

WOONG THE VOTERS: ECONOMIC PERFORMANCE AND REGIME CHANGE

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Wooing the Voters: Economic Performance and Regime Change

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Abstract

When outcomes of developmental projects undertaken are uncertain, ruling parties in a democracy often face a difficult choice. Taking up projects that fail result in bad publicity and hence a dent in the vote bank. But on the other hand a successful project leads to more votes as well as more money in the funds for the ruling party. In the context of a two party model of democracy with neutrals and supporters, we set up a dynamic stochastic model to explore this situation. Using numerical methods, we show that the rate of failure of projects play a crucial role in changing the probability of a reelection. We also explore the role of other factors like rate of project arrival, party loyalty and changeover probability. The results indicate that in a strategic setting, in some situations, the ruling party would be better off by ensuring a low rate of project arrival to increase their chances of reelection. This has interesting implications for addressing the development vs. political stability conundrum.

Key words and phrases: Stochastic Dynamic Model, Political Regime, Campaigning, Uncertainty in Project Outcome, Loyalty, Election, Length of Tenure

JEL Classification: C63, P16

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1 Introduction

In general, an improvement in political conditions will lead to faster and sustained growth. In this scenario of politically enhanced growth, the effects of political institutions on growth may persist over a long period of time (Barro 1997). For example, when a nation increases its level of economic freedom from a minimal to a maximal level as the result of political change, tremendous room will be created for long-run economic growth. The long-run growth rate of a country is determined also by politics, along with economic behavior and demographic trends.

There is a school of thought that political markets are inherently inefficient and competition among the players causes excessive rent-seeking activity (Tullock 1967, 1983, 1989; McCormick et al. 1984). The literature on trade policy argues that competitive rent-seeking results in an efficiency loss to the economy (Krueger 1974, Bhagwati 1982, Grossman and Helpman 1994). Laband and Sophocleus (1992), for instance, estimate that rent seeking in allocating transfers cost the US at least one-fourth of its GDP in 1985. Also growth of government debt is positively related to the frequency of government change (De Haan and Strum 1994). Persson and Svensson (1989) have shown that a conservative government, which favors a low level of government spending but knows that it will probably be replaced by a government in favour of higher spending levels, will borrow more than when it was certain to stay in office. In this context see also Alesina and Perotti (1996), Volkerink and De Haan (1999), Perotti and Kontopoulos (2002). Uppal (2009) examines the effect of legislative turnover on government expenditures in a panel of 15 Indian states during 1980-2000. He finds that political turnover promotes government expenditure (his results are robust with respect to alternative specifications of per capita or as percentage of GDP). De Haan and Strum (1994) have examined whether the number of government changes may help explain cross-country differences in public debt growth. It is very interesting that the frequency of government changes apparently does matter. This result is broadly in accordance with the conclusions of Grilli, Masciandaro and Tabellini, (1991). Jong-A-Pin and De Haan (2007) finds that economic growth accelerations are preceded by economic reforms. Furthermore, they find that growth accelerations are more likely to happen after the start of a new political regime. The dataset used by them consists of 106 countries over the period 1957-1993 of which 57 countries experienced at least one growth acceleration. More specifically, the findings are that the effect of economic reform on the probability of a growth acceleration is highly significant in all specifications. However, the results for political regime changes are less clear. Political regime changes are in general not related to growth accelerations, but there is a negative and significant effect of regime duration for all specifications. For a survey on the relationship between economic growth and political regimes see Przeworski, Alvarez, Cheibub and Limongi (2000).

But there is also a counter argument, for instance in the development literature, that asserts the concept of antagonistic growth, which refers to a situation where democratic governments face the possibly untenable problem of resolving conflicting claims of vested interests while concurrently pursuing sustainable paths for growth (Foxley, MacPherson and O'Donnell 1986).

Nordhaus (1975) shows that an opportunistic incumbent, who has an informational advantage over the voters, follows a suboptimal policy right before elections to increase his or her chances of reelection, leading to political business cycles. Besley and Burgess (2002) argue that the resolution of informational disadvantage make the governments more accountable. They find that state governments in India respond better to natural calamities where the newspaper circulation, which mitigates the informational disadvantage of voters, is high.

Lyne (2008), in the context of democratic accountability and development in Brazil and Venezuela, argues that the project choices made by the governments in these countries were among the more economically inefficient alternatives available within an inward oriented program. But policies that are economically inefficient can be highly politically advantageous in a system where structural conditions favor the clientelistic equilibrium. If economically detrimental policies maximize the transformation of government power and resources into goods for quid pro quo exchange, then politicians competing in clientelistic systems will favor them over economically superior choices. Despite the unfavorable economic consequences, permanent subsidies, capital intensity and high and variable protection turn out to be the more competitive political choice when voters opt for quid pro quo. Lahiri (2000) argues competitive politics in India has damaged any chances of fiscal prudence by the states for the want of securing their vote bank.

Feng (2005) has done a very interesting study of the interplay between economic performance and political events with a simultaneous equations model with growth, government change and degree of democracy as endogenous variables. Using data from several south-east asian countries he shows that not only growth is stimulated by regime changes, in turn it also facilitates regime changes. The results found are robust with respect to specifications.

Noting the interplay between the political process and the economic process, we try to model the strategic role of elected policy makers in undertaking development projects whose outcomes are uncertain. The activities considered for the ruling party are deciding to undertake and executing development projects, whose outcomes are uncertain in nature. Thus the projects, if undertaken, can be both beneficial or detrimental to the popularity of the ruling party. Also, the budget available to the ruling party would be related to the decision of undertaking projects. A successful project adds to the popularity of the elected government but a failed one will reduce their chances of being re-elected. Thus, the perceived or prevalent rate of success of development projects could play a key role in the government's decision to undertake such projects.

The process of a party coming to power in a democratic country depends on how the voters support them in the elections. Although the election is a discrete event taking place at pre-specified intervals of time, the whole process of alluring voters to a party (political campaigning process) goes on continuously between the elections. The social interaction among the different agents also plays a role in bolstering or eroding the support base of the two parties. This is also considered in this paper explicitly. One usually also holds the party accountable for its deeds when in power (public works, development projects undertaken etc.) and votes accordingly. Or, at least that is the standard assumption.

Our aim is to study the voting process as a three population (X, Y, Z) model (for a two party system with support base X and Y), with third population (Z) being passive towards any party even though they cast votes during election (assumptions need be taken on their voting behaviour also). We would like to study how, in an election X or Y becomes the winner and how it depends on their deeds during the time interval between the two elections.

In this direction, understanding the dynamics of (X, Y, Z) under some suitable standard assumptions would be important. Further, we would like to investigate what happens if the standard assumptions are violated. We would develop relevant theoretical results and also simulate the dynamics to see the changing pattern at different times and in the long run.

The specific questions we are interested in exploring are as follows: (i) What are the significant events for causing government change: Investment in campaigning or new projects happening? What would be the dynamics under the influence of such events. (ii) What are the conditions conducive to continuance (one party staying in power over repeated elections)? How to find $P(x_{t+s} > y_{t+s} | x_t > y_t)$ (x_t being the share of X in the population etc.)? And conversely, what are the conditions for transition?

Section 2 describes our general theoretical model, first for a single constituency or local model and then the Assembly model. Section 3 lays out the numerical specifications for the model. We study the effects of the different components; economic, political and social; in a progressive manner in sections 3, 4 and 5. The relevant discussions on model and the theoretical and numerical results are presented in several subsections. Section 6 concludes our paper and mentions a few possible extensions to our basic model. These could be taken up in future work.

2 The Modelling Strategy

2.1 Single Constituency (Local) Model

As mentioned above, the political parties engage in two kinds of activities. One of a developmental nature where the ruling party execute projects. These projects arrive randomly, the perceived potential social benefit in per capita terms is $\lambda > 0$ per unit of time. This is the quanta of benefit arriving in public awareness and thus even for a targeted project, there will be an indirect warm glow effect for all, besides the direct benefit for the targeted segment. For the sake of simplicity, we are modelling the arrival of projects and realisation of benefits without any lag. In reality the benefits start accruing with a lag and gradually over time.

If taken up, projects may result in a success or failure (that is measured by the fraction of total perceived benefit that is realised, $(1 - f)$, whereas f is the fraction of initially perceived benefit getting dissipated in the process of implementation). A successful project results in additional funds for the ruling party as well as positive publicity. Whereas a failed project creates negative publicity. Publicity (positive or negative) results in increased or reduced support. In case of positive outcome, neutral or opposing party supporters may join the ruling party (with some exogenously given probability p and $(1 - p)$). In case of a failure (low f) the party supporters

may leave the party and convert to neutral or opposing party supporters with same probabilities (p and $(1 - p)$). The flow of events for this is depicted in the figure below.

Note that in our rates of transition diagram we are considering an extreme case of transition to highlight changes. In reality the rates would only be some fraction of these.

The second activity that both parties engage in is political campaigning with available funds that helps in bringing opposition or neutrals to the party fold. The rate of conversion depends on the fund spent and an exogenous loyalty parameter (q).

Campaigning effects are modelled as follows: The ruling party has access to a campaigning fund, $R(t)$, at time t which result in the following rates of conversion from the opposition and the neutrals respectively (omitting time subscript when unambiguous).

From the opposition: $\gamma_1(R)(1 - q)y_t$ (for $Y \rightarrow X$)

and from the neutrals: $\gamma_0(R)z_t$ (for $Z \rightarrow X$)

Similarly for the Opposition, budget is $O(t)$ and conversion rates are, similarly,

$\gamma_1(O)(1 - q)x_t$ (for $X \rightarrow Y$)

and $\gamma_0(O)z_t$ (for $Z \rightarrow Y$)

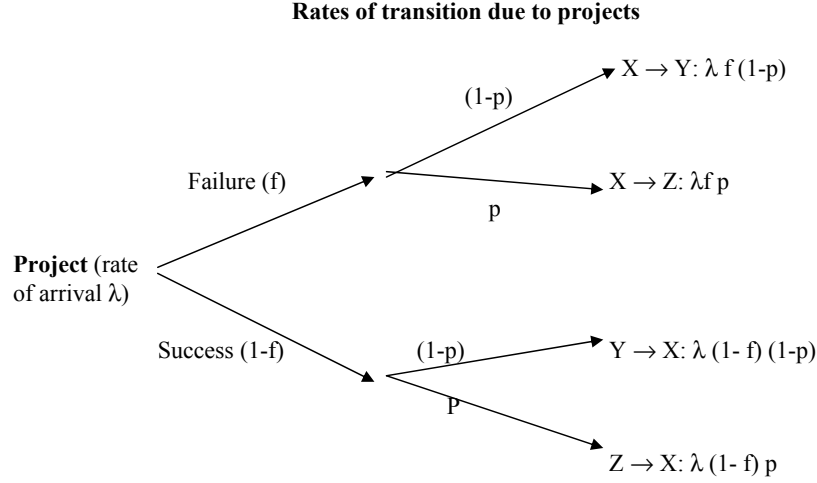
Here q is the loyalty parameter $\in (0, 1)$ and $\gamma_1(\cdot)$ and $\gamma_0(\cdot)$ are the campaigning technologies available to the parties that determine the effectiveness of campaigning on the opposition and the neutrals respectively. The specific choice of functional forms that we have taken here are:

$$\gamma_1(x) = \frac{x}{2(2+x)}$$

$$\gamma_0(x) = \frac{x}{2(1+x)}$$

The campaign fund for the ruling party evolves according to the relation $R(0) = 1$ and $R(t + \Delta t) = R(t) + \lambda(1 - f)$. The fund for the opposition is $O(t) = 1$, stays constant over time. The evolution for R is proportional to quanta of project success, as contribution to party funds becomes easier with more project accruals, directly from projects as well as indirectly from beneficiaries. The choice of initial values $R(0)$ and the value of O are to match with the dimension of rate of change. Actually any constant would be feasible, we have assumed it to be 1.

Apart from these two party based activities, there is also some switching over that happens autonomously through interaction between the three types of individuals in the population. The rates of conversion (β) are also exogenously given. these are described for all possible pairwise switches in *section 5*.



We assume that Z gets equally divided at the time of voting¹

2.2 Assembly Model

We now consider multiple seats in an assembly, shared between the two parties according to majority in each constituency. The theoretical model is analogous to the local model otherwise. We study the **single election, tenure and comparative statics**. To study the tenure pattern, we look at the pattern of government change over a 50 year period with the stochastic approach.

2.3 Incorporating the Dynamics

Here we have proposed a basic model which originated from a typical contagion type model used in epidemiology. Contagion type of model of spread is used to come up with the dynamic change of voter's opinion that happens in a small time interval, say Δt . We then go on to use three type of modeling procedure to come up with the final models.

Basic idea is in a small time Δt , when numbers of people in the three different group change, $(X_t, Y_t, Z_t) \rightarrow (X_{t+\Delta t}, Y_{t+\Delta t}, Z_{t+\Delta t})$, since it is a small time interval and the total population has been taken to be fixed (when growth of population is not considered), exactly one of the X, Y, Z decreases causing exactly one of the other to increase. This event has been assumed to occur with probability as in the contagion (disease) type model with some parameter p (probability of switching to Z due to project failure), q (probability to stay on (not switch due to campaign)), f (probability of failure), λ (rate of project arrival) as mentioned in section 2.

Thus in the model we take these parameters to be random and follow a Bernoulli distribution (independent and different for different parameters) indicating that the event occurs when

¹We may alternatively assume a random behaviour (e.g. χ fraction vote for Y where $\chi \sim B(\lambda f + \frac{1}{2}, \lambda(1-f) + \frac{1}{2})$. So that $E(\chi) = \frac{\lambda f + \frac{1}{2}}{\lambda + 1}$.)

Bernouli distribution takes the value 1, otherwise does not occur. We introduce a second source of randomness through the contagion system as indicated in section 2 and an exogeneous random vector. We calculate conditional expectation of the change in the system, i.e., $E(\Delta W_t | W_t)$ and the conditional variances and covariances which are the elements of the conditional covariance matrix, $Cov(\Delta W_t | W_t)$, where $W_t = (X_t, Y_t)'$ and $\Delta W_t = (\Delta X_t, \Delta Y_t)'$ since, $Z_t = 1 - X_t - Y_t$. Construction of the model is as follows:

$$W_{t+\Delta t} = W_t + E(\Delta W_t | W_t)\Delta t + (Cov(\Delta W_t | W_t))^{1/2}\xi_{t+\Delta t}\sqrt{\Delta t}$$

where Δt is the time to the step from t to $t + \Delta t$ and $\xi_{t+\Delta t}$ s are independent and identically distributed random vector with mean zero and covariance matrix as identity matrix (we took it as two dimensional Normal distribution for simulation but it is not necessary). Notice that, this is a typical diffusion approximation scheme (Basak, Hu and Wei, 1997) matching first two (conditional) moments of ΔW_t and that of a diffusion process with randomness introduced through ξ_{n+1} .

3 Effect of the Economic Process only

To focus on each of the processes in our model, we start by looking at a simplified verion of our model that looks at the consequences of the economic process only. To achieve this, we consider only the project arrival and performance process ('Economic' in short) and arrive at the following transition system (omitting time subscripts):

$$\begin{aligned} P(Y \rightarrow X) &= \lambda(1-f)(1-p)y \\ P(Z \rightarrow X) &= \lambda(1-f)pz \\ P(X \rightarrow Z) &= \lambda fpx \\ P(X \rightarrow Y) &= \lambda f(1-p)x \\ P(\phi) &= 1 - \text{all of the above} \end{aligned}$$

3.1 Comparative Statics

We first study the probability of change P_c at the end of one five year period (= 1 unit of time).

Consider the following expressions:

$$1. \quad \frac{\partial E(\Delta x)}{\partial f} = -\lambda x - \lambda(1-p)y - \lambda pz < 0$$

and

$$\frac{\partial E(\Delta y)}{\partial f} = \lambda(1-p)x + \lambda(1-p)y > 0$$

Also,

$$\frac{\partial E(\Delta x)^2}{\partial f} = \lambda x - \lambda(1-p)y - \lambda pz$$

So, if $X > Z$ then $\frac{\partial E(\Delta x)^2}{\partial f} > 0$. Therefore, $\frac{\partial V(\Delta x)}{\partial f} > 0$ if $X > Z$ and $E(\Delta x) > 0$. Implies $\frac{\partial P_c}{\partial f} > 0$.

2.

$$\frac{\partial E(\Delta x)}{\partial \lambda} = -fx + (1-f)(1-p)y + (1-f)pz$$

So $f \geq \frac{1}{2} \Rightarrow \frac{\partial E(\Delta x)}{\partial \lambda} < 0$.

$$\frac{\partial E(\Delta y)}{\partial \lambda} = f(1-p)x - (1-f)(1-p)y$$

Again, $f \geq \frac{1}{2} \Rightarrow \frac{\partial E(\Delta y)}{\partial \lambda} > 0$.

Also

$$\frac{\partial E(\Delta x)^2}{\partial \lambda} = fx + (1-f)(1-p)y + (1-f)pz > 0$$

Therefore, $\frac{\partial V(\Delta x)}{\partial \lambda} > 0$ if $f \geq \frac{1}{2}$ and $E(\Delta x) > 0$. Implies, if $f \geq \frac{1}{2}$, $\frac{\partial P_c}{\partial \lambda} > 0$.

3.

$$\frac{\partial E(\Delta x)}{\partial p} = -\lambda(1-f)y + \lambda(1-f)z$$

So, $Y < Z \Rightarrow \frac{\partial E(\Delta x)}{\partial p} > 0$.

$$\frac{\partial E(\Delta y)}{\partial p} = -\lambda fx + \lambda(1-f)y$$

Therefore, $f \geq \frac{1}{2} \Rightarrow \frac{\partial E(\Delta y)}{\partial p} < 0$. So, $Y < Z, f \geq \frac{1}{2} \Rightarrow \frac{\partial P_c}{\partial \lambda} < 0$ likely.

4. No definitive answers for q

Note that $\frac{\partial E(\Delta x)}{\partial \lambda} < 0$ if either f is large (close to 1) or x is large (support base of the ruling party is large). So the probability of change will increase with a larger λ when f is larger. We will explore this pattern in our numerical results. As a consequence of this, in case of either f or x being large, it is in the interest of the ruling party to have as low a λ as possible. This may lead to strategic behaviour by the ruling party in trying to 'go slow' on projects or not to be aggressive in looking for fresh investment.

3.2 Numerical Specifications and Results

The numerical model is constructed with the following specification:

- Time period $\Delta t = 1$ month, so there will be 60 periods between elections.
First we study the probability of change at the first election, simulating 1000 times.
- Then we trace for 10 consecutive elections, 50 years (= 600 periods), simulating 1000 times.
To calculate average tenure / number of government changes in the 50 year period.
- We also look at comparative statics, for alternative choices of parameter values.

We start with a population distribution given by $\left\{ \begin{array}{ccc} X_0 & Y_0 & Z_0 \\ 4 & 3.5 & 92.5 \end{array} \right\}$

The majority in the assembly is assumed to be 55%. In particular we assume that the assembly has 250 representatives and in the beginning 137 are from the ruling party. We explore the dynamics for the following choice of values of the parameters:

- λ : 0.1, 0.2, 0.3 rate of project arrival
 f : 0.1 to 0.9 at intervals of 0.1 probability of failure

The value of p is taken to be 0.75. We simulate $(\Delta X, \Delta Y)$ (in MATLAB) using N_2 (MVN-RND command) with the above moments (scaled by 1 month = $dt = 1/60 = 0.0167$) and generate ΔZ using the relation $\Delta Z = -(\Delta X + \Delta Y)$.

We first study the (deterministic) pattern of change over time in the first moment of (X, Y, Z) using a differential equation approach. To solve, we again use MATLAB (command: ODE45). The results are qualitatively consistent with the stochastic approach described below.

The simulation is carried out for the alternative values for each of the parameters (λ & f) as mentioned above, to get an idea about the importance of change in each. See Table 1 below (all results for the change probabilities, P_c , in this paper are presented in percentage format). When we consider the economic sprocess only, the change probability (P_c) decreases in λ for moderate to large values of f (≤ 0.7 , exception being the case for $f = 0.5$ which has a kinked trend). Beyond this level, for $f = 0.8$ or more, P_c increases in λ . So with only the economic process, it is beneficial for even moderately efficient ruling parties to bring in more projects to maximise their chance of re-election.

4 Economic and Political Process

We now add the political campaigning effect to our model and arrive at the following transition system:

$$\begin{aligned} P(Y \rightarrow X) &= \gamma_1(R)(1-q)y + \lambda(1-f)(1-p)y \\ P(Z \rightarrow X) &= \gamma_0(R)z + \lambda(1-f)pz \\ P(X \rightarrow Z) &= \lambda f p x \\ P(X \rightarrow Y) &= \gamma_1(O)(1-q)x + \lambda f(1-p)x \\ P(Z \rightarrow Y) &= \gamma_0(O)z \\ P(\phi) &= 1 - \text{all of the above} \end{aligned}$$

Now as there is an additional movement towards X and Y from Z , we may expect a higher value of P_c . In addition to the earlier parametric specifications, we consider three possible values for the loyalty parameter q : 0.7, 0.8 and 0.9 (probability to stay on (not switch due to campaign)).

See Table 1 below. When we introduce the political process along with the economic, the picture changes substantially. Now increasingness of P_c in λ holds for $f \geq 0.6$ and even for $f \leq 0.5$, the trend in P_c is seen to be non-monotonic with P_c being lower at $\lambda = 0.2$ but higher

for both lower ($= 0.1$) and higher ($= 0.3$) values. Even though the campaigning fund for the ruling party is always increasing in λ , the effect of it on Δx is concave. So initially the funding boosts the support but above a certain level of f it gets outweighed by the loss due to project failure. Thus in this situation the ruling party will not be looking for too many projects but would prefer a moderate number if they are fairly efficient ($f \leq 0.5$). If the chance of success is less than 50%, then the parties would revert to a 'no projects preferred' stance.

Table 1: P_c with Economic and Political process

	E			EP		
f	λ			λ		
	0.1	0.2	0.3	0.1	0.2	0.3
0.1	7.0	0.0	0.0	2.0	0.7	1.7
0.2	2.0	2.0	1.0	2.7	2.3	3.7
0.3	4.0	2.0	2.0	3.7	2.0	3.0
0.4	5.0	2.0	2.0	6.7	4.3	4.7
0.5	10.0	1.0	5.0	9.0	5.7	7.7
0.6	7.0	8.0	6.0	11.0	12.0	12.7
0.7	20.0	7.0	6.0	18.0	21.7	19.3
0.8	17.0	23.0	24.0	24.7	36.7	40.0
0.9	38.0	27.0	34.0	38.7	53.0	59.7

4.1 Effect of Loyalty

Political process only: When we consider the political campaigning process in isolation, it is seen that the effect of q on P_c is non-monotonic. So in the absence of the economic process, intensity of loyalty does not play a definitive role. It is possible that the effect of loyalty for the two sides gets cancelled.

We then consider the economic and political process together and look at the effect of q on P_c for each combination of values for (λ, f) . See table 3 for the results. In each cell, a '+' signifies that for that particular combination of values for (λ, f) , P_c increases in q . Similarly, a '-' signifies a decrease and finally '0' signifies that the trend is non-monotonic.

Now, this picture is not very clear for the (economic, political) process. Here the decreasingness or increasingness of P_c in q shows no discernible pattern. Probably again the cancellation of effects from two sides confuses the picture.

5 Adding the Social Interaction

We now consider all three effects together in three alternative forms.

5.1 Anti-incumbent Interaction only

First we postulate that the effect of social interaction is only in the erosion of the support base of the ruling party (x) and addition to the opposition base (y) or the neutrals (z). That is, social interaction is generally of the 'bad mouthing' or anti-incumbent variety. The transition system is then given by the following.

$$\begin{aligned}
 P(Y \rightarrow X) &= \gamma_1(R)(1-q)y + \lambda(1-f)(1-p)y \\
 P(Z \rightarrow X) &= \gamma_0(R)z + \lambda(1-f)pz \\
 P(X \rightarrow Z) &= \beta_{xz}xz + \beta_{xpyz}xy + \lambda fpx \\
 P(X \rightarrow Y) &= \gamma_1(O)(1-q)x + \beta_{xy}xy + \lambda f(1-p)x \\
 P(Z \rightarrow Y) &= \gamma_0(O)z + \beta_{zy}yz \\
 P(\phi) &= 1 - \text{all of the above}
 \end{aligned}$$

switch	parameter	value
$X \rightarrow Y$	β_{xy}	0.04
$X \rightarrow Z$	β_{xz} and β_{xpyz}	0.06
$Z \rightarrow Y$	β_{zy}	0.08

Note that the movement $X \rightarrow Z$ may happen through two possible interactions, one between X and Z (direct conversion) and the other between X and Y (indirect conversion through interaction with the opposition). Thus we have two parameters to specify the rate of this transition.

With this system, we expect a higher value of P_c than the earlier model as the ruling support base erodes more quickly.

5.2 Pro-incumbent Interaction only

Second we postulate that the effect of social interaction is only in support of the ruling party (x) and defection from the opposition base (y) or the neutrals (z). That is, social interaction is generally of the 'propaganda' or pro-incumbent variety. The transition system is then given by the following.

$$\begin{aligned}
 P(Y \rightarrow X) &= \gamma_1(R)(1-q)y + \beta_{yx}xy + \lambda(1-f)(1-p)y \\
 P(Z \rightarrow X) &= \gamma_0(R)z + \beta_{zx}xz + \lambda(1-f)pz \\
 P(X \rightarrow Z) &= \lambda fpx \\
 P(Y \rightarrow Z) &= \beta_{yz}yz + \beta_{ypxz}xy \\
 P(X \rightarrow Y) &= \gamma_1(O)(1-q)x + \lambda f(1-p)x \\
 P(Z \rightarrow Y) &= \gamma_0(O)z \\
 P(\phi) &= 1 - \text{all of the above}
 \end{aligned}$$

switch	parameter	value
$Y \rightarrow X$	β_{yx}	0.04
$Y \rightarrow Z$	β_{yz} and β_{ypxz}	0.06
$Z \rightarrow X$	β_{zx}	0.08

Again the transition rate for $Y \rightarrow Z$ is specified by two parameters to represent the direct and indirect components as mentioned in 5.1.

With this system, we expect a lower value of P_c than the earlier model as the ruling support base always bolstered through interaction.

5.3 Symmetric Interaction

Finally, we also explore the implications of having a symmetric effect of social interaction postulated as follows:

$$\begin{aligned}
P(Y \rightarrow X) &= \gamma_1(R)(1-q)y + \beta_{yx}xy + \lambda(1-f)(1-p)y \\
P(Z \rightarrow X) &= \gamma_0(R)z + \beta_{zx}xz + \lambda(1-f)pz \\
P(X \rightarrow Z) &= \beta_{xz}xz + \beta_{xpyz}xy + \lambda fpx \\
P(Y \rightarrow Z) &= \beta_{yz}yz + \beta_{ypxz}xy \\
P(X \rightarrow Y) &= \gamma_1(O)(1-q)x + \beta_{xy}xy + \lambda f(1-p)x \\
P(Z \rightarrow Y) &= \gamma_0(O)z + \beta_{zy}yz \\
P(\phi) &= 1 - \text{all of the above}
\end{aligned}$$

The first and second moments of change in x , y and z , $E(\Delta x)$, $E(\Delta x)^2$ etc. are shown in the appendix.

switch	parameter	value
$Y \rightarrow X$	β_{yx}	0.04
$X \rightarrow Y$	β_{xy}	0.04
$Y \rightarrow Z$	β_{yz} and β_{ypxz}	0.06
$X \rightarrow Z$	β_{xz} and β_{xpyz}	0.06
$Z \rightarrow Y$	β_{zy}	0.08
$Z \rightarrow X$	β_{zx}	0.08

Now the expectation would be for a lower P_c and higher tenure lengths on average.

The results for all three alternatives are shown in Table 2. When the social process added to the economic and political ones, in the three alternative forms as above, the chances of success reduces even further. Now parties with quite high levels of efficiency (up to the level of $f = 0.3$) will still prefer fewer projects as P_c decreases in λ for $f \geq 0.3$. Even for lower values of f (0.2 or less) the trend of P_c in λ is non-monotonic. So probably only the very efficient ($f \leq 0.1$) parties will take on moderate number of projects and all others will follow the 'no projects preferred' strategy. Interestingly, even with a pro-incumbent social interaction process, this conclusion does not change.

Table 2: P_c values for all three processes: Economic, Political and Social together

	EPS_{ai}			EPS_s			EPS_{pi}		
f	λ			λ			λ		
	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	0.3
0.1	3.7	3.7	2.7	1.3	1.0	1.7	0.7	1.7	1.3
0.3	14.7	20.7	19.3	8.7	15.3	18.3	4.3	5.3	12.3
0.5	31.0	33.3	38.7	23.7	31.0	34.3	13.3	22.7	23.3
0.7	42.7	52.0	58.0	39.3	47.0	49.7	28.0	38.3	43.0
0.8	54.7	64.0	73.7	48.3	59.7	67.7	37.3	56.7	59.7
0.9	71.3	80.7	91.3	62.0	75.7	81.0	50.7	64.3	83.0

Comparing the results of different social interaction processes: When the nature of social interaction changes from anti-incumbent to symmetric to pro-incumbent variety, P_c as expected decreases for most combinations of (λ, f) . See also the plots in figure 1 below for a visual representation of this. Exceptions being the two situations $(\lambda = 0.2, f = 0.1)$ and $(\lambda = 0.3, f = 0.9)$ where P_c (aymmmetric) $<$ P_c (pro-incumbent).

5.4 Comparisons

To understand the incremental effects of each of the processes (economic, political and social) we consider all possible parametric configurations and discuss the pattern of our results below in terms of figure 1 and table 3. A generic change that is observed is, with more processes in play the P_c value increases uniformly for all parametric configurations. We have considered this even for the combinations not discussed in detail below. E.g. 'political only' and 'political and social', in contrast with 'economic and political' and the full process with all three (the details are available on request).

When we consider the process 'economic and social only', the pattern changes compared to 'economic only' in that the increasingness of P_c in λ starts for even smaller values of f . Also the non-monotonic patterns tend to reduce or disappear. With the introduction of the political process to this, the pattern becomes even smoother (becomes monotonic and P_c starts increasing in λ for even smaller values of f).

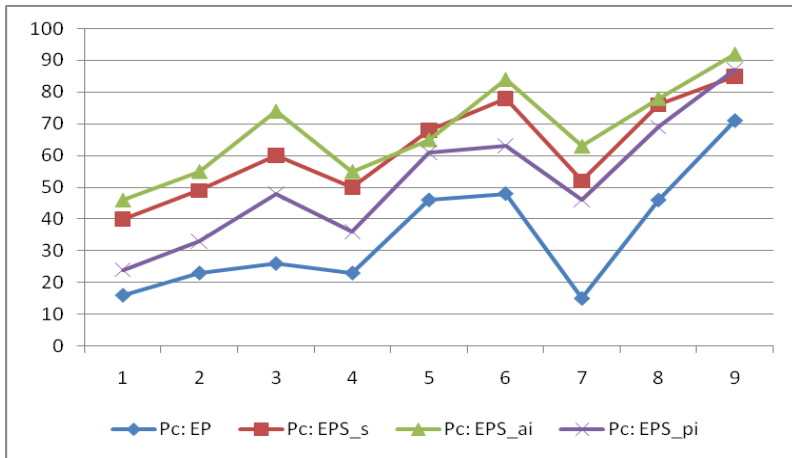
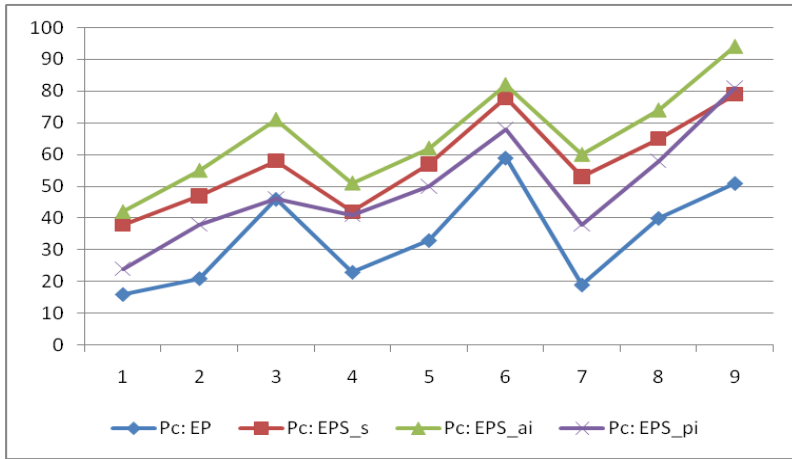
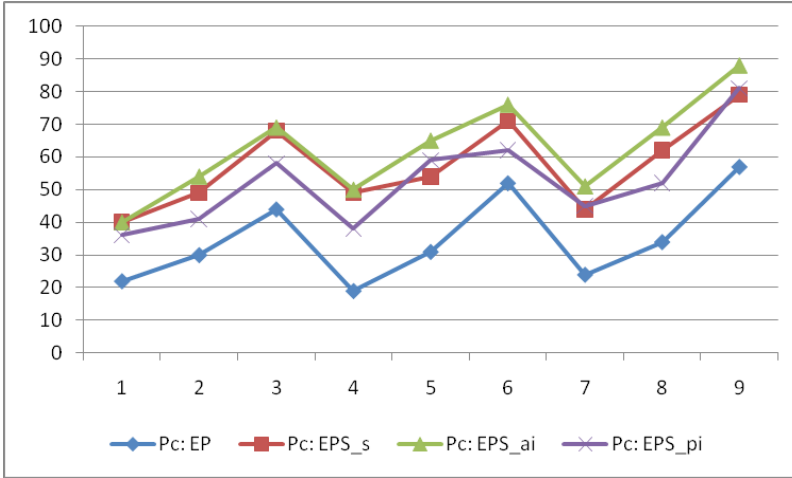


Figure 1: Plots of P_c against values of (λ, f) , where, in each of the figures, blocks of first 3 are given for $\lambda = 0.1$, against $f = 0.7, 0.8, 0.9$, similarly, next 3 for $\lambda = 0.2$, and last 3 for $\lambda = 0.3$. Three figures from top to bottom are given for the loyalty parameter $q = 0.7, 0.8$ and 0.9

We will now consider all the three processes together, with the alternative variations of the social process, and look at the effect of q on P_c for each combination of values for (λ, f) . See Table 3 below for the results. Loyalty in general decreases P_c for smaller f . This impact reduces as f increases and finally gets reversed for large λ and large f . This happens because when the expected loss potential gets much larger, then effect of loyalty towards the ruling party gets dominated by that for the opposition. As now there will be too many failures that will erode x and bolster y due to loyalty. Of course, as intuitively expected, this impact is more pronounced with a pro-incumbent interaction than for the symmetric one and least for the anti-incumbent variety. Similar pattern is observed in terms of figure 1 also. P_c increases as f increases. There is no visually clear trend with respect to q . As discussed above, the values of P_c in case of 'economic and political only' (EP) is less than the full process 'EPS' (indicating social interaction plays a role in increasing P_c). In particular, we observe that the P_c graph for 'EPS' in symmetric case (EPS_s) overlaps with that for the pro-incumbent (EPS_{pi}) and the anti-incumbent (EPS_{ai}) case, but in general the anti-incumbent case shows a higher rate of change than the pro-incumbent one.

Table 3: Change in P_c with loyalty (q)

	EP			EPS_{ai}			EPS_{pi}			EPS_s		
f	λ			λ			λ			λ		
	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	0.3
0.1	0	-	0	0	-	-	-	-	-	-	-	-
0.3	+	0	+	0	0	0	0	-	-	-	-	-
0.5	0	0	0	+	-	+	-	-	+	-	0	0
0.7	-	+	-	+	+	+	-	0	0	0	0	0
0.9	0	0	0	+	+	0	0	0	+	0	+	+

5.5 Length of Tenure

To study the pattern of the average lengths of tenure with respect to changes in the values of λ and f , we produce the frequency distribution of such lengths in the figures below. It is observed that, almost uniformly, the frequency of longer tenures decrease with an increase in λ or f for a fixed f or λ respectively. The decrease is intuitive as with higher threats of failure and/or higher rate of project arrival, the loss potential increases, which in turn give rise to a higher probability of losing the election. Exceptions occur for the combination of the smallest values of λ and f where the frequency initially decreases but then rises for large tenure lengths (8, 9 or 10). This is probably due to the fact that with small λ and f , the expected gain outweighs the loss and hence a party surviving a few elections will gain enough strength (majority) and funds to carry on for a long term. So the probability of re-election for successive terms turns out to be non-monotonic in number of elections in this case. What is more intriguing is the frequency of

a very high tenure length is more in the anti-incumbent case than the pro-incumbent case! It is not clear why this is so and would be an interesting direction for future work.

6 Concluding Remarks and Future Extensions

When outcomes of developmental projects undertaken are uncertain, ruling parties in a democracy often face a difficult choice. Taking up projects that fail result in bad publicity and hence a dent in the vote bank. But on the other hand a successful project leads to more votes as well as more money in the funds. In the context of a two party model of democracy with neutrals and supporters, we set up a dynamic stochastic model to explore this situation. In this context we have considered the political campaigning process and alternative social interaction patterns explicitly.

Using numerical methods, we show that the rate of failure of projects play a crucial role in changing the probability of a re-election. We also explore the role of other factors like rate of project arrival, party loyalty and changeover probability. We have studied the unconditional and conditional (fixing the value of other parameters at different levels) effect of all the parameters on the probability of change. The results bring out some interesting patterns on joint effects that are quite intriguing and calls for further research.

The results indicate that in a strategic setting, in some situations, the ruling party would be better off by ensuring a low rate of project arrival to increase their chances of reelection. This has interesting implications for addressing the development vs. political stability conundrum. Also the very important effect of social interaction in the political outcomes and consequently on the economic performance in a democracy is suitably emphasised through our results.

In the sequel we point out some possible future directions of research in this area. there are many interesting alternatives to be explored. (i) The stochastic game formulation for the strategic choice problem need to be studied. (ii) An extension to a multi-party (three parties or more) democratic system needs to be studied to allow for other realistic scenarios. (iii) The dynamic nature of a project with delays and gradual benefit accrual need to be incorporated. (iv) **Possible asymmetry in campaigning:** We can consider that the campaigning effects are asymmetric across constituencies. Then the budget allocation may also be asymmetric. To study the optimisation problem in this situation. (v) **Population growth:** If all groups grow equally, then no change will happen in terms of proportions and results are unchanged. If Z grows faster than X or Y, then one may assume Z has net growth, X & Y are stationary. Also the reverse case may be considered. (vi) **Episodic event:** War or Natural Calamity. Should have both short term and long term impact. May be modelled by "delay" equations.

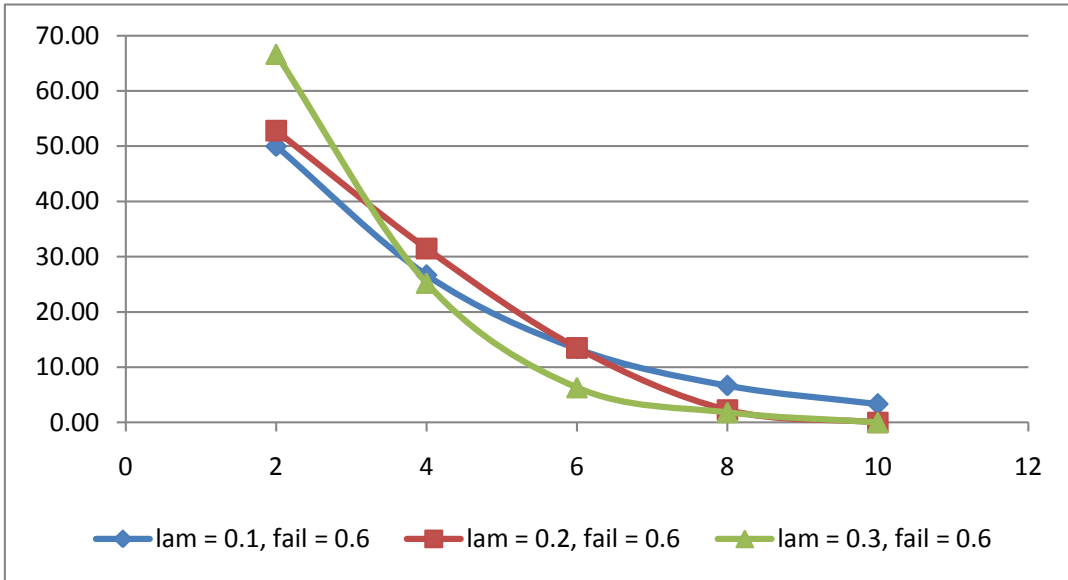
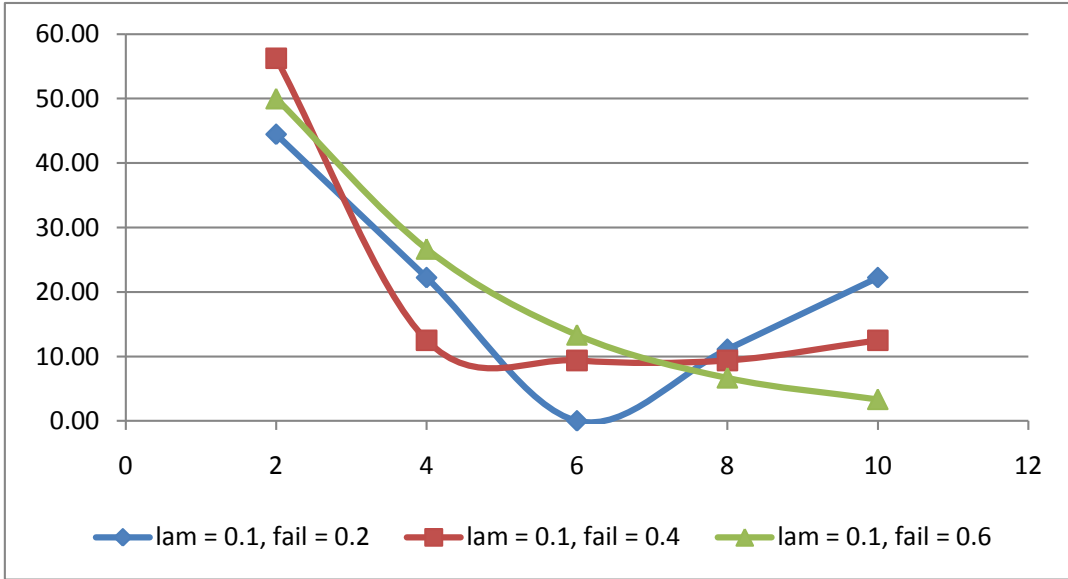


Figure 2: Frequency distribution of Length of Tenure for some combinations of (λ, f) , in the Pro-incumbent interaction case. First varying f , keeping λ fixed and then varying λ keeping f fixed

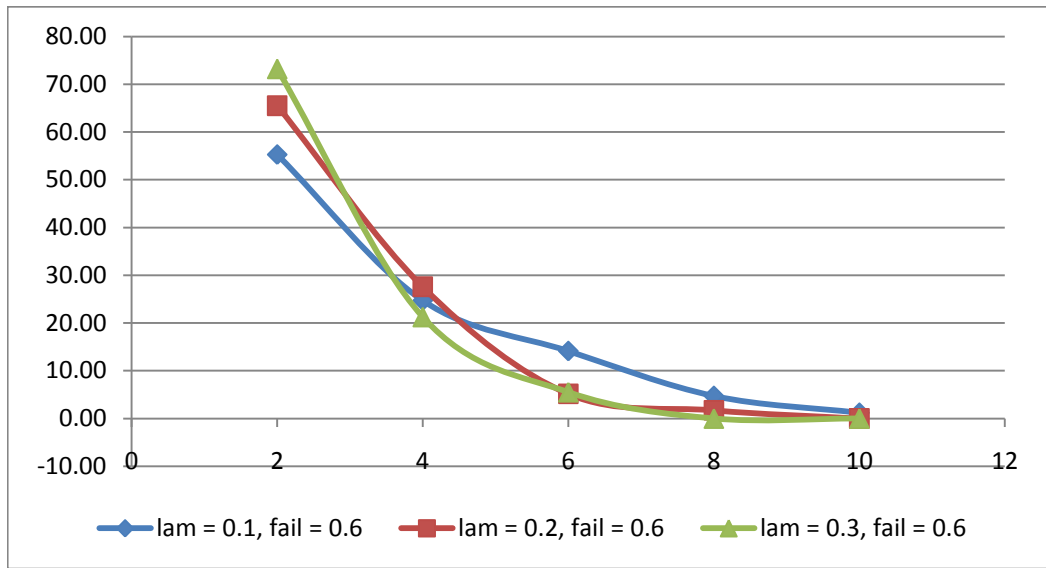
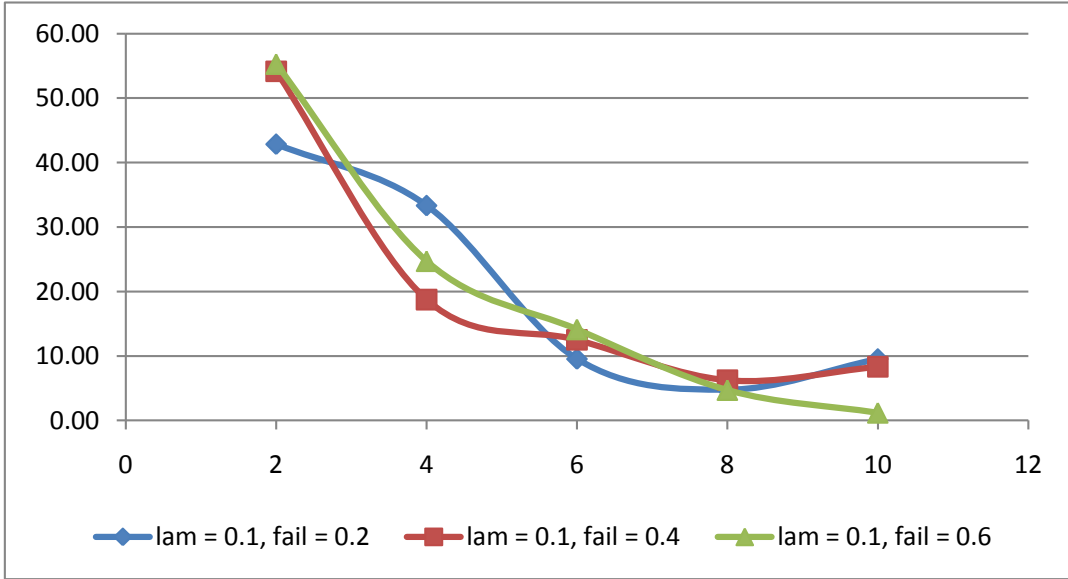


Figure 3: Frequency distribution of Length of Tenure for some combinations of (λ, f) , in the Symmetric interaction case. First varying f , keeping λ fixed and then varying λ keeping f fixed

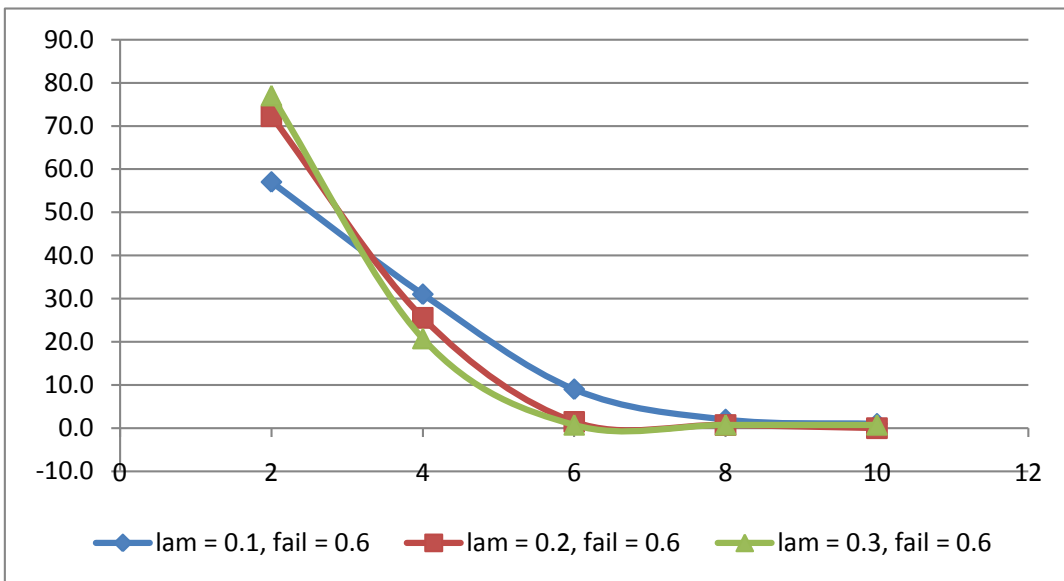
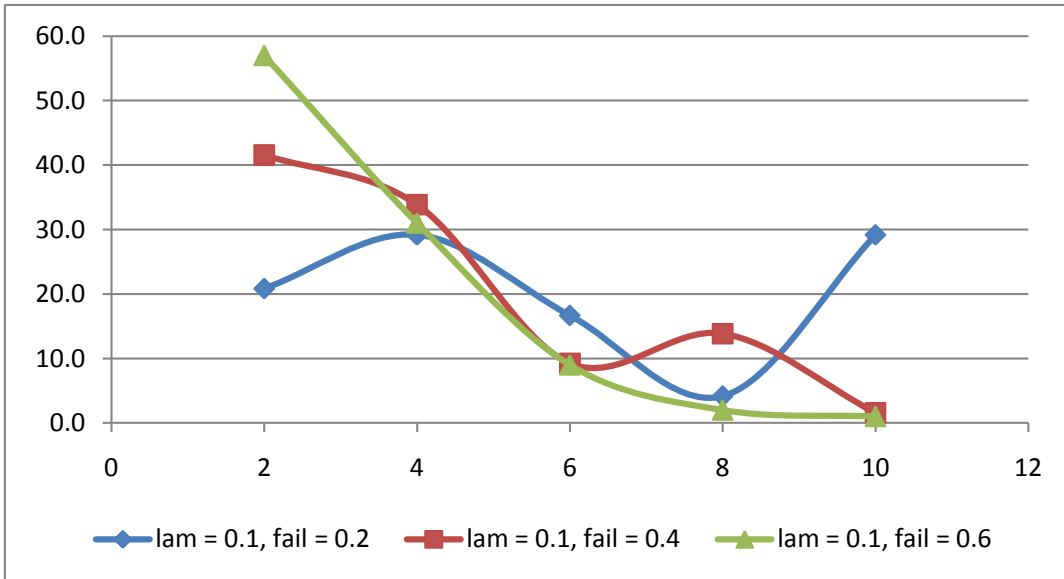


Figure 4: Frequency distribution of Length of Tenure for some combinations of (λ, f) , in the Anti-incumbent interaction case. First varying f , keeping λ fixed and then varying λ keeping f fixed

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Appendix: Moment Calculations

The change expectations are as follows:

$$\begin{aligned}
E(\Delta x) &= -(\lambda f + \gamma_1(O)(1 - q))x + (\gamma_1(R)(1 - q) + \lambda(1 - f)(1 - p))y \\
&\quad + (\gamma_0(R) + \lambda(1 - f)p)z - \beta_{xpyz}xy + (\beta_{zx} - (\beta_{yx} - \beta_{xy}))xz \\
E(\Delta y) &= (\lambda f(1 - p) + \gamma_1(O)(1 - q))x - (\gamma_1(R)(1 - q) + \lambda(1 - f)(1 - p))y \\
&\quad + \gamma_0(O)z - \beta_{ypxz}xy + (\beta_{zy} - \beta_{yz})yz + (\beta_{xy} - \beta_{yx})xy \\
E(\Delta z) &= \lambda fpx - (\gamma_0(R) + \gamma_0(O) + \lambda(1 - f)p)z \\
&\quad + (\beta_{xpyz} + \beta_{ypxz})xy - (\beta_{zx} - \beta_{xz})xz - (\beta_{zy} - \beta_{yz})yz
\end{aligned}$$

This is by construction closed, $E(\Delta x) + E(\Delta y) + E(\Delta z) = 0$.

The second moments are calculated as follows:

$$\begin{aligned}
E(\Delta x)^2 &= (\lambda f + \gamma_1(O)(1 - q))x + (\gamma_1(R)(1 - q) + \lambda(1 - f)(1 - p))y \\
&\quad + (\gamma_0(R) + \lambda(1 - f)p)z + (\beta_{xy} + \beta_{yx} + \beta_{xz})xy + (\beta_{zx} + \beta_{xz})xz \\
E(\Delta y)^2 &= (\lambda f(1 - p) + \gamma_1(O)(1 - q))x + (\gamma_1(R)(1 - q) + \lambda(1 - f)(1 - p))y \\
&\quad + \gamma_0(O)z + (\beta_{xy} + \beta_{yx} + \beta_{ypxz})xy + (\beta_{yz} + \beta_{zy})yz + \lambda fp \\
E(\Delta z)^2 &= \lambda fpx + (\gamma_0(R) + \gamma_0(O) + \lambda(1 - f)p)z + (\beta_{xz} + \beta_{yz})xy \\
&\quad + (\beta_{zx} + \beta_{xz})xz + (\beta_{yz} + \beta_{zy})yz + \lambda(1 - f)pz \\
E(\Delta x \Delta y) &= -(\lambda f(1 - p) + \gamma_1(O)(1 - q))x - (\gamma_1(R)(1 - q) + \lambda(1 - f)(1 - p))y \\
&\quad - (\beta_{xy} + \beta_{yx})xy \\
E(\Delta x \Delta z) &= -(\gamma_0(R) + \lambda(1 - f)p)z - \lambda fpx - \beta_{xz}xy - (\beta_{xz} + \beta_{zx})xz \\
E(\Delta y \Delta z) &= -\gamma_0(O)z - \beta_{yz}xy - (\beta_{yz} + \beta_{zy})yz
\end{aligned}$$