \delta_i} \right) \left(\frac{1 - \delta}{1 - \delta^4} \right) \left(\frac{1 - \delta^4}{1 - \delta} \right) u_i(C_{i1}^k) \\ &\quad + \left(\frac{\delta_i^4}{1 - \delta_i} \right) \left(\frac{1 - \delta}{\delta^4} \right) \left(\frac{\delta^4}{1 - \delta} \right) u_i(C_{i1}^{*k}) \\ &= \left(\frac{1 - \delta_i^4}{1 - \delta_i} \right) \left(\frac{1 - \delta}{1 - \delta^4} \right) UC_{kt}^i + \left(\frac{\delta_i^4}{1 - \delta_i} \right) \left(\frac{1 - \delta}{\delta^4} \right) UK_{kt}^i \\ &= \beta_{1i} UC_{kt}^i + \beta_{2i} UK_{kt}^i \end{aligned}$$

where

$$\frac{\beta_{1i}}{\beta_{2i}} = \left(\frac{1 - \delta_i^4}{\delta_i^4} \right) \left(\frac{\delta^4}{1 - \delta^4} \right).$$

Thus $\beta_{1i} > \beta_{2i} \Rightarrow \delta_i < \delta$, and $\beta_{1i} < \beta_{2i} \Rightarrow \delta_i > \delta$. We thus estimate the model

$$Pr(V_t^i = 1) = 1 - \Phi(\beta_{1i} DUC_t^i + \beta_{2i} DUK_t^i), \quad (6.2)$$

allowing different coefficients for each subject. For subjects who participated in two experiments, we pool the data. Our results, summarized in table 7, are improved in terms of the percent of voting behavior predicted correctly, but

TABLE 7. Summary of Individualized Estimates of Equation 6.2

	Version A	Version B
Average β_1	.184 (0.5420)	.678 (4.980)
Average β_2	.335 (1.050)	.919 (7.130)
Average δ_i	.813 (0.354)	.942 (0.171)
<i>N</i> of subjects	49	33
Percent predicted	.660	.631
Vote	483/732	351/556

Note: Standard deviation in parentheses.

the estimates of the individual coefficients are seldom significant. Note that the estimates of δ_i indicate that voters are acting as if they have lower discount rates than the induced factor of .97. Thus, voters are placing more weight on current consumption and less on the value of the capital stock than they should. This makes the candidate behavior even more perplexing.

7. Conclusions

Candidate behavior in our experiments exhibits considerable regularity, with the candidates converging toward the point that optimizes long-run, steady state sustainable consumption. However, the candidates tend to overinvest. In addition, political business cycles appear frequently, although, with the exception of one experiment, the amplitude of the cycle seems to moderate as each experiment proceeds. These cycles occur with more regularity in the version A experiments, which incorporate more uncertainty about preferences.

We find that there is no support in our experiments for the idea that political processes lead to suboptimal investment plans because of the shortsightedness of the candidates. On the contrary, we do not find optimal investment, but only because the candidates tend to overinvest. Regarding political business cycles, we find that they are indeed a feature of the experimental data. Moreover, we find them in models that have none of the features that are required to generate cycles in the theoretical models of Nordhaus, Alesina, or Rogoff. Given the differences between the version A and version B experiments, we are tempted to attribute the business cycles to incomplete information and to ambiguities in the messages of the candidates. However, we know of no model that has been able to theoretically derive cyclical behavior in such contexts.

We are much less successful, on the other hand, at discerning patterns in

voter behavior, and it is somewhat of a puzzle why, in this context, the candidates act so predictably. Certainly, voters send only weak signals to the candidates regarding the policies they prefer. We cannot, then, exclude the possibility that candidates ignore voters and, instead, approach their task as a problem-solving exercise.

We conclude that there is some experimental support that political systems of two-party competition can achieve consumption paths that approximate those that would be chosen by a central planner. However, in the experiments that did not incorporate complete information, we found more evidence of consistent business cycles. In contrast, then, to the explanations offered by Nordhaus, Hibbs (1977), and Rogoff, these findings suggest that such phenomena may be characteristic of incomplete information rather than of the myopia of the voters.

APPENDIX

General Information

There will be two experiments. After the first experiment is completed, the second experiment will begin. It will be the same as the first, except that between each experiment, both voters and candidates will be shuffled. This means that the candidates may (or may not) be relabeled, and the voter income functions will be changed. The voters will remain voters, and the candidates will remain candidates.

After the two experiments have been completed, the session will be complete, and subjects will be paid on the basis of the earnings they have accrued. To compute your total payment, add the amount you have earned from each of the two experiments, and multiply by the exchange rate, which is listed on your record sheet. Enter this amount in the final column of your record sheet, and submit it to the experimenter to receive your payment.

Are there any questions?

Experiment Instructions

General Instructions:

This experiment is part of a study of elections. You are being paid in cash for your participation; the amount of your payment depends on your decisions, the decisions of others, and chance. The incomes in the experiment are not necessarily fair, and we cannot guarantee that you will earn any specified amount. However, if you are careful, and make good decisions, you can generally expect to make a substantial amount of money.

The experiment consists of a series of elections in which some of you will be candidates, some of you will be advisers to candidates, and most of you will be voters. Candidates, with the help of their advisers, will make promises to the voters. Voters will then vote, and the winning candidate will become the incumbent, who will serve a four-period term in office. If you want, you can think of each period as a year in office. In each period, the incumbent must select a policy and, as in public opinion polls reported in the media, voters can indicate their approval or disapproval of this policy. At the end of the incumbent's term of office, we will hold the next election.

The experiment will take place through a network connecting computer terminals. All interaction between you will take place through these terminals, and you are not allowed to communicate in any other way. If any difficulty arises, raise your hand, and an experimenter will come to assist you.

Before beginning the actual experiment, we will have an instruction session so that you can familiarize yourself with the terminals, the information they display, and with the sequence of events. After the instruction session there will be a brief quiz. It is important that you pay close attention to the instructions, since you must pass the quiz to participate. Any questions you have should be addressed to me, and I will repeat the answer for everyone to hear.

At this point, one of the experimenters will give each of you an envelope. A card inside the envelope will tell you your role in the experiment. Will the experimenters please pass out the envelopes.

[ENVELOPES PASSED OUT]

Now that you all know your roles, we are ready to proceed with the instruction session. Will the candidates and advisers please sit at the terminals to my left, and will the voters sit at the terminals in the center of the room. A candidate and his or her adviser should share one terminal. Voters each get their own terminal.

Candidate Advisers:

Both candidates have their own campaign adviser. The role of a candidate is demanding, and an adviser's purpose is to assist the candidate. Candidates should discuss their actions with their advisers. If a candidate and his or her adviser disagree on strategy, the candidate has the final say as to what action will be taken.

Computer Instruction:

Turn on your terminal now by pressing the key labeled "master" directly below the screen. When the terminal asks for your name, please type in your name, then hit "Enter."

[SUBJECTS ENTER THEIR NAMES]

[MASTER: ENTER INSTRUCTIONAL DATA SET]

[WAIT FOR EXPERIMENT SCREEN TO APPEAR]

Voter and candidate screens are different, but have some similarities. The top part of all screens keeps a record of what has happened previously, while the bottom part tells you what is happening now. The first column on all of the screens is labeled ELECT and tells you which election in the sequence you are in. It is currently election number 1. The second column tells which period you are in. It is currently period E of election 1, which means that it is time to hold an election.

[SUBJECTS LOOK AT SCREEN]

Each experiment consists of a series of elections. In each election, the voters will vote for one of the two candidates, called A and B. The vote is then tallied, and that candidate obtaining the largest number of votes will be declared the winning candidate, and will serve a four-period term of office.

Before describing the sequence of events, we want to tell you about the way candidates affect how much voters earn in the experiment. You should think of this experiment as corresponding to a situation in which you are like an island society that exists, for the most part, off of the tropical fruit of Mangoes. Each year, Mango trees produce fruit, some portion of which can be consumed (eaten). The remainder of the year's crop, which is not eaten, may be invested (planted) to produce more trees in the future. If all of the year's fruit is consumed (eaten), the old trees will slowly age and die, producing less fruit each year; whereas if all the fruit is planted (invested), living standards may be low initially, but more fruit is produced in the future. In your society, it is the government that owns the land and the trees, and must decide how much may be consumed by the voters each year, and how much is invested (planted). In this experiment, government decisions are made by the incumbent candidate, whom the voters elect. The incumbent's investment decision in one period, then, determines the budget (total crop of Mangoes) in the next period.

Because the way in which resources grow or decline as a function of investment is complicated, we would like you to refer now to the chart that we have given each of you. This chart tells you how resources change as a function of an incumbent's decisions. Suppose that the incumbent starts with a budget of 100 units and that 10 units are invested and 90 consumed. To see what the budget in the next period will become, locate 100 on the vertical axis, and locate 10 on the horizontal axis. Notice that the corresponding point on the grid, (10, 100) falls approximately on the curve marked 80. Thus, investing 10 of 100 units means that the total budget available next period drops to 80. On the other hand, suppose 75 out of 100 units are invested. Since the corresponding point (75, 100) falls on the curve marked 120, investing 75 increases the budget in the next period to 120. Of course, this policy requires that voters consume less and be paid less in the current period.

For points falling between two curves, you should interpolate to estimate the effects of a particular investment. For example, if the investment is 50, then the next period budget is about one third of the way between the 100 and 120 curves, so the next period budget would be about 107.

On your screens now, you see that the budget for the first period is 77. This is the amount that will be available for consumption or investment in the first period of the experiment.

Candidate promises:

In an election, both candidates must make promises. These promises tell voters how much consumption (C) and investment (I) they intend to choose, if elected, by the last (fourth) period of their term in office.

During the actual experiment, candidates will make these decisions on their own. For now, the candidates should make the promise $I = 40$ and $C = 40$. To make this promise, type in 40, and press enter, then type 40, and press enter again. Candidates will be asked to confirm their promise, they can do so by typing "Y" then enter. If candidates make a mistake in typing in their promise, they can correct it by typing "N."

[CANDIDATES ENTER PROMISE]

First Election:

Voters, when I instruct you, please vote in election 1. The promises are displayed on the bottom of your screen. Pressing "Enter" will move the promises to the top part of your screen. To vote for candidate A, type "A," then hit "Enter." To vote for candidate B, type "B," then hit enter. Please vote for candidate A in election 1 now by entering "A" at your terminal. Wait for further instructions before doing anything else.

[SUBJECTS VOTE IN ELECTION 1]

As you can see, candidate A has won the election, because a majority of you voted for that candidate. To see the election result, look in the last column, which is labeled "Vote." This column shows the vote for A followed by the vote for B. Notice that all of the information you receive about elections will be in red.

Candidate and Adviser Income:

Candidates, notice on the right side of your screen, the column labeled "INCOME." Since candidate A won the election, candidate A will see that he or she has 100 pounds, while Candidate B will see that he or she has zero pounds. These pounds can be exchanged for dollars at the end of the experiment at a fixed exchange rate. Candidates and advisers are paid for participating in the experiment based on the number of elections they win. Both candidate and adviser earn 100 pounds each for an election victory, but earn nothing for each election they lose. The total income for both candidates and

advisers is kept track of at the bottom of the candidates' screens.

[SUBJECTS LOOK AT SCREEN]

After each election, there will be a term of office during which the winning candidate is the incumbent. You can find who the incumbent is by looking in the third column.

[SUBJECTS LOOK AT SCREEN]

The incumbent's term of office is divided into four periods. The current period is indicated in the second column on your screen. It is currently period 1 of candidate A's term in office.

Incumbent's Policies: (To candidates)

Candidates, after you win an election, you must choose policies which consist of the amount of consumption (C) and investment (I) for the first period of your term in office. The amount of C and I you can choose depends on your budget.

The budget, located in the bottom left corner of your screens, is the total amount available for consumption or investment during your first period of your term in office. How the budget is divided between C and I and from period to period is up to you and your adviser.

Voter Income:

The policy you choose will determine, according to the function on the graph you have been provided, the income for each voter that period. This function will be different for different voters, but they all share one characteristic: The higher the value of C in a period, the higher all voters' incomes.

At this time, will the incumbent, candidate A, please enter the policy $I = 0$, thus consuming the whole budget. When asked to confirm this policy, please do so by pressing "Y," then "Enter."

[INCUMBENT ENTERS POLICY]

To Voters:

Pressing the "Enter" key will move the record of this policy to the top of the screen in the column labeled "POLICY." Each voter's income from the policy appears in the column labeled "INCOME." Your income is computed in "Pounds," which you will exchange for dollars at the end of the experiment at a prespecified exchange rate. In this instruction session, all of the voters will receive the same income. Your income from the incumbent's policy should equal 8.77 pounds. In the real experiment, a given policy will give each voter a different income.

[SUBJECTS SHOULD CHECK SCREENS]

Your total income in each experiment is kept track of by the computer under the heading "CUMULATIVE INCOME," which is at the bottom of your screen in green.

[SUBJECTS SHOULD CHECK SCREENS]

Polls:

After the incumbent chooses a policy and its value is reported to each voter, there will be an opinion poll. Thus, there will be four polls taken between each election. In the poll, the voters are asked their opinion of the way the candidate is performing his or her duties in office, and voters indicate that they approve or disapprove.

The polls do not affect the candidate or voter incomes, and do not determine if the incumbent remains in office (he or she does remain in office regardless of the poll result). The poll is simply informative, and can be used by the candidates to adjust their subsequent policy positions.

When I instruct you, type "A," then "Enter" if you approve of the incumbent's policy. Type "D," then "Enter" if you disapprove. How you make this decision is up to you. Please enter "A" or "D" in election 1, period 1, now.

[SUBJECTS ENTER THEIR CHOICE]

The first poll in election 1 has been completed. You can find out the results of the poll by looking in the column labeled "Poll." The first number in the column tells how many voters approved of the incumbent's performance, the second number shows how many disapproved. Both the voters and candidates see the poll and election results, but no one will ever learn how specific voters voted or who approved and disapproved of the policies.

Notice, in the bottom left hand corner of your screen, the letters "PC," followed by a number which is less than 1 but greater than zero. "PC" is short for "Probability of Continuing" and is the probability that the experiment will continue at the end of this period. Currently "PC" is .9999. "PC" is updated after each period so that the number on your screen is the current probability of continuing. During the real experiment, you will be given a table that includes the value of "PC" for every period of the experiment.

Instruction Session Continues:

The incumbent must now enter another policy. Candidates will notice that the computer keeps track of their budget at the bottom of their screen. Since the incumbent began with a budget of 77 and the first policy was $I = 0$, $C = 77$, the second period budget is 56, as you could determine from the chart. Remember, the policy C and I that you choose in a given period determines the next period budget according to the handout you have been provided. Will the incumbent please enter the policy $I = 21$.

[INCUMBENT ENTERS POLICY]

As before, voters should now indicate whether they approve or disapprove of the incumbent's performance.

[VOTERS RESPOND TO POLL]

Notice that the probability of continuing, "PC," is now .9989.

The same sequence as we have just completed will continue for each of the four periods of the incumbent's term of office. We will now proceed with the remaining two periods of A's term in office. After the fourth poll, wait for further instructions. Will the incumbent please enter the policy $I = 15$ as his or her third policy and $I = 52$ as his or her fourth policy when prompted by the computer to do so. When prompted, will the voters please participate in periods 3 and 4 of election 1.

[SUBJECTS PLAY PERIODS 3 AND 4 OF ELECTION 1]

The policy adopted by the incumbent in period 4 was $I = 52$, and $C = 0$. Notice that this breaks the promise of $I = 40$, $C = 40$, that was made by the candidate, because C is less than the promised value of $C = 40$.

At this point, voters can see that they have accumulated a total of £21.08 in income. In a real experiment, this would represent your total earnings during candidate A's term in office, and at the end of the experiment would be converted to dollars at the prespecified exchange rate.

Candidates will notice that the upcoming budget equals 75. This represents the amount that will be available in the first period of your term of office, if you are elected.

Election # 2:

After four periods, the incumbent's term of office ends, and an election takes place. Will both candidates please enter the promise $I = 30$, $C = 25$, now. Confirm this promise, if correct, when asked to do so. [PAUSE] Voters can now see the promises of the candidates in the lower part of their screen. Voters, please press "Enter" and then vote for candidate B. After voting, wait for further instructions.

[SUBJECTS PARTICIPATE IN ELECTION 2]

You can now verify that candidate B has won election 2 by checking the last column of your screen. [PAUSE] As before, candidate B will serve four periods in office. Since candidate B is now the incumbent, I will ask that he or she submit the policy, of $I = 25$. Please confirm that the promise on your screen is the correct promise by pressing "Y," then "Enter." [PAUSE] Voters, when I instruct you, approve or disapprove of the policy of the incumbent. At the end of the fourth poll, wait for further instruction. Please participate in periods 1-4 of election 2 now by typing in "A" or "D."

Will the incumbent enter $I = 2$ as the second, $I = 53$ as the third, and $I = 50$ as the fourth policy.

[PAUSE BETWEEN EACH POLICY FOR VOTER POLL]

The policy adopted by the incumbent in the fourth period was $I = 50$, $C = 27$. This satisfies the promise of $I = 50$, $C = 25$, as both I and C are at least what the candidate promised they would be.

Election # 3:

It is time for election 3 of the instruction session. Will the candidates please enter their promises and, when asked to do so, will the voters vote for either candidate A or candidate B. How you decide to vote in this election is totally up to you. After voting, wait for further instructions. Please vote in election 3 now. Don't forget to hit "Enter" after choosing your candidate.

[SUBJECTS SHOULD VOTE IN ELECTION 3]

Candidate _____ has won the third election, which completes the instruction session.

The Quiz:

It is now time for a brief quiz. Please do not touch your terminal until I tell you to. It will be necessary for you to pass this quiz in order to participate in the experiment. The quiz is on things which we have already discussed. If you have any questions about the content of your screen or the structure of the experiment, please ask them now.

[EXPERIMENTERS HAND OUT QUIZZES]

You have four minutes to complete this quiz, please begin, now.

[SUBJECTS ANSWER QUIZ, EXPERIMENTERS CORRECT]

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