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SOCIETAL DECISION MAKING: AN EMPIRICAL STUDY IN CALIFORNIA CITIES

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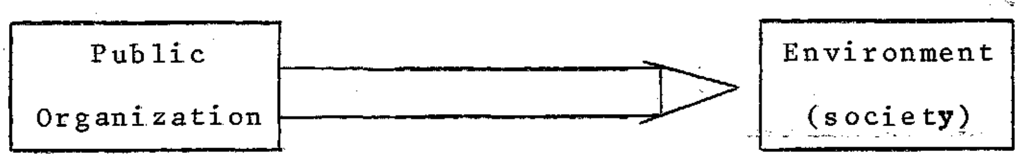
I - INTRODUCTION

The aim of this research is to formalize the existing competing hypothesis to explain the public organizations behavior in regard to the societal decision making, and to conduct an empirical test of these hypothesis in California cities. The specific contribution of this research is to present enough evidence to show that a contingency theory approach to societal decision making is the best plausible explanation to the public organizations behavior at least in California cities.

There are at least four theories explaining the process of societal decision-making: (a) bureaucratic theory, (b) ecological theory, (c) analytical or sinoptic theory, and (d) contingency theory.

<u>Bureaucratic Theory</u>: Decision-making in public organizations affects the environment but is remotely affected by it. Decision-making is internal to the bureaucracy, relying on the dynamics of the organizational life and on the cognitive and informational constraints existing in the turbulent society we live in.



The "Politics of bureaucracy" is the best explanation of public policies being enacted by public organizations.

The rationale behind the power of the bureaucracy to establish policies based on its values and motives can be recast in the words of Weber almost a century ago:

> *Under normal conditions, the power position of a fully developed bureaucracy is always overtowering. The political master finds himself in the position of the "dilettante" who stands opposite the "expert", facing the trained official who stands within the management of administration. This holds whether the "master" whom the bureaucracy serves is "people", equipped with the weapons of "legislative initiative", the referendum, and the right to remove oficials, or a parliament, elected on a more aristocratic or more "democratic" basis and equipped with the right to vote a lack of confidence, or with actual authority to vote it (Weber, 1946).*

From the moment the bureaucracy became the rational - meaning based in knowledge and expertise - source of power in the society, as compared with charismatic and theological sources of power, it gained a relative autonomy to determine what is "better" for society at large.

Many authors have continued to explore the skills of bureaucracy as the new basis for power in society, for example, Rourke (1978, 1976), Mouzelis (1967), Habermas (1975), and Dreitzel (1975), among others, but without considering explicitly the type or mode of decision process undertaken by the bureaucracy. What is at stake here is the transformation of bureaucracy in technocracy - the independence of bureaucracy from the "political, non-rational", aspects of societal decision-making, to the paramount importance of rationality and expertise - in the so-called post-modern society.

Three main explanation of the way in which bureaucracies make decisions are to be noted: (a) the satisficing theory, (b) the incrementalist theory, and (c) learning systems theory.

CHANGE/COGNITION	high understanding	low understanding
incremental	some administrative and "technical" decision-making analytical method: synoptic (rational)	incremental politics analytic method: Disjoint Incrementalism (among others
large	revolutionary and utopian decision-making analytical method: none.	wars, revolutions, crisis and grand opportunities analytical method: not formalized or well understood

Source: Adapted from Diagram 2, p. 78, op.cit.

The "disjoint incrementalism", contend the authors, represents the typical decision-making of the bureaucracy in present society. It is characterized by "marginal choices" with regard to existing objectives and policies; therefore a "restricted variety of policy alternatives", as well as, "a restricted number of consequences" are considered for any given policy. Ends and means are chosen together, and the criteria for choice of an alternative - incremental change - is the consensus or agreement among the bureaucrats involved in that specific policy - independent of whether they agree that the policy "is the most appropriate means to an agreed objective" (Lindblom, 1959).

Schon (1971) introduced the notion of "dynamic conservatism" of social systems - meaning "a tendency to fight to remain the same... to maintain its boundaries and its patterns of internal relationships" (p. 32) - and of "learning systems" - meaning a social systems "in which dynamic conservatism operates at such a level and in such a ways as to permit change of state (from

Simon (1957) introduced the notions of "bounded rationality" - meaning that for different points in the decision hierarchy the "rational" solutions to a problem will differ given the level of commitment one has at each point to specific problems and goals - of "limits to human cognition" - meaning that perception and cognition intervene between the decision-maker and his objective environment and that the human capacity to grasp reality is limited by his view of the world, knowledge, etc. - and of "satiation" - meaning the psichological drive and motivation of a decision-maker to achieve his aspiration level and to satiate his needs and desires. Therefore, not knowing the precise contours of reality, conditioned to his place in the hierarchy, and motivated by his own aspirations, the decision-maker looks for a satisficing resolution of a perceived problem situation, rather than "optimal" solution to the actual problem.

Braybrook and Lindblom (1963) introduced the notion of "incremental changes":

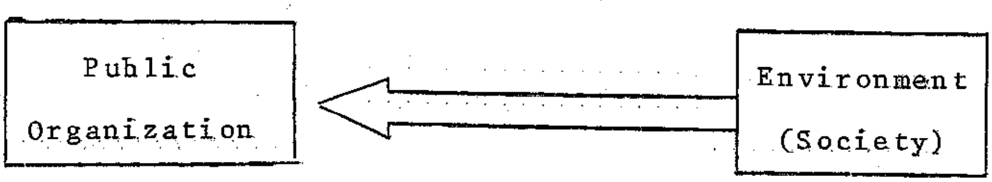
> *We consider the introduction through public policy of what is considered to be a new and important element (in the combination of elements to which people refer in explaining important social change) to be a nonincremental change. On the other hand, a somewhat greater or reduced use of an existing social technique or a somewhat higher or lower level of attainment of some existing values is a small or incremental change... We therefore wish to specify that a small or incremental change is one that, within some short time period, such as five years, is small or incremental, regardless of the indefinite future (page 64).*

They combine this notion with the limits of human cognition to generate a four state possible policy situation, as seen below:

one stable state to another, through zones of crisis) without intolerable threat to the essential functions the system fulfills for the self" (P. 60) to explain the behavior of the bureaucracy. Therefore, the policies chosen are the ones capable of assuring the survival of the bureaucracy as an entity. Accordingly Schon characterizes the behavior of public organizations as:

> *Government is an institution for performing public functions and an agent for inquiring into public problems affecting society as a whole. As an instrument of public learning, ... the government... rests largely on a theory of the stable state. It accepts as mysteriously given the issues around which policy and programs must be shaped. It treats government as center, the rest of society as periphery. Central has the responsibility for the formation of new policy and for its imposition on localities at the periphery. In spite of the language of experimentation, government-initiated learning tends to be confined to efforts to induce localities to behave in conformity with central policy.* (pp. 176-177)

Ecological Theory: Decision-making in the environment affects public organizations but is remotely affected by them. Decision-making is external to public organizations, and public policies and services reflect the socio-economic characteristics of the environment, the society.



The demand for services and "consumer" satisfaction is the best explanation of public policies which reflect the satisfaction of societal needs by public services and goods.

The nature of public goods was identified, although in a very preliminary way, already at the time of Adam Smith:

> *The third and last duty of the sovereign or commonwealth is that of erecting and maintaining those public institutions and those public works, which, though they may be in the highest degree advantageous to a great society, are, however, of such a nature, that the profit could never repay the expense to any individual or small number of individuals, and which it therefore cannot be expected that any individual or small number of individuals should erect or maintain.* (Vol. II, page 244)

But, the reason of profitability overshadows the real nature of the public goods - the indivisibility of the services among separate persons. Once produced they are available for a whole collectivity. The defense against external enemies provided by an army, cannot be consumed by some persons in a country, without all others sharing it. Another way to say it is that "Public goods are not subject to the 'exclusion principle'; it is impossible to prevent their consumption by many while permitting their consumption by some. Thus, [for example] mosquito control is not only jointly consumed by many persons in equal amounts, it is impossible to exclude persons in the control area from consuming this product" (Davie and Duncombe, 1972, p.40). Of course this is not to say that all persons value them equally. In some cases, a minority, or even a majority, may oppose their production and distribution, while the public goods will still be provided equally to them.

Since one cannot exclude persons from getting the benefit of public goods it is impossible for a producer to provide them for a profit - the Smith argument. Therefore, either they are provided by public organizations, or they will not be provided at all.

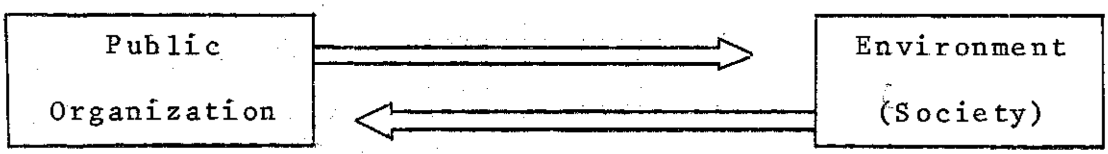
Wagner (1883) introduced the "law of increasing expansion of public activity" to relate the public goods, as measured by public expenditures, and the level of economic development, as measured by real income, such as "State expenditure may be higher, in absolute and as a percentage of national income, in [a] proportion ...greater [than] the [free] national income..." (p. 7). Buchanan (1970), interpreting Wagner's law, argued that the income elasticity of demand for public services should be larger than one as "income rises beyond subsistence levels,... but..., as individuals become affluent, basic needs for collectively provided services may also be met, and the public clamor for additional public activity may subside" (p. 56).

The role of public organizations is seen as the service provider of public goods as a function of the "public wants". Decision-making with regard to policies in public organizations is a reflex of the demands for the public goods as expressed by the level of economic development. Or, as interpreted by Musgrave (1959, p. 73), political variables intermediate this process:

> *The tax must be set as a price, designed to maximize the satisfaction that the consumer derives from his payments for public and private services. The equilibrating force by which this adjustment is secured is, in most cases, the political mechanism by which the agency of government is forced to represent the wishes of the voters.*

Dye (1965) extends the notion of the dependency of policy outputs from public wants to include two possible ways in which the level of economic development is linked to public services providing: a resource view, and a need view of the policy process. In the former he includes the cases foreseen by the Wagner's law. In the latter he includes the cases of poor states where public organizations impose higher or more severe taxation, in order to provide the level of services demanded by the population, that would not be provided otherwise. But, again, it is the high or low level of economic development that determines the policy outputs.

Analytical Theory: The decision-making process of public organizations affects and is affected by the environment. The decision-making is internal but based on externally determined problems and issues of the society.



The rational analysis of societal problems - the definition of "public interest" or a societal "welfare function", - and the definition of alternatives to cope with them, are the best explanation of public policies.

Different reasoning can be invocated to explain and support a rational behavior for decision-making in public organizations. The tradition of rationalism is one of the most important in today's way of thinking, and as such, it has seeds in so many branches of knowledge that it would be almost impossible to sumarize how these branches came to explain that decision-making is rational. We will limit ourselves to review three, perhaps interrelated theories with these characteristics: public finance/ economics, comprehensive planning, and systems analysis. They have in common the same paradigm of decision-making as composed of: (a) identification of the problem situation or issue, (b) objectives selections, (c) identification of possible alternatives that solves means equality in terms of "maximum welfare" to all members of society, with some receiving more than others, in a way to maximize the total. From a radical perspective it means actual equality in economic welfare at any given time|1|.

Finally, the policies for economic stabilization refer to actions to assure price-level stability and full employment. Its rationale is as follows:

> *A free economy, if uncontrolled, tends towards more or less drastic fluctuations in prices and employment and apart from relatively short-term swings, maladjustments of a secular sort may arise towards unemployments or inflation. Public policy must assume a stabilizing function in order to hold within tolerable limits in departures from high employment and price stability (Musgrave, op. cit., p.22).*

Therefore, from this perspective, the role of decision-making in public organizations is to identify the issues and problems associated with the delivery of public goods, income distribution, and economic stability, and to conduct an analysis and search for the best policies to cope with the existing discrepancies in each of these areas.

Comprehensive Planning

"We define planning as a process for determining appropriate future action through a sequence of choices." (Davidoff and Reiner, 1962, p.11). The same authors see the reasons for planning taking place as (a) efficiency and rational action, (b) market aid or replacement, and (c) change or widening of choice.

In the first case planning is justified as "a means the problem, (d) evaluation of these alternatives in regard to the objectives and resources, (e) selection of the "best" alternative - the one whose outcome maximizes the objectives, and (f) implementation and follow-up of the best alternative, leading to a new cycle of decision-making.

Public Finance/Economics

Musgrave (1959) calls what was described as ecological rasoning here, as the "benefit approach" to the satisfaction of public wants. He then proceeds to describe what is know as "the ability-to-pay approach" as the mechanism capable of satisfying public wants. He sees the functions of public policies as threefold: (1) to secure adjustments in the allocation of resources, (2) to secure adjustments in the distribution of income and wealth, and (3) to secure economic stabilization" (p.5).

The first refers to the process of effectuating taxation in order to provide public goods, covering the same ground that the ecological theory supports: "Indeed, there was a time when the provision of public services was considered [the governmental] only legitimate function, and it was argued 'the fiscal problem pure and simple' should not be confused with alien considerations of social and economic policy'" (p.17)

The second - the "distribution branch", in Musgrave's terminology - corresponds to the notion that the "revenue-expenditure process of government is bound to have social and economic effects, and that these may be aimed usefully at purposes not directly connected with the immediate objective of satisfying public wants. Adjustments in the state of (income) distribution are one such purpose" (p.17). The "proper" state of distribution can be formulated from a variety of points of view. From a democratic point of view economic and social equality is an assumption. But even there the interpretation of equality can again be seen from a variety of perspectives. From a conservative point of view it means "equality of opportunity" to obtain income. From a liberal perspective it of reducing waste or producing the greatest return from employment of resources" (ibidem, pp. 14-15). If the process of decision-making is not logically organized and directed towards the achievement of an optimal alternative, scarce resources will be wasted, and/or the greatest social benefit will not be accomplished.

As market aid or replacement planning can be seen either as a regulator of markets so that they can operate effectively - "providing the factual basis that will permit various value alternatives to be confronted and tested [through free competition]" - or to serve as "a new and controlling system of pricing and distribution... - a 'directive' method that will in itself yield rational order". (ibidem, p.16).

Finally, as a change or widening of choice, the planning process can be seen as the arena where the "interested parties" can get information about possible alternatives to the allocation of resources, and the implications of each of the choices open. The values underlying each proposed course of action can be aired - as assumptions and value judgements. With regard to change, its contribution is in the sense of not taking old or present values and policies for granted, but questioning their rationality and proposing alternative views and actions. The "spell cast" words of tradition and conservatism are challenged by reason, and the meaning of present actions as well as alternative actions are discussed.

Many interpretations of comprehensive planning do exist, whether it be corporate planning - Ackoff (1970), William and Harris (1976), among others - or systematic planning - Stuart (1976), Collins (1974), among others or strategic planning - Steiner (1969), Ansoff (1971), among others.

Systems Analysis

> *If we are going to consider planning in a systematic manner, we will have to undertake a description of planning as*

> *an activity. That is, we must try to break down the system of planning into its component parts. The decision as whether or not there should be planning is itself a plan. The decision about effectiveness and opportunity costs of planning are again a planning type of decision. But just because there is a paradox need not detract from the value of planning. Indeed, the systems approach itself is based on a paradox. The approach advises us to look at the 'whole system,' but the amount of effort we spend on trying to understand the whole system is itself a system problem (Churchman, 1968, pp. 150 and 176).*

Therefore, although dealing with the whole system, system analysis takes a completely different point of view to planning than the comprehensive planning approach. The approach addresses the problem of understanding each isolated public policy from the perspective of the holistic nature of social problems and systems, of governmental systems and actions, as well as of planning as as system. Human behavior is understood not only from "the mechanistic (so-called behavioristic) view of human behavior... [but, also,] from a teleological or purposeful view [of behavior]" (Ackoff and Emery, 1972, p.5). The implications of this point of view are very far reaching:

> *Put another way,..., scientists tended to derive their understanding of the functioning of the whole from the structure of the parts and the structural relationships between them. Today we increasingly tend to derive our understanding of the structure of the parts of a system from an understanding of the functioning of the whole (Ackoff and Emery, 1972, p.5).*

Churchman (1968, b) established as the basic criterion to the design of planning systems (and social system, in general) the "ethics of the whole system," "that is that there is no such thing as improving a part of the system without taking into account what happens to the whole system as a consequence" (ibidem, p.70). Therefore planning can only be conceived as performed by a "well-informed public", because no "expert" planner will be able to see and understand the whole - given his needs to reduce the problem to such a specific level that it can be solved by a group of specialists. How a well-informed public can come into existence, is an open question (even to Churchman) given the "hidden leadership" in our society - which "operates by attracting the attention of society to certain issues and consequently neglecting other issues" (ibidem, p.74), the complexity of the whole, and the costs and education necessary to obtain the "relevant" information in regard to the "important" issues of the society.

Many systemic thinkers (Mason (1969) and Rittel and Webber (1973)) have tried to cope with this requirement by proposing a dialectic and dialogue role to planning while conducting an inquiry into social problems.

Contingency Theory: The type of relationship between the public organization and society in the decision-making process depends upon the characteristics of the society in which the organization is immersed. There is no such thing as the **best** explanation; one theory will explain the relationship of organization-environment to each set of circumstances better than others. For the purpose of this research the contingency theory is also proposed. It will use all of the above theories as possible explanations, depending upon the characteristics of the environment as follows (Emery & Trist, 1965, 1972): (a) bureaucratic theory in turbulent environments, (b) ecological theory in reactive environments, and (c) analytical theory in disturbed-reactive environments.

To verify and "prove" a societal decision-making contingency theory requires a test of the following conditions:

<u>Necessary</u>

There are at least two different models to explain the societal decision-making process in that model **i** has superior explanatory power over model **j** in environment **i**, and model **j** has superior explanatory power over model **i** in environment **j**.

<u>Sufficiency</u>

There are at least two types of "causal textures" of the environment that logically imply different relations between public organizations and society in the societal decision-making process.

This research, although still exploratory, will test the necessary condition by examining the behavior of a local government through the record of traces left behind by its resource allocation decisions - that is, the budgets and expenditures of local government functions. It is assumed that plans and programs are translated into budgets and actualized as expenditures, reflecting the societal decisions of public resource allocation by function/agency in order to generate specific types of public services. Budgets are surrogates of other types of plans and also are used in decision-making on how to actualize these other types of plans. Expenditures, besides prossessing the same properties as the budgets, add information on how the decisions were actualized in practice. Finally it is important to note that in the local government the budgetary process is often the only existing overall planning process. Its validity as a surrogate of the other possible types of plans is thus increased.

II - PAST RESEARCH

The main findings of previous research in societal decision-making will be reviewed here using the previously defined framework of the various main trends in existence. This is not an exhaustive bibliography of the area, but rather a selected review of some representative works in each of the existing trends.

Bureaucratic Theory: Testing of the concepts of societal decision theories through budgets derived from the incrementalist movement. The incrementalist position was defined by Lindblom (1959, pp. 79-88) and discussed later by Wildavsky (1964) who, for the first time, introduced budgets as surrogates to the decision-making process. It was expanded by Crecine (1969) who first applied the methodoloty used in this study to local-level government.

Justifying why the environment is not considered in the budgetary process and introducing the notion that it is an internal process, Wildavsky (1964) said:

> *Secular trends in the growth of national welfare programs and increasing federal responsibility for a host of services are unlikely to be reversed. The participants (from the organization) take these environmental conditions as "given" to a considerable extent and so much we if we expect to understand why they act as they do (p. 7).*

The rationale for budgeting is incremental in that no agency budget is reviewed as a whole, "but it is based in last year's budget with special attention to a narrow range of increases of decreases" (Wildavsky, 1964, p.15). He introduces the concept of "base", the amount necessary to carry on the existing programs, and of "increments", the variations of the base. Finally, the determination of the budget becomes a matter of internal politics within the bureaucracy with a series of "games" among the participants.

Davis, Dempster, and Wildavsky (1966, pp. 529-47) conducted and empirical study of fifty-six non-defense agencies of the U.S. Federal Government in the period 1947 to 1963. They studied different formulations of the budgetary process in termos of linear regression equations and tried to explain the reasons for the actual decision making process. They considered two levels or decision-makers: first, the executive - the agencies and the OMB and, second, the legislature - Congress. Their reason for utilizing the regression equations was that "the alternative decision equations can be tried and the most appropriate one used. The appropriate equation explains the data in that, given a good fit, the process behaves as if the data were generated according to the equation" (Davis, Dempster, and Wildavsky, 1966, p.542). Their findings were that the incremental model explained the executive (66% of the equations fitted had $R^2 \geq .81$) and the legislative (78% of the equations fitted had $R^2 \geq .92$) behavior in enacting policies. Many studies, such as those by Sharkansky (1969, 1978, 1971) and Friedman (1975) of the American States; Wannat (1974) and Padget (1976) of the Federal Government; Crecine (1969) and Larkey (1975, 1976) of the local government; and Campbell (1973), Souza (1974) and Cowart, Hansen and Brofoss (1975) of the Japanese, Brazilian, and Norwegian governments, followed the same paradigm and, with the exception of Padget and Souza, generally found that the incremental model explained public policies.

Three main counter-arguments against the incremental model appear in the literature. They are: (a) random selection within constraints, (b) conflict and coalition among politicians in the effort to maximize re-election chances, and (c) slow changes in the environment affecting policies. The two first counter-arguments are explanations based on the bureaucratic theory and the last one refers to the ecological theory.

Ecological Theory: The testing of societal decision theories through political process variables and their relationships to public expenditures is rooted in the basic works of Dawson and Robinson (1963) and Dye (1965). They conclude that the political variables considered were not significant to explain policies. Rather, socio-economic factors were the determinants of public policies. These studies were conducted as cross-section correlation and regression studies of the American states where the main variables considered are:

Variable	Operationalization
Public policy	Public expenditure (total or per capita)
Political process	Party competition, participation, equity
Socioeconomic	Income, industrialization, urbanization

The rationale of why public expenditures are determined by the environment is that the socioeconomic conditions represent the needs of society which are satisfied through the delivery of public services by government agencies, therefore shaping public policies and expenditures (Elliot, 1965, pp. 186-ff).

Wilensky (1970, p. 197), referring to the research works in this area, has said that "the number of these 'determinant studies' has reached almost epidemic proportions and no attempt will be made to review all or even most of the studies." This task is much more difficult ten years later than it was at that time. For the purpose of this research, it is enough to say that works such as: Dye (1969) and Wilensky (1970) concluded for socioeconomic determinism, the so-called Dawson-Robinson model; others, as Sharkansky and Hofferbert (1969) and Cnudde and McCrone (1969) concluded for the joint effect of socioeconomic and political variables on policies and that the political aspect was a function of socioeconomic variables, the so-called Hibrid Model. Tompkins (1975) and Dyson and St. Angelo (1975) and others argued that only methodological errors (treated through path analysis and analysis of the relationships in multiple points in time) can account for environment determinism, and concluded that the policital variables determined policies, the so-called Key-Lockard model.

From the point of view of public organizations, all three conclusions refer to influences of the environment on policy.

<u>Analytical Theory</u>: Although analytical theory, one of the oldest traditions, is considered to be the "classical" approach, it has only recently been systematically tested as a plausible explanation of public policies.

The rationale to explain why public policies and expenditures depend on both environment characteristics (societal needs and problems) and decisions made internally by public officers is that the public organization management analyzes the environment, defines problems and objectives of society, and then proceeds to evaluate alternatives, select the best one, and enact public policies. The public organizations are seen as expert staffs to analyze and provide public policies for the resolution of socio-economic problems of society.

Shepard and Godwin's (1975) study of seventy-three Michigan municipalities in the year 1967 discovered the effects of socioeconomic and political variables on policy and the feedback of policy outputs on these variables. They also estimated the recursive formulation of Cnudde and McCrone and Tompkins and concluded that "although recursive models might appear adequate for the study of determinants of public policies, their use can be misleading" (p. 582). The differences in results were striking. Participation in the recursive system was seen as the political variable affecting policy, together with socioeconomic status and family life structure. Party competition had no influence either on participation or policy. When feedback was introduced, party competition was seen as affecting participation and being affected by policy, together with the same socioeconomic variable. Finally, participation showed insignificant relationship to policy but it was affected by the feedback of policies. The "one way" character of the previous two theories was reorganized.

Salanick and Pfeffer (1977) studied the expenditure and income of thirty U.S. cities during the years 1951-1968 and concluded that the policy expenditures were determined: (a) 60% by socioeconomic conditions, (b) 20% by mayor's discretion, and (c) the remaining 20% by other unexplained reasons. Since they included the existing "form of government" as part of the socioeconomic conditions, it is not clear and has yet to be studied how much is really due to the environment of public organizations and how much is due to the organizational policy-making process, but it is clear that both are the determinants of public policies and expenditures.

To date there has not been any attempt to study a contingency theory of policy determination. However, I conclude from the existing, apparently contradictory, evidence that the theory which best explains the patterns of public policies in a given action-space is dependent upon the type of environment condition present.

III - RESEARCH HYPOTHESIS

The overall research question addressed by this research is: Is the necessary condition for a contingency theory for societal decision-making satisfied in the cities of California?

The data for this study came from the official records of budgets and expenditures for the cities. The data are analyzed with respect to three basis assumptions: (a) inflation and population changes impact public policies because they effect increments in revenues and expenses and therefore should <u>not</u> be controlled; (b) the local resource allocation process should be studied through the agencies that actually participate in it since it is their behavior which is recorded in the budget, and (c) budgets should be considered as endogenous variables while expenses are exogenous variables in the local agencies decision process. Let us consider each assumption in turn.

The first assumption is based on the rationale that both inflation and population changes can be sources of non-incremental variations in revenues and because "the 'great equation' binding budget makers demand that: expenditures = revenues + budget deficit" (Wanat, 1974, p. 1227). Consequently, to control inflation or population change is to eliminate part of the phenomenon we are observing, the allocation of resources generated by these means. Also, inflation has a "redistributive effect" over budgets (Souza, 1974, pp. 47-8, 78) through the nominal increase of all agency budgets but some more than others, which represents in constant dollars, a decrease of one in favor of others.

The second is based on the rationale that the budgetary process should be studied through agencies that have no other sources of revenue than the city budget and which, excluding mandatory programs and capital expenditure funds, account for the majority of the city budget. In doing so, we lose a "balancing routine" connecting all agencies to total revenue. We assure the selection of agencies through a "relevance principle" (Bento and Rands, 1977, ch. 4) and exclude agencies that possess their own sources of revenue. The agencies chosen accounted for over 75% of the total operating fund in both cities. This assumption is also based on the conclusions of Crecine (1969), Friedman (1975), and Larkey (1976) that the role of the legislature in the local government is very limited in budgeting. Either or both the agencies and the mayor play the major role in the process, and by studying an equation that represents the attitude of the agencies, or by studying the mayor, with respect to the correspondent agency, we are being consistent with the process models developed for local government.

Finally, the last assumption is based on the rationale that, as a consequence of the limited role of the legislature, the previous year's budget does not express to the executive, at local level, what level of expenditure is acceptable; that is, the ceiling base, as effectively as actual expenditures do. Hence, the decisions to be made in the research allocation process are guided more by exogenously generated expenditures than endogenously generated prior budgets because the expenses are actual values agreed upon by the participants in the day-to-day operating decisions. It is reasonable to assume that these agreements will be carried on into the budgetary process by the same participants — the various levels of the executive.

The incremental model was chosen to represent the bureaucratic theory in this research because, as seen previously, it is the prevailing model in this tradition. The DDW function stands for Davis, Dempster and Wildavsky (1966, pp. 532-3) formulation, slightly changed to consider expenses as the base; WBI for Wanat (1974, pp. 1224-6) new basis for incrementalism, also slightly modified considering the actual increments of the budget for the current year; and, CPRI for constant-proportion-of-the-revenue-increment, CGRI for constant-growth-revenue-increment, and DCFP for dollar-change-fiscal-pressure, as defined by Larkey (1976, pp. 51-2).

The competing theories and models are operationalized as follows:

Theory	Model	Class of Function	Forms of Functions
Bureaucratic	Incremental	Linear	1. DDW : $Y^*_t = b_1 + b_2 Y_{t-1}$
			2. WBI : $Y^*_t = b_1 + b_2 Y^*_t - 1 + b_3 \Delta Y_{t-1}$
			3. CPRI : $\Delta Y^*_t = b_1 + b_2 \Delta X^*_t$
			4. CGRI : $Y^*_t = b_1 + b_2 Y_{t-1} + b_3 \Delta X^*_t$
			5. DCFP : $\Delta Y^*_t = b_1 + b_2 \Delta Y_{t-1}$
Ecological	Satisfaction	Semilog	6. SSLT: $Y^*_t = b_1 + b_2 l_n\ Y_{t-1}$
			7. SSLI: $\Delta Y^*_t = b_1 + b_2 \Delta \ln\ Y_{t-1}$
Analytical	Rational	Step Function	8. RSF : $Y^*_t = b_1 p_1 + b_2 p_2 + b_3 p_3$

The notation to be used throughout this research is:

y^*_t = budgetary figures to year t.

y^*_{t-1} = budgetary figures to year t-1, last year budget.

Δy^*_t = increment of budget of year 1 over expenses of year t-1.

y_{t-1} = expense figures to year t-1, last year expenses.

Δy_{t-1} = increment of expenses from year t-2 to year t-1.

x^*_t = estimated revenue of year t.

x_{t-1} = actual revenue of the year t-1.

Δx^*_t = increment of estimated revenue of year t over actual of t-1.

$\Delta' y_{t-1}$ = expenses increment proportional to revenue proportional increment = $\frac{\Delta x^*_t}{x_{t-1}} \cdot y_{t-1}$

$l_n\ y_{t-1}$ = naperian logarithm of expenses in year t-1.

$\Delta \ln\ y_{t-1}$ = increment of naperian logarithm of expenses in the year t-1 over t-2.

p_1 = policy in effect from year 1 to shift-point 1.

p_2 = policy in effect from shift-point 1 to shift-point 2.

p_3 = policy in effect from shift-point 2 to last year studied.

The satisfaction model was chosen to represent the ecological theory because (a) the prevailing tradition of relating socioeconomic variables to expenditures, as previously seen, does not allow the test of the hypothesis based solely on budgets and expenses; (b) the underlying phenomena is more "satisfaction" of social needs than "supply" of public services and goods, and (c) the intrinsic characteristics of human satisfaction process. It is an overall hypothesis of the contingency theory that organizations develop actions and strategies to cope with the environment, and as such, we should be able to study these actions (their decision-making process, and the environment characteristics) in isolation. Then it should be possible to establish the relationships between them. For this reason our design should allow us to study the resource allocation process within public organizations, and yet allow us to identify the policies as responses to societal needs and problems. To do so, we can see the responses of public organizations as (a) the supply function of public services and goods, based on a societal demand for them, and (b) the satisfaction function of social needs through the delivery of public services. The first approach is more appropriate to explain the behavior of "client-oriented" organizations, while the latter is a better foundation for "public-oriented" organizations. The satisfaction model, then, is more suitable because, by our assumptions, we are dealing with primarily public-oriented organizations. The semilog class of functions was chosen over the hyperbolic class to represent the satisfaction model based on two conditions for human satisfaction: (a) diminishing rate of substitution — the satisfaction with a good increasing rapidly in the beginning and later on increasing by diminishing rates of increment; and (b) no upper bound exists — the human satisfaction is unlimited. Finally, two formulations of the semilog are possible: (a) SSLT (satisfaction-semilog-total) function to explain the pattern of the total public expenditures and (b) SSLI (satisfaction-semilog-increment) function to explain the pattern of the increments in public expenditures.

The rational model was chosen to represent the analytical theory because it is the prevailing theory in this tradition, although as seen previously almost no empirical studies have been done on it. The step function is selected to represent the rational model because it meets the following conditions for the rational model: (a) relative independence of decision from internal factors, (b) shifts in decisions due to changes in the environment, and (c) endurance of decisions, once rationally established. Decisions are seen to be made based on the scanning of the environment and identification of social problems and societal needs. Budgets <u>cannot</u> be explained by expenses but by social problems and needs. When changes in the needs of society related to a specific type of service occur, the problem is reanalyzed and a new level of budget figures is established. This generates distinct "quantitum leaps" or outcomes to new levels, either over or under the previous one. A new policy, once established, should remain almost constant until another change in social problems and needs occur. Then, the observable rational behavior can be imagined as a sequence of policies, with up down discontinuities between them — each one enduring a certain number of years. This is <u>not</u> to say that policies are a function of time, but rather that they are <u>fixed</u> during a certain time. The RSF (rational-step-function) formulation expresses this characteristic and also contemplates two major shifts in policies in order to simplify the analysis.

An illustration of these three models is contained in Figure 1. The data are from the City of Los Angeles. The incremental model is depicted by the Davis, Dempster and Wildavsky model (DDW) applied to the Fire Department budget and expenditure data. The satisfaction model is depicted by satisfaction semilog total function (SSLT) applied to the Public Utilities and Transportation department data. The rational model is depicted by a step function (RSF) applied to the Building and Safety department data.

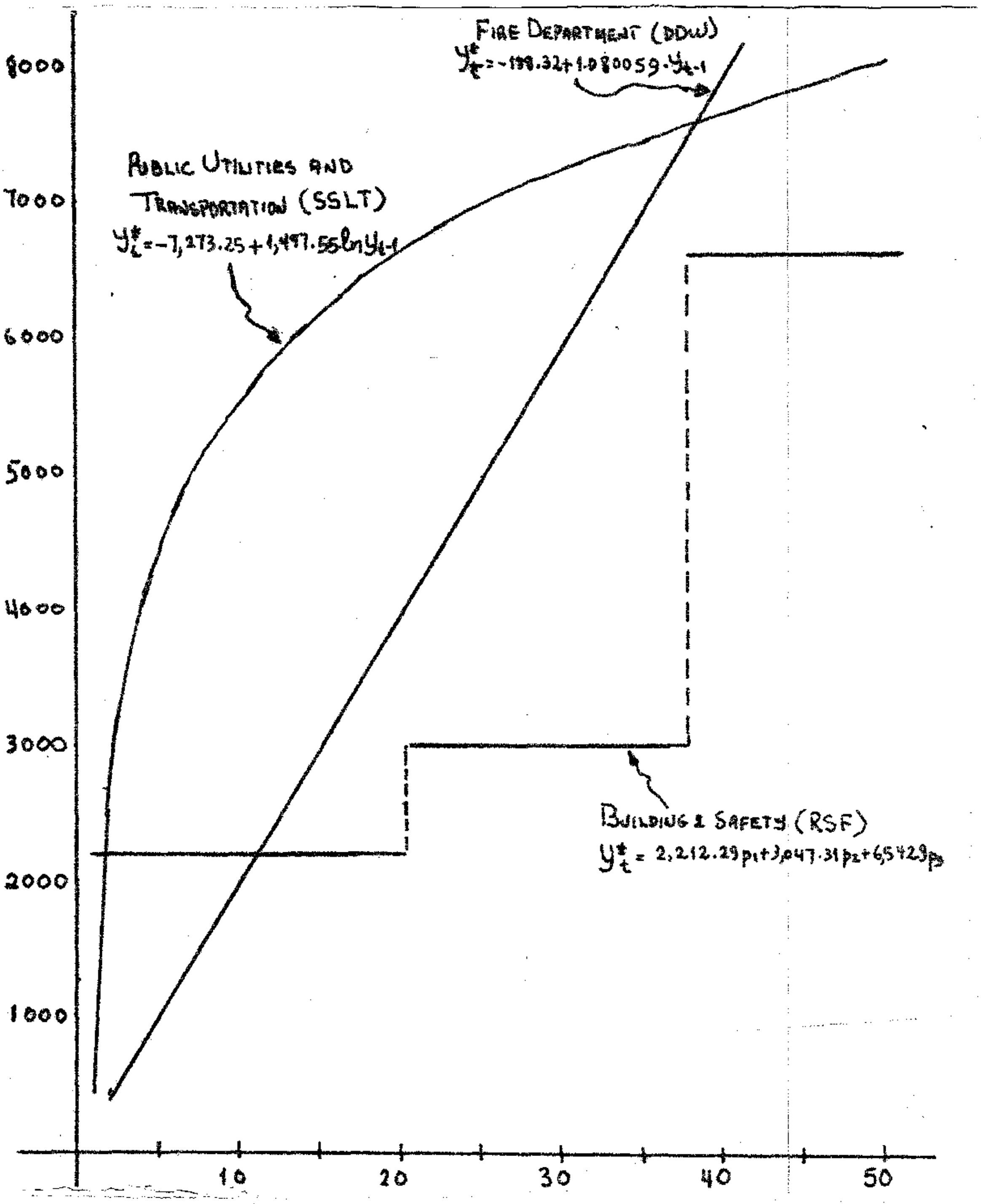


Figure 1

DECISION MODELS ILLUSTRATION

IV - RESEARCH METHODOLOGY

This research is based on budget and expenditures as well as estimated and actual revenue data for the 91 agencies shown in Table 1, from 1940 to 1978. The selection of the 7 agencies within each city, was based upon a "relevance principle," and the existence of the agency during all the years considered. Finally, in all the cities, revenue was considered to be the total of the operating funds.

As noted earlier in the paper, existing methodology has employed linear incremental functions exclusively. Existing methodology is summarized in Figure 2(a). The methodology necessary for this study requires that we discriminate not only among forms of linear functions but also between linear and non-linear models. Moreover, it requires that each class of model, the different forms of linear and/or linear functions, be discriminated. As can be seen in Figure 2(b), the methodology developed includes a step for determining the shift-points and policy variables (p_i) and a linearity test to discriminate between classes of functions. Steps 2, 4, and 5 are similar to the existing methodology, with the non-linear functions "converted into ordinary linear models by a suitable transformation of variables" (Kmenta, 1971, p. 451). The significance test is based on F and R^2 statistics after the necessary autoregression transformations.

The shift-point identification is not an entirely new concept in this kind of study, since Davis, Dempster and Wildavsky (1966, pp. 538-47) considered it in their pioneer study; however, later works disregarded its implications. Following Malinvaud (1964, pp. 233-4) and Kmenta (1971, pp. 568-9) only two major shift-points were looked for. This was in order to assure enough observations for the three resulting policy-endurance periods.

Two general strategies could be followed in the iden-

Table I

Departments Studied by City

Functions	Gen. Government		Public Safety		Culture & Recreation		Other	
Cities Depts.	Buildings	City Mgr.	Police	Fire	Parks & Recreat.	Library	Public Works	Other
Alameda	x		x	x	x Golf	x	Streets	
Alhambra	x		x	x	x	x	Streets	Sanitation
Berkeley		x	x	x	x	x	x	Health
Compton	x	x	x City Attorney	x	x		x	
Long Beach	x		x	x	x	x	Public Services	Health
Los Angeles	x Personnel		x	x	x		x	Public Ut&Trans.
Oakland	x Finance		x	x	x	x	x	
Sacramento	x	x	x	x	x	x	x	
San Diego	x		x	x	x	x	Street	Solid Waste
San Francisco			x City Attorney	x	x	x	x	Health
San Jose	x	x	x	x	x	x	x	
Santa Ana	x Finance		x	x	x	x	x	
Whittier	x	x	x	x	x	x	x	

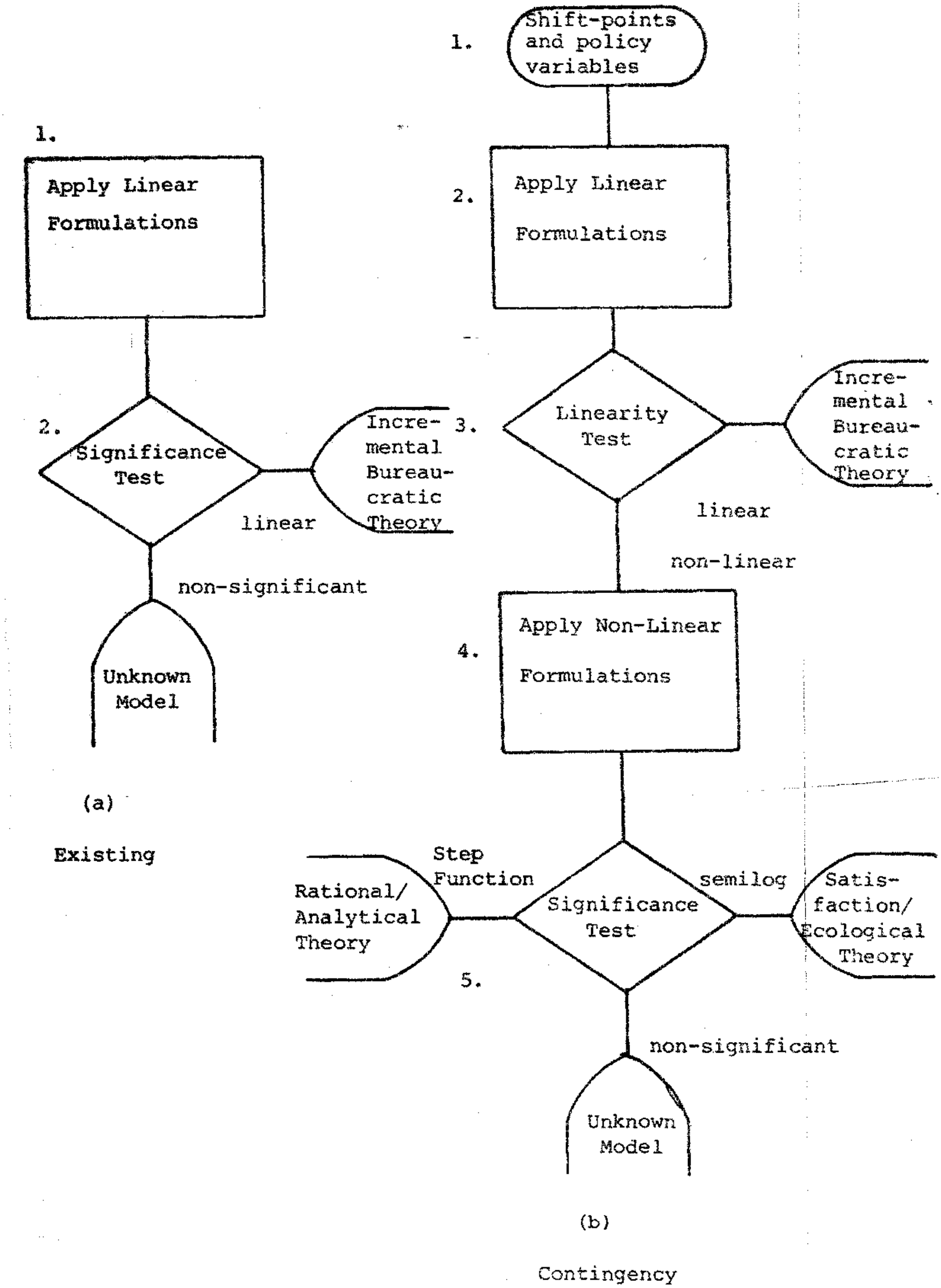


Figure 2
Methodology Flowchart

tification of the shift-points: (a) to look for individual shift-points for each agency within a city, or (b) to look for overall shift-points that fit approximately all the functions within a city. In general, due to its simplicity, the second strategy is preferable to the first. However if the shift-points by agencies were significantly different, individual measures would be preferable. Given the volume of data involved in the analysis, and the fact that the shift-points of the individual agencies occur in concentrated periods of time, the second strategy was chosen.

Table II shows the results obtained in the various agencies, by city. Unfortunately, data was not available for all years foreseen in the design for the different cities. When no data was available, the corresponding year was left blank in Table II.

Appendix A presents the full development of the method used to determine shift-points at the agencies. It is based on least-squares estimation and measures when a given parameter of an equation relating expenditures to revenue, does not belong to the same equation of a much larger time span than the one considered in the given year. This research also contributes to the development of methods to study the linearity of such equations, albeit preliminary. Some sensitivity analysis to the method was made, but a full scale experiment is necessary to give external validity to such a method, which, of course, is beyond the scope of this present research.

The policy-endurance variables were created as follows:

Table II

Frequency of Shift-Points by Year
For Each City

YEARS	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	
Los Angeles	4	3	2	6	1	5	3	3	4	2	1	3	2	1	1	3	4	
YEARS (Cont'd)	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
Alameda						4	1	4	5	4	4	4	1	3	3	3	2	0
Alhambra	0	2	4	1	2	1	0	3	1	1	1	1	3	1	0	0	0	0
Berkeley			6	7	6	4	4	3	3	6	6	3	3	2	3	3	3	3
Compton	3	3	4	3	1	2	0	0	0	1	1	1	3	3	2	1	0	1
Long Beach	1	2	1	4	3	2	2	3	4	5	4	3	5	5	4	3	5	4
Los Angeles	2	3	6	3	4	0	2	3	2	1	1	1	5	1	2	0	0	2
Oakland	1	2	1	5	3	3	1	1	2	4		3	3		0	0	0	0
Sacramento	3	6					0	0	0	0	2	1	2	0	0	0	1	3
San Diego	4	4	3			1	2	2	2	2	1	2	2	1	2		1	1
San Francisco	4	4	3	3	2	0	2	1	0	4	4							5
San Jose							2	1	3	4	1	0	3	4	4	4	5	
Santa Ana					4					2	3	5	4	3	4	6	5	4
Whittier	6	7	6	5			4	4			3	3	4	7	4	2	1	2

Table II

(cont'd)

YEARS (Cont'd)	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Alameda	0	0	1	2	1	1	1	0	0	1	5	1	2		5	6	5	
Alhambra	0	1	0	5	3	1	1	2	2	2	1	1	2	3	2	5		
Berkeley	1	1	3	2	0	0	0	0	2	3	2	2	1	4	3	2		
Compton	3	2	2	2	2	2	1	0	1	0	1				3	3	1	
Long Beach	3	3	6	4	4	5	6	4	4	3	3	2	3	2	3	1	2	
Los Angeles	3	2	3	1	1	1	1	1	3	3	1	1	2	2	0			
Oakland	0	0	3	5	3				4	5	3	3	1	5	3	0	0	
Sacramento	5	4	4	2	2		3	3	3	4	1	1		2	1	1	1	
San Diego	4	3	4	4	5	5	3	0	0	2	2	1	1	0	0	1		
San Francisco	6	3	2			1	3	4	0	0	0	0	1	1	0	2	1	
San Jose	4	3	3	3	3	4	3	2		1	3	4	3	2	0	3	1	
Santa Ana	3	3	3	2	0	1	3	3	3	1	4	3	1	1	2	3	2	2
Whittier	2	2	1	0	3	3	2	1	0	1	0	0	1	0	1	3	1	

Note: The method used consumes the four first observations in order to build the first short-term equation, as explained in Appendix A.

City	P_1=1 (0, otherwise)	P_2=1 (0, otherwise)	P_3=1 (0, otherwise)
Alameda	1944 - 1953	1954 - 1964	1965 - 1978
Alhambra	1940 - 1950	1951 - 1964	1965 - 1977
Berkeley	1940 - 1952	1953 - 1963	1964 - 1977
Compton	1940 - 1955	1956 - 1966	1967 - 1978
Long Beach	1940 - 1955	1956 - 1967	1968 - 1978
Los Angeles	1926 - 1945	1946 - 1962	1963 - 1976
Oakland	1940 - 1952	1953 - 1964	1965 - 1978
Sacramento	1940 - 1953	1954 - 1963	1964 - 1978
San Diego	1940 - 1952	1953 - 1965	1966 - 1977
San Francisco	1940 - 1953	1954 - 1968	1969 - 1978
San Jose	1945 - 1955	1956 - 1966	1967 - 1978
Santa Ana	1944 - 1958	1959 - 1969	1970 - 1979
Whittier	1940 - 1956	1957 - 1965	1966 - 1978

The testing of non-linearity is new in this context, although a very familiar one to other fields. Malinvaud (1964, pp. 233-4) and Kmenta (1971, pp. 468-9) have presented a method in which, irrespective of the alternative functional form the relation among variables may take, if we have two to four shift-points available in the linear function we suspect of non-linearity, then we can identify such a condition. Theil (1971, pp. 225-5) and Kmenta (1971, pp. 470-2) described an alternative method, also independence of the possible alternative non-linear form based on the ordering of the residuals and using equivalent measures — the (modified) von Neuman ratio, and the Durbin-Watson statistics, respectively. The disadvantage of the second method is that "if the ordering of the residuals according to increasing values of x and according to time is similar, we cannot distinguish between nonlinearity and auto-regression of the disturbances over time" (Kmenta, 1971, p. 472). In our case, unfortunately, this has happened, and the only possible method to be applied is the first one. Kmenta (1971, p. 469) has described the method and its rationale:

> *The rather obvious implication of linearity is that the slope and the intercept of the regression equation must remain constant over all values of the explanatory variable. What we can do, then, is to divide the sample observations into a number of subsamples, each subsample corresponding to a different and nonoverlapping interval of values of the explanatory variable. We can estimate the slope and the intercept for each subsample and test whether there are any significant differences from one subsample to another.*

A more straightforward approach to the test can be set up by a regression equation that combines the original independent variable with binary instrumental variables corresponding to the time periods in which the function was divided in subsamples. Then, we can test the linearity as if the function defined above was a competing theory in which additional explanatory variables were included in the equation (Kmenta, 1971, pp. 370-1). The test statistics to be used is:

$$F_{Q-K,\ n-Q} \sim \frac{n-Q}{Q-K} \times \frac{R^2_Q - R^2_K}{1 - R^2_Q}$$

where n = number of observations; Q = number of variables considered in the new enlarged regression equation; and K = number of variables considered in the regression equation we suspect of non-linearity. If the F-statistic is significant at various levels, .001, .01, .05, then it is said that the relation among the variables is non-linear; otherwise it is linear.

We already have binary variables that satisfy the requirements of the method: the policy-endurance vectors. The sub-samples are meaningful because they are defined by the shift-points in policies of each and all of the agencies. To avoid confusion in the notation used, when referring to these variables as policy-endurance, we shall note them, as defined previously, p_i. When referring to these variables as instrumental to the test, we shall note them z_i.

From the inspection of the regression equations of the five functional forms of the incremental model and with the aim of simplifying the analysis of results, it was assumed that by testing the linearity of DDW, this result could be extended to the WBI; and testing the linearity of DCFP, this result would be extended also to the CGRI. The following three equations were then formulated to test the linearity of the agencies' decision-making.

$$\text{LDDW: } y_t^* = b_1 + b_2 y_{t-1} + b_3 . z_1 + b_4 . (z_1 . y_{t-1}) + b_5 . z_2 + b_6 . (z_2 . y_{t-1})$$

$$\text{LCPRI: } y_t^* = b_1 + b_2 . \Delta x_t^* + b_3 . z_1 + b_4 . (z_2 . \Delta x_t^*) + b_5 . z_2 + b_6 . (z_2 . \Delta x_t^*)$$

$$\text{LDCFP: } y_t^* = b_1 + b_2 . \Delta' y_{t-1} + b_3 . z_1 + b_4 . (z_1 . \Delta' y_{t-1}) + b_5 . z_2 + b_6 . (z_2 . \Delta' y_{t-1})$$

V - RESULTS AND CONCLUSIONS

The overall results of this research confirm our hypothesis that the necessary condition of the Contingency Theory occurs in practice, as can be seen in Table III. There is evidence to conclude that decision-making processes other than the incremental model have been employed in significant number of agencies of local government. In our research almost 40% of the cases were non-bureaucratic.

To measure the significance of our results, a series of counter-hypotheses were considered and tested against the overall hypothesis that the three types of decision-making considered did exist in practice:

Table III

Sumary of the Results

THEORY / CITY	BUREAUCRATIC	ECOLOGICAL	ANALYTICAL
Alameda	5	2	0
Alhambra	3	3	1
Berkeley	5	1	1
Compton	2	3	2
Long Beach	5	2	0
Los Angeles	3	2	2
Oakland	5	2	0
Sacramento	7	0	0
San Diego	4	2	1
San Francisco	4	3	0
San Jose	7	0	0
Santa Ana	1	4	2
Whittier	4	1	2
TOTAL	55	25	11
% of Total	60.4	27.5	12.1

(a) There is only Bureaucratic decision-making in the population,

(b) There is only Ecological decision-making in the population,

(c) The results could have been obtained from random numbers chosen between 1 and 3, and

(d) There is only Bureaucratic and Ecological decision-making in the population; the results obtained for Analytical decision-making are random errors.

These counter-hypotheses were translated in terms of expected frequencies in each of the decision models, as follows:

Table IV

Counter-hypothesis Expected Frequencies (in %) and χ^2 Values

Hypothesis / Model	Bureaucratic Only	Ecological Only	Random Numbers	No Analytical
Bureaucratic	100	0	33	50
Ecological	0	100	33	0
Analytical	0	0	33	50
χ^2 Statistics	203.4	787.5	33.3	18.1

Using χ^2 tests we are able to reject all the counter-hypotheses at the .001 level of significance. Therefore, it seems that the three types of decision-making did exist in the population.

1. <u>Linearity testing</u>

The linearity test was conducted using the criteria that if at least two results were significant at .05, or at least one result was significant at .01 (provided that the LDDW was one of these results — since it represents the best linear fit), then the function would be considered non-linear.

The results of applying step 3 — the linearity test — to the data of all cities is displayed in Table V.

In performing the linearity test 21.6% of the cases (157 regressions out of the 728 performed) were found to have autoregression problems. Positive autoregression accounted for the majority of the cases — 66% (103 regressions out of 157) — while negative autoregression was also important with the remaining percentage, amounting to one third of the cases.

The regressions found to have autoregressive schemas were re-estimated using the procedure AUTOREG of SAS, [2] and assuming a lag — the time frame in which one residual still affects the following residuals — of two years, that is, a second-order autoregressive schema. The value of the lag was chosen after experimenting with the sensitivity of the regressions to be estimated to lags varying from 1 to 5. The great majority of the regressions achieved non-autoregression when the lag was equal to the one chosen — that is two.

Table V

Linearity Test — All Cities

City/ Agency	LDDW		LCPRI		LDCFP		Result
	F	Signif.	F	Signif.	F	Signif.	
Alameda							
Police	5.147	.01	1.87	NS.05	2.425	NS.05	Non-linear
Fire	11.691	.001	2.541	NS.05	1.535	NS.05	Non-linear
Parks & Recreation	1.800	NS.05	1.478	NS.05	.019	NS.05	Linear
Golf Course	1.414	NS.05	1.524	NS.05	1.595	NS.05	Linear
Library	1.898	NS.05	.392	NS.05	.093	NS.05	Linear
Streets	.897	NS.05	.376	NS.05	.667	NS.05	Linear
Buildings & Inspections	2.158	NS.05	1.938	NS.05	.329	NS.05	Linear
Alhambra							
Police	17.069	.001	11.797	.001	9.178	.001	Non-linear
Fire	3.373	.05	8.864	.001	7.890	.001	Non-linear
Parks & Recreation	23.97	.001	.141	NS.05	.138	NS.05	Non-linear
Library	14.02	.001	2.066	NS.05	1.503	NS.05	Non-linear
Street	1.16	NS.05	2.653	NS.05	1.42	NS.05	Linear
Sanitation	1.113	NS.05	2.293	NS.05	6.26	.001	Linear
Buildings & Planning	2.654	NS.05	.332	NS.05	.190	NS.05	Linear

Table V (cont'd)

Linearity Test — All Cities

City/ Agency	LDDW		LCPRI		LDCFP		Result
	F	Signif.	F	Signif.	F	Signif.	
Berkeley							
Police	.241	NS.05	5.884	.01	5.433	.01	Non-linear
Fire	.929	NS.05	.099	NS.05	.091	NS.05	Linear
Recreation & Parks	.038	NS.05	.175	NS.05	.074	NS.05	Linear
Library	.044	NS.05	1.07	NS.05	1.024	NS.05	Linear
Public Works	2.094	NS.05	.182	NS.05	.096	NS.05	Linear
Health	228.269	.001	3.055	.05	36.429	.001	Non-linear
City Manager	.252	NS.05	.226	NS.05	.299	NS.05	Linear
Compton							
Police	4.857	.01	.14	NS.05	1.527	NS.05	Non-linear
Fire	19.229	.001	.159	NS.05	.562	NS.05	Non-linear
Parks & Recreation	49.265	.001	2.116	NS.05	1.093	NS.05	Non-linear
Public Works	1.52	NS.05	8.956	.001	4.072	.05	Linear
Buildings & Safety	1.136	NS.05	.338	NS.05	.982	NS.05	Linear
City Manager	4.543	.01	4.244	.01	2.074	NS.05	Non-linear
City Attorney	11.746	.001	2.555	NS.05	.837	NS.05	Non-linear

Table V (cont'd)

Linearity Test — All Cities

City/ Agency	LDDW		LCPRI		LDCFP		Result
	F	Signif.	F	Signif.	F	Signif.	
Long Beach							
Police	.133	NS.05	1.566	NS.05	3.036	.05	Linear
Fire	.471	NS.05	1.441	NS.05	2.253	NS.05	Linear
Parks & Recreation	.127	NS.05	4.297	.01	2.187	NS.05	Linear
Library	5.776	.01	1.488	NS.05	.355	NS.05	Non-linear
Public Service	.32	NS.05	4.402	.01	2.297	NS.05	Linear
Planning & Buildings	5.812	.01	.29	NS.05	.109	NS.05	Non-linear
Health	.237	NS.05	.458	NS.05	.243	NS.05	Linear
Los Angeles							
Police	1.00	NS.05	1.05	NS.05	1.62	NS.05	Linear
Fire	.47	NS.05	.50	NS.05	.38	NS.05	Linear
Recreation & Parks	3.58	.01	.91	NS.05	.59	NS.05	Non-linear
Public Works	3.72	.01	9.77	.001	8.60	.001	Non-linear
Building & Safety	3.41	.01	7.35	.001	7.29	.001	Non-linear
Public Util. & Transporta.	2.90	.05	2.01	NS.05	2.39	.05	Non-linear
Personnel	.0	NS.05	.42	NS.05	.01	NS.05	Linear

SDM DETAILED RESULTS

BERKELEY

Linear Analysis
(ARSQ)

	Fire	Public Works	Recreation & Parks	Library	City Manager
DDW	.96706	.93738	.90546	.98672	.89972
WBI	.97026	.93542	.90547	.98803	.90700
CPRI	.15955	-.00430	.43327	.61791	.23098
CGRI	.97420	.93574	.94627	.99002	.89948
DCFP	.16837	.00872	.53393	.71008	.19917

Non-Linear Analysis
(ARSQ)

Regression	Police	Health
SSLT	.7022	.3710
SSLI	.271001	.211108
RSF	.4389	.4395

SDM DETAILED RESULTS

COMPTON

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	City Attorney	Public Works	Parks & Recreation	City Manager	Buildings & Safety	Results
LDDW	2.12741	1.90089	2.02546	2.17885	2.04987	2.0245	1.66539	--
LCPRI	1.64709	1.24865	1.31046	1.96143	1.29471	1.69562	2.38828	--
LDCFP	1.62043	1.52618	1.39375	1.77494	2.30528	1.4966	1.99929	--
DDW	2.13759	1.77004	1.99253	2.09139	2.05771	1.95999	1.86768	--
WBI	1.73315	1.29823 pa	1.4908	2.46311	1.81857	1.40423	1.99532	1pa
CPRI	1.5242	.9465 pa	1.03353 pa	1.54354	1.14258 pa	.84724 pa	2.65061 na	4pa 1na
CGRI	2.03594	1.60456	2.00456	1.986	1.88003	1.90369	1.78553	--
DCFP	2.33869	1.5037	1.14184 pa	1.06602 pa	2.46671	1.0186 pa	2.51209	3pa
TOTAL	--	2pa	2pa	1pa	1pa	2pa	1na	8pa 1na

SDM DETAILED RESULTS

COMPTON

Linear Analysis (ARSQ)

	Public Works	Building & Safety
DDW	.95590	.25445
WBI	.95670	.29054
CPRI	.11661	-.01649
CGRI	.96478	.22999
DCFP	-.00490	.05523

Non-Linear Analysis (ARSQ)

	Police	Fire	City Attorney	Parks & Recreation	City Manager
SSLT	.5912	.613	.6655	.694089	.4549
SSLI	.0068	.05133	.8304	.1446	.000259
RSF	.6798	.8298	.2249	.6669	.3042

NOTE: Fire services are bought from the City of Los Angeles

SDM DETAILED RESULTS

<u>LONG BEACH</u>

Auto-Regression Test

(d statistic)

Func. Reg.	Police	Fire	Health	Public Service	Parks & Recreation	Planning & Building	Library	Results
LDDW	2.2121	2.13679	2.34464	2.0044	2.22941	2.86437^{na}	2.76352^{na}	2na
LCPRI	2.54824	2.60861	1.92447	1.33817	2.9931^{na}	2.75754^{na}	3.0168^{na}	3na
LDCFP	2.81558^{na}	2.82022^{na}	1.95466	1.10307^{pa}	2.92161^{na}	2.70493^{na}	2.90427^{na}	5na 2pa
DDW	2.17495	2.02261	2.27894	1.94461	2.19554	2.72425^{na}	2.6034^{na}	2na
WBI	2.18445	1.96215	2.65806^{na}	1.73507	2.27823	2.12061	2.37992	1na
CPRI	2.24199	2.39363	1.82972	1.12887^{pa}	2.74201^{na}	2.76628^{na}	2.95165^{na}	3na 1pa
CGRI	1.85638	2.07843	2.18873	1.88626	2.28696	2.14764na	2.63769^{na}	1na
DCFP	2.60614^{na}	2.64921^{na}	1.8832	1.26678^{pa}	2.76925^{na}	2.70077^{na}	2.92094^{na}	5na 1pa
TOTAL	2na	2na	1na	3na	4 na	6 na	7na	22na 3pa

SDM DETAILED RESULTS

LONG BEACH

Linear Analysis
(ARSQ)

	Police	Fire	Health	Public Service	Parks & Recreation
DDW	.99686	.99815	.99035	.99519	.99343
WBI	.99721	.99870	.99684	.99510	.99326
CPRI	.57810	.53222	.10910	.20214	.13441
CGRI	.99837	.99884	.99021	.99508	.99330
DCFP	.72795	.74116	.18297	.27346	.23554

Non-Linear Analysis
(ARSQ)

	Planning & Building	Library
SSLT	.526	.820369
SSLI	.5298	.0423
RSF	.2787	.6995

SDM DETAILED RESULTS

LOS ANGELES

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	Recreation & Parks	Building & Safety	Public Works	Pub. Util. & Trans.	Personnel	Results
LDDW	1.64933	2.14228	1.03165[pa]	2.00417	1.10000[pa]	2.64004	2.07066	2pa
LCPRI	1.54671	2.03517	.80189[pa]	1.73378	.91152[pa]	2.75184	1.93661	2pa
LDCFP	1.50980	1.98036	.80258[pa]	1.58098	.89570[pa]	2.67521	2.30471	2pa
DDW	1.48629	2.01733	.77338[pa]	1.57778	.74609[pa]	2.83418[na]	2.07068	2pa 1na
WBI	3.07992[na]	2.69626	1.75643	2.40927	1.96142	1.75992	2.71885	1na
CPRI	1.47360	1.95632	.75929[pa]	1.46731	.97798[pa]	2.55656	1.77553	2pa
CGRI	1.44112	2.05343	.81859[pa]	1.41638	.69240[pa]	2.82286[na]	2.05813	2pa 1na
DCFP	1.39002	1.94259	.77808[pa]	1.56648	1.09656[pa]	2.65813	2.31317	2pa
TOTAL	1 na	--	7 pa	--	7 pa	2 na	--	14pa 3na

SDM DETAILED RESULTS

LOS ANGELES

Linear Test
(ARSQ)

	Police	Fire	Personnel
DDW	.9972	.9777	.9875
WBI	.9958	.9960	.9747
CPRI	.7864	.7682	.5022
CGRI	.9982	.9983	.9878
DCFP	.7478	.7351	.6570

Non-Linear Test
(ARSQ)

	Buildings & Safety	Public Works	Recreation & Parks	Public Utilities & Transportation
SSLT	.0559	.0297	.0350	.7553
SSLI	.2270	.4531	.1933	-.0176
RSF	.3433	.1984	.2434	.3744

SDM DETAILED RESULTS

OAKLAND

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	Public Buildings	Public Works	Parks & Recreation	Library	Finance	Results
LDDW	2.45365	3.194[na]	2.11848	2.47574	2.25334	2.72833	1.55162	1na
LCPRI	2.06251	1.76457	1.74446	2.18010	1.51953	2.07468	1.99067	--
LDCFP	2.14174	1.71399	1.41733	2.08858	1.46727	1.9068	2.38887	--
DDW	2.4052	3.13923[na]	2.24978	2.56203	1.78918	2.53902	1.29825[pa]	1na 1pa
WBI	2.46557	2.90491[na]	2.04073[na]	3.0152[na]	2.05252	2.70873	.7598[pa]	2na 1pa
CPRI	2.05548	1.83338	1.70872	1.9281	1.47662	1.98421	2.01918	--
CGRI	2.74932[na]	3.10217[na]	1.76260	2.25627	1.74282	1.76565	1.30143	2na
DCFP	2.06245	1.72472	1.43785	1.91244	1.36612	1.94082	2.47879	
TOTAL	1na	4na	--	1na	--	--	2pa	6na 2pa

SDM DETAILED RESULTS

OAKLAND

Linear Analysis (ARSQ)

	Police	Public Building	Public Works	Parks & Recreation	Library
DDW	.99317	.81842	.99080	.97170	.99097
WBI	.99357	.83175	.98013	.97085	.99064
CPRI	.40810	.52322	.30584	.05940	.24229
CGRI	.99882	.91148	.99350	.97094	.99251
DCFP	.53845	.52481	.25919	.00995	.26275

Non-Linear Analysis (ARSQ)

	Fire	Finance
SSLT	.7524	.8455
SSLI	.3362	.1749
RSF	.5837	.6049

SDM DETAILED RESULTS

SACRAMENTO

Auto-Regression Rest

(d statistic)

Func. / Reg.	Police	Fire	Building Inspection	Public Works	Recreation & Parks	Library	City Manager	Results
LDDW	1.50002	1.5065	1.52777	1.86174	1.1612	1.22157	2.10601	--
LCPRI	2.29294	1.16538	1.70044	2.06476	1.70276	1.83611	2.26407	--
LDCFP	2.28515	1.09716	1.9162	2.06529	1.51852	1.71993	2.20919	--
DDW	1.41747	1.56164	1.58586	1.85311	1.19594 pa	1.16436 pa	1.97764	2pa
WBI	1.46393	1.56896	.96318 pa	1.33629	1.31344	1.09679 pa	2.08704	2pa
CPRI	1.92597	.90132 pa	1.69175	2.10717	1.61971	1.69089	2.24187	1pa
CGRI	2.2935	1.41577	2.34443	2.51112	1.01446 pa	1.98827	2.80722 na	1pa 1na
DCFP	1.90905	.80328 pa	1.86658	2.10075	1.49962	1.66606	2.16911	1pa
TOTAL	--	2pa	1pa	--	2pa	2pa	1na	7pa 1na

SDM DETAILED RESULTS

SACRAMENTO

Linear Analysis
(ARSQ)

	Police	Fire	Building Inspection	Public Works	Recreation & Parks	Library	City Manager
DDW	.98744	.98816	.94115	.93083	.95886	.93493	.97744
WBI	.98703	.98913	.96079	.94348	.97311	.92543	.97794
CPRI	.41735	.73010	.07898	-.02999	.80432	.37564	.38242
CGRI	.99214	.99354	.95300	.92937	.97075	.95996	.99807
DCFP	.36426	.66834	.15280	-.03036	.73126	.29068	.32039

SDM DETAILED RESULTS

SAN DIEGO

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	Building Inspections	Street	Parks & Recreation	Library	Solid Waste	Results
LDDW	3.09001^{na}	2.93119^{na}	2.16267	2.10607	1.89789	2.0425	1.97981	2na
LCPRI	2.03513	2.14618	2.10268	2.9192^{na}	1.83939	2.32983	2.01433	1na
LDCFP	1.97671	2.15309	2.03251	2.97197^{na}	1.7971	2.26698	1.52786	1na
DDW	2.99182^{na}	2.91202^{na}	1.83284	2.09926	1.40351	1.8007	1.90523	2na
WBI	2.55331	2.54998	1.28571	2.0815	1.64876	1.83866	1.71922	--
CPRI	1.93134	2.18985	2.21327	3.03498^{na}	1.85261	2.35281	2.22369	1na
CGRI	1.86651	1.50466	1.83912	2.28585	1.33562	1.88214	2.05041	--
DCFP	1.94927	2.20823	2.20585	3.04477^{na}	1.80931	2.38933	1.09402	1na 1pa
TOTAL	2na	2na	--	4na	--	--	1pa	8na 1pa

SDM DETAILED RESULTS

SAN DIEGO

Linear Analysis
(ARSQ)

	Building Inspections	Street	Parks & Recreation	Library
DDW	.99379	.60751	.99404	.99783
WBI	.99427	.59658	.99395	.99775
CPRI	.60599	.14903	.56873	.54104
CGRI	.99355	.61425	.99520	.99785
DCFP	.60129	.15131	.56360	.54663

Non-Linear Analysis
(ARSQ)

	Police	Fire	Solid Waste
SSLT	.6736	.5186	.6871
SSLI	.2948	.455928	.3110
RSF	.5213	.5442	.5557

SDM DETAILED RESULTS

SAN FRANCISCO

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	Health	Public Works	Recreation & Parks	Library	City Attorney	Results
LDDW	1.68154	2.46533	1.90174	1.85697	2.54859	2.07097	2.13359	--
LCPRI	2.40696	1.83856	1.92282	1.7467	2.63996	2.4174	.6994^pa	1pa
LDCFP	1.8921	1.90841	1.84648	2.1499	2.39761	2.3904	.84694^pa	1pa
DDW	1.63757	2.12724	2.23112	2.00676	2.28466	2.25213	.81983^pa	1pa
WBI	1.65707	1.90781	1.92116	1.96578	1.97283	1.92266	2.04245	--
CPRI	1.21023^pa	1.62512	1.03614^pa	2.10686	1.1644^pa	2.09071	.31567^pa	4pa
CGRI	2.12653	1.79097	2.03812	2.08897	2.24029	2.47238	.93915^pa	1pa
DCFP	1.17597^pa	1.75255	1.21626^pa	1.93154	1.83073	2.05014	.30934^pa	3pa
TOTAL	2pa	--	2pa	--	1pa	--	6pa	11pa

SDM DETAILED RESULTS

SAN FRANCISCO

Linear Analysis
(ARSQ)

	Police	Fire	Public Works	Public Library
DDW	.98597	.99147	.91855	.98573
WBI	.98550	.99128	.91496	.98579
CPRI	.07128	.25211	-.02737	-.03692
CGRI	.98796	.99386	.91643	.98546
DCFP	-.03996	.09846	.00260	-.04184

Non-Linear Analysis
(ARSQ)

	Health	Recreation & Parks	City Attorney
SSLT	.8138	.8408	.7399
SSLI	.0644	.029175	.314072
RSF	.8127	.7512	.6656

SDM DETAILED RESULTS

SAN JOSE

Auto-Regression Test
(d statistic)

Reg. \ Func.	Police	Fire	City Manager	Public Works	Parks & Recreation	Library	Property & Code Enfor.	Results
LDDW	1.63254	1.93232	1.39777	1.761	2.03782	2.12875	2.67822	--
LCPRI	2.43642	1.53487	1.67343	1.39171	1.70605	2.0043	2.53049	--
LDCFP	2.6254	1.52189	1.67036	1.25567	1.75491	2.18448	2.65395	--
DDW	1.29874	1.72591	1.22397[pa]	1.70456	1.9931	2.07362	2.51031	1pa
WBI	1.10533[pa]	1.77964	1.40999	2.102	2.0544	1.89219	2.53027	1pa
CPRI	2.48113	1.83024	1.45154	1.16743[pa]	1.65051	2.03478	2.40986	1pa
CGRI	2.47262	1.70798	1.18543[pa]	1.3348	2.17317	3.19949[na]	2.4625	1pa 1na
DCFP	2.56667	1.74616	1.46463	1.13617[pa]	1.66945	2.15901	2.42912	1pa
TOTAL	1pa	--	2pa	2pa	--	1na	--	5pa 1na

SDM DETAILED RESULTS

SAN JOSE

Linear Analysis
(ARSQ)

	Police	Fire	City Manager	Public Works	Parks & Recreation	Library	Property & Code Enforce.
DDW	.99498	.99783	.91252	.98879	.98654	.97900	.79672
WBI	.99341	.99827	.91432	.99074	.98967	.98928	.78906
CPRI	.59707	.62864	-.03158	.73574	.87340	.57559	-.01359
CGRI	.99788	.99815	.93758	.99696	.99841	.99870	.79084
DCFP	.60772	.63580	-.04045	.75560	.89106	.56328	-.02028

SDM DETAILED RESULTS

SANTA ANA

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	Finance	Public Works	Recreation & Parks	Library	Building Safety	Results
LDDW	.91801^{pa}	.99268^{pa}	1.18503	2.59346	1.38153	2.12513	1.28081	2pa
LCPRI	2.40706	2.89319	1.49075	.69799^{pa}	1.72622	3.0599^{na}	2.34762	1na 1pa
LDCFP	2.39187^{na}	2.95431^{na}	1.38108	.82543^{pa}	1.6116	2.96019^{na}	2.47496	2na 1pa
DDW	0.79119^{pa}	.63128^{pa}	.91726^{pa}	1.83442	.88457^{pa}	1.344	.69473^{pa}	5pa
WBI	.88034^{pa}	1.00919^{pa}	.96774^{pa}	1.92677	1.73602	1.50396	1.0402^{pa}	4pa
CPRI	2.33846	2.565	1.36602	.45268^{pa}	1.64304	2.6823^{na}	1.83013	1pa 1na
CGRI	2.75644^{na}	2.61244	1.41731	1.96538	.93118^{pa}	1.666	1.75462	1pa 1na
DCFP	2.37301	2.48708	1.24392^{pa}	.42885^{pa}	1.62951	2.67086^{na}	1.64802	2pa 1na
TOTAL	3pa 1na	3pa 1na	3pa	4pa	2pa	4na	2pa	17pa6na

SDM DETAILED RESULTS

SANTA ANA

Linear Analysis
(ARSQ)

	Public Works
DDW	.97363
WBI	.97260
CPRI	.02311
CGRI	.97394
DCFP	.02456

Non-Linear Analysis
(ARSQ)

	Police	Fire	Finance	Recreation & Parks	Library	Building Safety
SSLT	.6244	.6516	.6502	.6657	.7661	.6550
SSLI	.2776	.373584	.00004	.078433	.4022	.2805
RSF	.4131	.5664	.5046	.8001	.6547	.6953

SDM DETAILED RESULTS

WHITTIER

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	City Manager	Public Works	Parks & Recreation	Library	Building & Safety	Results
LDDW	3.04378^{na}	1.27652	2.54205	1.95013	2.21944	1.92901	2.39281	1ma
LCPRI	2.88447^{na}	1.87887	2.75718	2.58279	2.72765	2.76723	1.97122	1na
LDCFP	2.87898^{na}	1.72347	2.33749	2.48116	2.76363	2.72447	2.22028	1na
DDW	2.81272^{na}	1.10038^{pa}	2.33945	1.81679	2.19104	1.47233	2.36421	1na 1pa
WBI	2.37669	1.382	2.3216	1.7249	1.84498	1.60238	2.18868	--
CPRI	2.1187	1.50744	2.50918	2.37963	2.38763	2.25106	1.49404	--
CGRI	2.82551^{na}	1.94015	2.32519	2.19148	2.63209	2.16635	2.46671	1na
DCFP	2.23833	1.50577	2.51342	2.37142	2.48019	2.42303	1.4964	--
TOTAL	5na	1pa	--	--	--	--	--	5na 1pa

SDM DETAILED RESULTS

WHITTIER

Linear Analysis (ARSQ)

	City Manager	Public Works	Parks & Recreation	Building & Safety
DDW	.87626	.90717	.98712	.99074
WBI	.87020	.91024	.98765	.99087
CPRI	-.04739	.11003	.34196	.02852
CGRI	.87013	.93752	.98896	.99292
DCFP	-.04514	.10384	.35443	-.00427

Non-Linear Analysis (ARSQ)

	Police	Fire	Library
SSLT	.5578	.3771	.5954
SSLI	.4534	.011867	.111242
RSF	.4768	.4774	.6395

FOOTNOTES

1. See Musgrave (1959, p. 19) for an overall discussion and Goldscheid (1925) for a discussion from a radical perspective.

2. The regressions were originally estimated using SPSS (Nie et alli, 1975). Unfortunately, SPSS has no routine to estimate regressions where autoregressive schemas are found. Therefore, SAS (Barr et alli, 1976) was used instead.

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WILLIAM and HARRIS (1976)

Table V (cont'd)

Linearity Test — All Cities

City/ Agency	LDDW		LCPRI		LDCFP		Result
	F	Signif.	F	Signif.	F	Signif.	
Oakland							
Police	.137	NS.05	.119	NS.05	.250	NS.05	Linear
Fire	4.017	.01	.160	NS.05	.394	NS.05	Non-linear
Parks & Recreation	1.05	NS.05	.651	NS.05	.738	NS.05	Linear
Library	.245	NS.05	.112	NS.05	.863	NS.05	Linear
Public Works	.182	NS.05	1.184	NS.05	1.371	NS.05	Linear
Public Buildings	.243	NS.05	.313	NS.05	.138	NS.05	Linear
Finance	12.125	.001	.077	NS.05	.484	NS.05	Non-linear
Sacramento							
Police	.907	NS.05	1.924	NS.05	2.158	NS.05	Linear
Fire	.171	NS.05	.778	NS.05	.334	NS.05	Linear
Recreation & Parks	.084	NS.05	.467	NS.05	.04	NS.05	Linear
Library	.955	NS.05	.206	NS.05	.049	NS.05	Linear
Public Works	.071	NS.05	.092	NS.05	.09	NS.05	Linear
Building Inspection	.301	NS.05	.005	NS.05	.044	NS.05	Linear
City Manager	.909	NS.05	.483	NS.05	.683	NS.05	Linear

Table V (cont'd)

Linearity Test — All Cities

City/ Agency	LDDW		LCPRI		LDCFP		Result
	F	Signif.	F	Signif.	F	Signif.	
San Diego							
Police	7.917	.001	.776	NS.05	.456	NS.05	Non-linear
Fire	5.938	.01	.453	NS.05	.275	NS.05	Non-linear
Parks & Recreation	1.993	NS.05	.468	NS.05	.613	NS.05	Linear
Library	.781	NS.05	.450	NS.05	.339	NS.05	Linear
Street	1.016	NS.05	1.746	NS.05	2.339	NS.05	Linear
Building Inspections	1.563	NS.05	.660	NS.05	.780	NS.05	Linear
Solid Waste	3.39	.05	6.811	.001	4.442	.01	Non-linear
San Francisco							
Police	.487	NS.05	3.813	.05	2.725	NS.05	Linear
Fire	2.459	NS.05	1.164	NS.05	1.118	NS.05	Linear
Recreation & Parks	.857	NS.05	6.27	.001	3.456	.05	Non-linear
Library	.823	NS.05	1.555	NS.05	.994	NS.05	Linear
Public Works	2.191	NS.05	.91	NS.05	.517	NS.05	Linear
Health	1.218	NS.05	4.356	.01	5.178	.01	Non-linear
City Attorney	15.50	.001	2.735	.05	2.489	NS.05	Non-linear

Table V (cont'd)

Linearity Test — All Cities

City/ Agency	LDDW		LCPRI		LDCFP		Result
	F	Signif.	F	Signif.	F	Signif.	
<u>San Jose</u>							
Police	.976	NS.05	.716	NS.05	.736	NS.05	Linear
Fire	1.389	NS.05	3.09	.05	1.91	NS.05	Linear
Parks & Recreation	.649	NS.05	.183	NS.05	.242	NS.05	Linear
Library	.164	NS.05	.206	NS.05	.132	NS.05	Linear
Public Works	.184	NS.05	1.382	NS.05	.565	NS.05	Linear
Property & Code Enforcement	.196	NS.05	.907	NS.05	.87	NS.05	Linear
City Manager	.989	NS.05	.289	NS.05	.374	NS.05	Linear
<u>Santa Ana</u>							
Police	3.918	.01	.167	NS.05	.149	NS.05	Non-linear
Fire	2.106	NS.05	15.09	.001	61.851	.001	Non-linear
Recreation & Parks	9.444	.001	.135	NS.05	.05	NS.05	Non-linear
Library	3.936	.01	8.785	.001	7.398	.001	Non-linear
Public Works	1.718	NS.05	1.779	NS.05	1.945	NS.05	Linear
Buildings Safety	10.221	.001	3.967	.01	4.139	.01	Non-linear
Finance	11.314	.001	2.661	NS.05	1.614	NS.05	Non-linear

Table V (cont'd)

Linearity Test — All Cities

City/ Agency	LDDW		LCPRI		LDCFP		Result
	F	Signif.	F	Signif.	F	Signif.	
Whittier							
Police	4.354	.01	5.727	.01	5.52	.01	Non-linear
Fire	3.974	.01	1.44	NS.05	.752	NS.05	Non-linear
Parks & Recreation	1.272	NS.05	1.578	NS.05	1.103	NS.05	Linear
Library	3.968	.01	1.672	NS.05	.936	NS.05	Non-linear
Public Works	1.11	NS.05	.935	NS.05	.179	NS.05	Linear
Building & Safety	.186	NS.05	1.371	NS.05	2.72	NS.05	Linear
City Manager	.179	NS.05	1.033	NS.05	.433	NS.05	Linear

Table VI summarizes the frequencies of departments/divisions in regard to linearity vs. non-linearity by governmental function.

Table VI

Frequencies of Linearity/Non-linearity By Government Function

Function	Linear %	Non-linear %	Total %
General Government	68.4	31.6	19
Public Safety	42.9	57.1	28
Culture & Recreation	64.0	36.0	25
Other	73.7	26.3	19
Total	60.4	39.6	91

It can be seen that Public Safety is significantly more non-linear than any other function. On the other hand, the other government functions — Public Works, Health, etc. — are linear in almost three fourths of the cases. This may imply that certain functions are more sensitive to the environment than others, but the pursuit of this type of inquiry is beyond the scope of the present research. We are concerned here with how sensitive they are, and whether there is a relationship between the type of environment and the decision model.

2. Linear Analysis

The DDW, WBI and CGRI models dominated all fifty-five divisions/departments found to be linear. In Appendix B the individual results in terms of ARSQ (adjusted R^2) are shown for each of the models tested, in each of the departments found to be incremental.

As can be seen in Table VII, 88% of the ARSQ of the three best fitting models was well over .9, which assures a very good fitting of the models in general. In many cases it is hard to say which model better explains the departmental behavior. CGRI was the best fitting model — in 67% of the cases — followed by WBI — in 18% of the cases — and DDW — in 15% of the cases.

Table VII

ARSQ Distribution of the Three Best Linear Fitting Models

Range \ Model	DDW		WBI		CGRI	
	n	%	n	%	n	%
.991 - 1.00	17	31	18	33	25	45
.951 - .99	21	38	22	40	15	27
.901 - .95	9	16	8	15	10	18
.851 - .90	2	4	3	5	2	4
.801 - .85	2	4	1	2	0	-
.751 - .80	2	4	1	2	1	2
≤ .75	2	4	2	4	2	4

Note: Some percentages do not add to 100 because of rounding.

The CPRI and DCFP models showed a poor fitting. In almost 50% of the cases the models were not significant at .05, and in the remaining cases none had and ARSQ superior to 9. Of the remaining cases more than two thirds were below .6 — that is, from the total cases three-fourths were non-significant or below .6.

Therefore, it seems reasonable to say that all departments found to be linear use the previous year's actual expenditures as the basis for establishing the new budget. Two-thirds of the agencies modify this base, taking into consideration the incremental change in the revenue; almost one-fifth change the base using the incremental changes of the previous actual expenditures; and the remaining one-sixth do not change it at all.

3. Non-Linear Analysis

As seen previously, more than two-thirds of the departments found to be non-linear have their behavior better explained through the satisfaction semi-log function — the ecological theory. The remaining one-third of the departments can be said to follow an analytical pattern, as measured by the rational step-function. In Appendix B the detailed results are shown for each of the models tested, in each of the departments found to be non-linear.

As can be seen in Table VIII, the fitting of the models was not in the same range of ARSQ as the incremental models. Here one model will be extremely significant in one case, and non-significant in another. In general, the SSLT model was always significant, but in 3 cases; the SSLI was non-significant in more than 50% of the cases, but was the best fitting model in 3 cases (12% of the satisfaction cases); and the RSF was always significant, but in three cases, with overall lower fit than the SSLT model.

Table VIII

ARSQ Distribution of the Three Non-linear Models

Range \ Model	BEST		SSLT		SSLI		RSF	
	n	%	n	%	n	%	n	%
.801 - .85	8	22	5	14	1	3	3	8
.751 - .80	4	11	4	11			1	3
.701 - .75	2	6	2	6				
.651 - .70	8	22	9	25			6	17
.601 - .65	2	6	2	6			2	6
.551 - .60	4	11	6	17			5	14
.501 - .55	2	6	2	6	1	3	3	8
.451 - .50	3	8	1	3	3	8	2	6
.401 - .45	1	3			1	3	3	8
.351 - .40	0	-	2	6	1	3	2	6
.251 - .35	2	6			9	25	6	17
non-signif.	0	-	3	8	20	56	3	8

Note: Some percentages do not add to 100 because of rounding

The best model fitting the departmental pattern is also shown in Table VIII. More than two-thirds of the ARSQ of the models fitting the best the departments are over .6, representing a multiple correlation coeficient of over .75 — which also guarantees a reasonably good fit for them.

Therefore, it seems reasonable to say those departments found to be non-linear follow one of two patterns: (a) some consider their task to be the satisfaction of the public wants, without any further interpretation and/or judgment if public wants are or are not maximized, (b) some consider their task to be the satisfaction of public wants with interpretation and judgment of what is the "best" policy to be implemented in light of the overall needs of society.

Our purpose in studying decision-making in departments of local government was to assure that different decision models could better explain the behavior of these departments in different environments. The results obtained allow us to say that such a thing does happen in the cities studied, and given the character of the sample, we can extend these results to the cities in California.

Thus lending evidence and support to the contingency theory as applied to societal decision making.

To the practitioners these results are important because they should be aware that no decision model is the solution to all situations. Moreover, that a given model, choosen in a given set of environment conditions, may not last forever. That environment scanning should be also a concearn in regard to the need for a change in the decision model, if the given set of environment conditions change significantly.

To the researches these results came to reconciliate the, many times apparently conflicting, evidences on the public organizations behavior, in regard to the public policies enactement, in an unified theoretical body. The results obtained follow the same pattern found in previous studies, if accounted by non-linearity and the new methodology introduced in this research. Yet, since we have used the same measurement principles, the results can be presented as complementary, and not conflicting, under the umbrella of a more elaborated hypothesis — the contingency theory.

Future research should focus their attention in two paths: (a) the test of a sufficient condition of the contingency theory; and (b) the enlargement of the external validity of this research. In the first case, it is necessary to propose and test an environment taxonomy that captures the main variables having a bearing on the societal decision making process and, then, showing that these environment types are related to the decision models found to explain the public organizations behavior, in regard to the same societal decision making process. In the second case, replications and extensions of this research are much needed.

./sspm.

APPENDIX A

The pervasive notion that societal decision-making was found and assumed to be incremental, and therefore linear, precluded many researches, as discussed previously, from insuring that this was the case in the data they were analyzing — no test of linearity was made.

In this research a key item of the methodology proposed to study societal decision-making models in the test for linearity. As described in part IV, in order to do so we need to split the observations in at least three time periods to test if these segments are or are not part of a single straight line. Therefore, if we wish to maximize the strenght of the test for linearity, we should carefully choose the possible locus of discontinuities of the assumed linear relation — the shift-points.

This appendix is dedicated to identifying and discussing methods of selecting shift-points that can strenghten our test for linearity. We will discuss, first, two methods that appear intuitively to do so, and the overall method that can properly determine the optimum shift-points. Then, we will discuss alternative implementations of this method, and, finally, will present the alternative implemented and used in this research.

SEARCH FOR A METHOD

We will review three possible methods to find shift-points: (a) the intuitive formula — derived from the practical routine of comparing budget increments, (b) the analytical intuitive formula — derived from simplifying the situation to assume the phenomena to be deterministic, and (c) a probabilistic formula — assuming the full complexity of treating data as stochastic.

The intuitive formula, as shown below, compares the present year increment of the budget with last year's increment. If the increment is approximately the same size as the last year's increment, there is no shift-point, and vice-versa. This can be formalized as follows:

$$c_{ij} = \frac{y_t - y_{t-1}}{y_{t-1} - y_{t-2}}, \text{ and if } |c_{ij} - 1| \geq k \text{ there is a shift-point.}$$

where k= is the margin we consider acceptable as variation of the budget increment.

If we assume linearity, as is the case, then: $y_i = a + b.x_i$, and the above formula can be rewritten as follows:

$$c_{ij} = \frac{a+b \cdot x_t - a - b.x_{t-1}}{a+b \cdot x_{t-1} - a - b.x_{t-2}} = \frac{b(x_t - x_{t-1})}{b(x_{t-1} - x_{t-2})}, \text{ and if}$$

if assume b constant:

$$c_{ij} = \frac{x_t - x_{t-1}}{x_{t-1} - x_{t-2}}$$

Therefore the formula measures either the growth rate of x_i, or the growth rate of x_i times the ratio of the variation of b (if not assumed constant). Since we know that the change value of y with regard to x in a straight line is given by $dy/dx = b$, we can see that the intuitive formula does not allow us to study the linarity relation, but rather the rate of growth of x. To illustrate the problems a formula like this can introduce into the analysis, let us consider the following simplified example, where y = 5x:

x	1	3	4	7	12	20	25
y	5	15	20	35	60	100	125
c_{ij}	-	-	5	3.0	1.7	1.6	.625

All points would have been considered shift-points, when the function is strictly linear, just because the interval between the x values are not the same — and this is the relationship being measured.

The analytical intuitive formula would try to correct the above error comparing the values of b obtained at two different points. If the values of b are close enough, then no shift-point would exist, and vice-versa. This can be formalized as follows:

$$c_{ij} = \frac{\Delta y_t / \Delta x_t}{\Delta y_{t-1} / \Delta x_{t-1}}, \text{ and if } |c_{ij} - 1| \geq k \text{ there is a shift-point}$$

where k= is the variation of b considered acceptable.

As was intended, this formula measures the relationship the straight line inclination as drawn in each point considered as shown in Figure A-1.

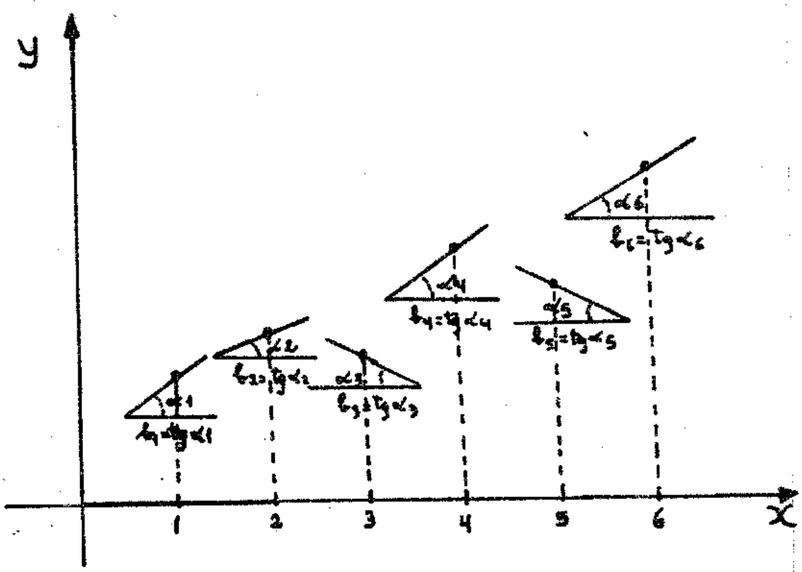
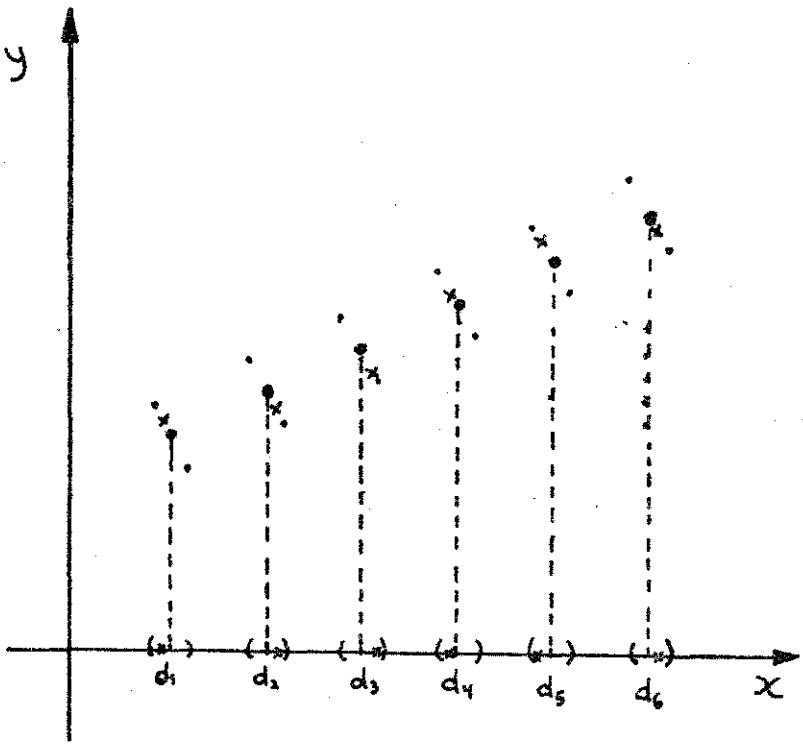


Figure A-1

The problem here is that we are dealing with empirical data and, as such, random errors are present in the measures we have of each point. Considering the random error term, the linear relation is expressed as $y_t = a+b\ x_t + e_t$. The implication of such error is shown in Figure A-2 — not a value but a range of values should be considered, associated with a given probability.

The analytical intuitive formula does not account for e_t and will depict shift-points where they do not exist because the empirical data will have embedded error terms,



● deterministic values (d)

. probabilistic values ($d \pm e_t$)

x empirical data

Figure A-2

as can be illustrated by the following example:

x	1	3	4	7	12	20	25
y (determ.)	5	15	20	35	60	100	125
y (empiri.)	5.464	15.137	22.465	34.677	59.932	100.296	124.712
c_{ij} (deter)	--	1	1	1	1	1	1
c_{ij} (empir)	--	.923	1.513	.557	1.240	.999	.968

Note: E_t was assumed to be distributed with μ=0 and σ=1, and a table of random numbers (Kmenta, 1971, p.628 ff) was used to generate the residuals.

At least 50% of the points would have been considered shift-points, when, again, the function is strictly linear, just because the error term is not being considered.

The probabilistic formula will account for the straight line properties, as well as the empirical character of the data, as follows:

$$c_{ij} = 0 \quad \text{if } b_1 - t_{n-2,\lambda/2} \cdot s_{b1} \leq b_2 \leq b_1 + t_{n-2,\lambda/2} \cdot s_{b1},$$

and

$= 1$ otherwise

where, b_1 and b_2 are computed through linear regression methods,

s_{b1} is the sample standard deviation of b_1,

$t_{n-2,\lambda/2}$ is the Student statistic with n-2 degrees of freedom, and $1-\lambda$ level of confidence.

The problems that remain to be solved are how to compute b_1 and b_2 values, as well as the confidence interval for b_1, as shown above. The next section deals with this item.

ALTERNATIVE IMPLEMENTATIONS OF THE PROBABILISTIC FORMULA

The first issue to be dealt with is the type of regression analysis that should be used in the present case. The decision models and equations proposed in part III are primarily based either on the previous year's expeditures or on the revenue increment from one year to another. Therefore the additional information that multiple regression can give with regard to simple regression in this case is very limited. We are interested in knowing whether the relationship between the dependent and independent variables is linear or not, rather than measuring the atrenght of the relationship between them. Therefore it seems that the simple regression will suffice to determine the shift-points for each independent variable considered.

The second issue is the choice of a procedure to compute the desired statistics, among least squares, maximum likelihood, etc. Since the main statistical routines used in this research (SPSS) is base on the least squares procedure, for the purposes of consistency, the same method will be used here. The computational formulas utilized are the ones recommended by Kmenta (1971, pp. 613-615).

Finally, we have to consider how b_1 and b_2 can be computed and what confidence interval should be used. There are at least three different approaches to computing b_1 and b_2: (a) the split regression line approach, (b) the cumulative regression line approach, and (c) the local and global regression lines approach.

In the split regression line approach the full regression line is considered at each point studied. The regression line is split in two segments at the point being considered, as shown in Figure A-3. Regression I goes from the first observation up to the point being studied: Regression II goes from the point next to the one being considered up to the last observation. The first and last three observations are lost, in order to assure a minimum of four data items in each regression.

In the cumulative regression line approach for each point studied two cumulative segments of the full regression line are considered, as shown in Figure A-4. Regression I goes from the first observation up to the point being considered; Regression II goes from the first observation up to the point next to the one being considered. The first three observations as well as the last are lost in order to assure a minimum of four data items in Regression I.

In the local and global regression lines approach for

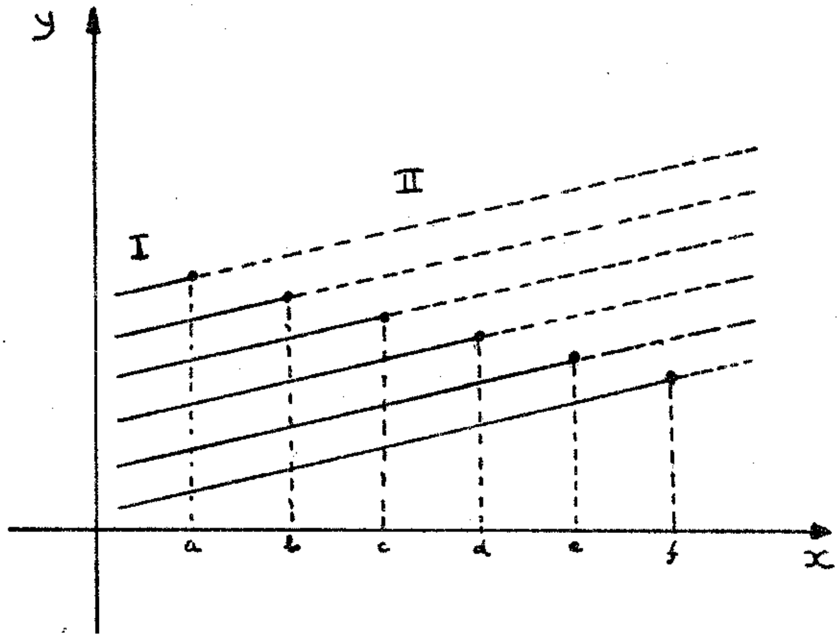


Figure A-3

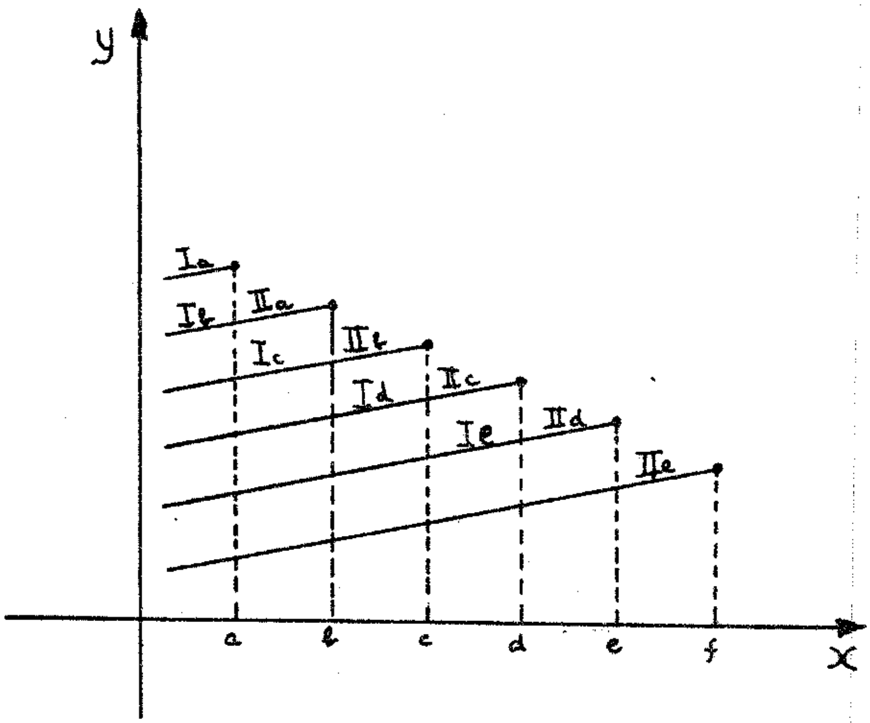


Figure A-4

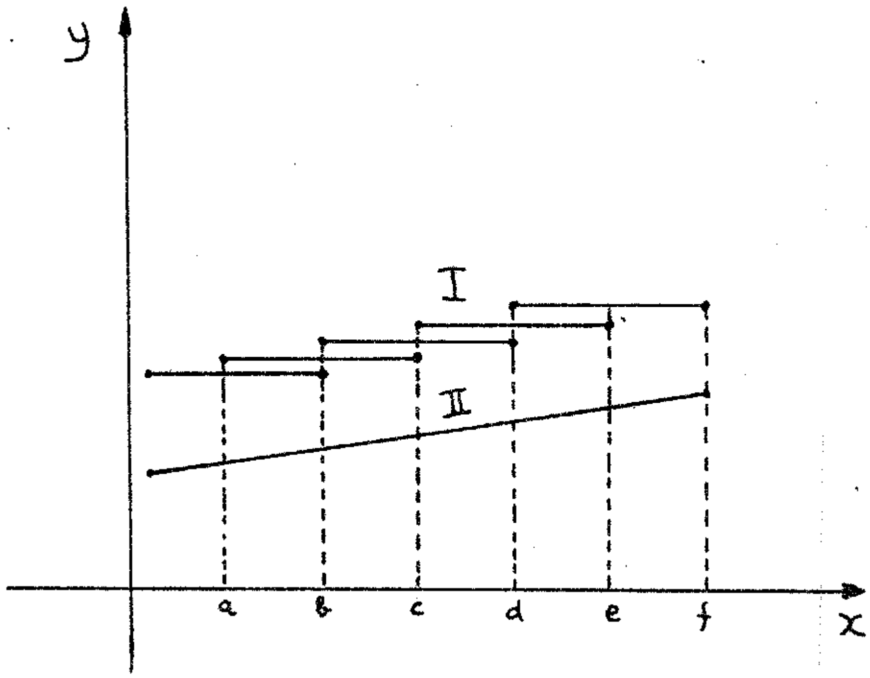


Figure A-5

each point studied the full regression line and a local segment of the full regression are considered, as shown in Figure A-5. Regression I goes from four previous observations up to the one being considered; Regression II goes from the first to the last observation. The first four observations are lost, in order to assure the existence of five data items in Regression I.

In each of the above approaches two types of confidence intervals can be computed: (a) type I — the confidence interval is computed to b_1, and b_2 is tested against it, or (b) type II — the confidence interval is computed to b_2, and b_1 is tested against it. Therefore six implementations of the probabilistic formula are possible.

In order to select the best alternative of implementing the formula we should derive a criteria on line with the objective of maximizing the strenght of the linearity test. Therefore, we can say that the "best" method will be the one that discriminates the most between the shift-points with potential to be actual discontinuities of the supposed linear relations we are studying. Given the complexity of this analysis, sensitivity studies are the only feasible method to use in the present circumstances. We applied the various methods to the data used in this research, and measured the results each one produced. Two types of non-meaningful results were obtained: (a) almost no points were found to be shift-points — as was the case of the cumulative regression line approach, confidence intervals type I and II, and (b) almost all points were founds to be shift-points — as was the case of the split regression line approach, confidence intervals type I and II, and the local and global regression lines approach, confidence interval type I. The only method that was somewhat between these extremes was the local and global regression lines approach, confidence interval type II. Therefore, this was the method selected to conduct the shift-point analysis in this research.

In order to be able to generalize the present method to other circumstances in which shift-point analysis might be important, it would have been necessary to hypothesize all possible data occurrences, conduct sensitivity analysis of the proposed implementation methods, as well as to explore other alternatives to implement the formula and analytically measure the results obtained by each method. As it is, the local and global method implementation can only be said to be "best" method for the present set of data, but not necessarily for different circumstances.

LOCAL AND GLOBAL REGRESSION APPROACH IMPLEMENTATION

The enclosed FORTRAN program was used to implement the approach selected and with modifications, to test the other approaches.

The main program reads from files for each city studied, excludes missing data, reorganizing the file of remaining non-missing observations, defines the approach used, tests if b_1 belongs to the confidence interval of b_2, and produces two reports:

(a) Shift-points by departments (1-7) — presents the shift-points by department in each year at the .05, .01, and .001 level of significance. The results are shown using the following numerical conventions: 0 = no shift-points, 1 = shift-point with regard to a (alpha), 2 = shift-point with regard to b (beta), and 3 = shift-point with regard to a and b (alpha and beta). Figure A-6 shows this type of output for the city of Compton.

(b) Shift-points in All Departments — presents the summary of the shift-points in all departments in each year at the .05, .01, .001 levels of significance. The results show the number of departments having shift-points with regard to alpha and beta in each year. Figure A-7 shown this type of output for the city of Compton.

```
FORTRAN IV G LEVEL  21                    MAIN                JUNE 11,1980
                DIMENSION IY(39,8), CON(3,2)  ,IY1(39,8),PDIF(2)
                DIMENSION IT(39),IT1(39),IS(36,3,2),ID(36,7,3)
                DATA IS,ID / 972 * 0 /
                READ(5,100)  (IT(I),(IY(I,J),J=1,8),I=1,39)
                DO 15 N=1,39
                   IF ( IY(N,1) .EQ. 0) GOTO 10
                         IT1(N-L) = IT(N)
                      DO 5  J=1,8
                         IY1(N-L,J)  =  IY(N,J)
         5            CONTINUE
                      GOTO 15
        10         L = L + 1
        15      CONTINUE
                N2=1
                NL = 39 - L
                NB= NL - 4
                DO 20  I=2,8
                   DO 20 M1 = 5,NL
                   N1 = M1 - 4
                   M2 = NL
                   M3 = 5
                      CALL MINSQ (IY1,N2,M2,I,A2,B2,CON)
                      CALL MINSQ (IY1,N1,M3,I,A1,B1,CON)
                      PDIF(1)= ABS(A2-A1)
                      PDIF(2)= ABS(B2-B1)
                      DO 18 IP=1,2
                         DO 18 LS=1,3
                            IF( PDIF(IP) .LE. CON(LS,IP)) GOTO 18
                               ID(M1-4,I-1,LS)= ID(M1-4,I-1,LS)  + IP
                               IS(M1-4,LS,IP)  = IS(M1-4,LS,IP)  + 1
        18            CONTINUE
        20      CONTINUE
```

```
FORTRAN IV G LEVEL  21                  MAIN                JUNE 11,1980
 0033              NFIN= NL - 4
 0034              WRITE(6,110)
 0035              WRITE(6,111)
 0036              WRITE(6,150) (IT1(I+4), ((ID(I,J,K),K=1,3),J=1,7),I=1,NFIN)
 0037              WRITE(6,160)
 0038              WRITE(6,161)
 0039              WRITE(6,200) (IT1(I+4), ((IS(I,J,K),K=1,2),J=1,3),I=1,NFIN)
 0040              STOP
 0041         100  FORMAT( 1(I2,1X,6(I6,6X)/3X,2(I6,6X)))
 0042         110  FORMAT(//,20X,'**** SHIFT-POINTS BY DEPTS(1-7) ****')
 0043         111  FORMAT(1X,'YRI',7('.05.01.001I' ) )
 0044         150  FORMAT(1(1X,I2,'I ',7(I1,2X,I1,2X,I1,2X,'I ' ) ) )
 0045         160  FORMAT(//,20X,'**** SHIFT-POINTS ALL DEPTS   ****' )
 0046         161  FORMAT(20X,'YEARI   .05    I   .01    I  .-001   I' /
                  +         24X,'I',3('ALPHA BETAI' ) )
 0047         200  FORMAT(1(21X,I2,' I',3(2X,I1,4X,I1,'   I' ) ) )
 0048              END
```

```
FORTRAN IV G LEVEL  21                    MINSQ          JUNE 11,1980
            SUBROUTINE MINSQ(MY1,N1,N,IY,ALPHA,BETA,C)
            DOUBLE PRECISION SX2,SY2,SXY,XXM,XYM,YYM,SSEN,S2N,S2B,S2A,Y1(39,8)
            DIMENSION MY1(39,4),TT1(37),TT2(37),TT3(37),TTEST(37,3),C(3,2)
            DATA TT1/12.706,4.303,3.182,2.776,2.571,2.447,2.365,2.306,2.262,
           +2.228,2.201,2.179,2.16,2.145,2.131,2.12,2.11,2.101,2.093,2.086,
           +2.08,2.074,2.069,2.064,2.06,2.056,2.052,2.048,2.045,2.042,2.04,
           +2.038,2.036,2.034,2.032,2.029,2.027 /
            DATA TT2/63.657,9.925,5.841,4.604,4.032,3.707,3.499,3.355,3.25,
           +3.169,3.106,3.055,3.012,2.977,2.947,2.921,2.898,2.878,2.861,
           +2.845,2.831,2.819,2.807,2.797,2.787,2.779,2.771,2.763,2.756,
           +2.75,2.745,2.741,2.736,2.732,2.727,2.722,2.718/
            DATA TT3/636.619,31.598,12.941,8.61,6.859,5.959,5.405,5.041,
           +4.781,4.587,4.437,4.318,4.221,4.14,4.073,4.015,3.965,3.922,
           +3.883,3.85,3.819,3.792,3.767,3.745,3.725,3.707,3.69,3.674,
           +3.659,3.646,3.637,3.627,3.618,3.608,3.599,3.589,3.85/
            M=N1 - 1 +  N
            DO 1 I=1,37
               TTEST(I,1) = TT1(I)
               TTEST(I,2) = TT2(I)
               TTEST(I,3) = TT3(I)
    1       CONTINUE
            DO 2 I=1,39
               DO 2 J=1,8
                  Y1(I,J) = MY1(I,J)
    2       CONTINUE
               SX=0.
               SY=0.
               SX2=0.
               SY2=0.
               SXY=0.
                DO 5  IOB=N1,M
                   SX=SX + Y1(IOB,1)
                   SY=SY + Y1(IOB,IY)
```

```
FORTRAN IV G LEVEL  21                      MINSQ           JUNE 11,1980
                      SX2=SX2+Y1(IOB,1)**2
                      SY2=SY2+Y1(IOB,IY)**2
                      SXY=SXY  +Y1(IOB,1)*MY1(IOB,IY)
          5        CONTINUE
                   XXM=N*SX2-SX**2
                   XYM=N*SXY-SX*SY
                   YYM=N*SY2-SY**2
                   BETA=XYM/XXM
                   ALPHA=(SY-BETA*SX)/N
                   SSEN=YYM-BETA*XYM
                   S2N=SSEN/(N-2)
                   S2B=S2N/XXM
                   S2A=(S2N*SX2)/(N*XXM)
                 IF(SSEN .LT. 0. .OR. XXM .LT. 0. .OR. SX2 .LT. 0.) GOTO 17
                 IF( N .LT.0 .OR. (N-2) .LT. 0) GOTO 17
                    SA=DSQRT( S2A )
                    SB=DSQRT( S2B )
                 DO 15 I=1,3
                      T=TTEST(N-2,I)
                   C(I,1) = T * SA
                   C(I,2) = T * SB
         15      CONTINUE
                 GOTO 20
         17      WRITE(6,100) SX,SY,SX2,SY2,SXY
                 WRITE(6,101) XXM,XYM,YYM,SSEN
                 WRITE(6,102) M1,N,S2N,S2B,S2A,ALPHA,BETA
         20      CONTINUE
                 RETURN
        100      FORMAT(//,'  ****  ERROR IN MINSQ SUBROUTINE  ****' /
               +        5(F14.0,2X) )
        101      FORMAT( 4(F18.0,2X))
        102      FORMAT( 2(I2,2X),F13.5,2(F10.5),F10.4,2X,F10.5)
                 END
```

Shift-points with regard to alpha were only included as additional information. Given the way the method was designed, by constantly moving the origin, we expected that alpha would shown many more changes than beta, which in fact was the case.

The subroutine MINSQ is called by the main program and computes the values of a and b as well as the confidence interval for a and b. If any of the key statistics to be computed are found to be singular, MINSQ prints an error message and the values of those key statistics as computed up to the point where the error is detected. As said previously, this subroutine is based on Kmenta's (1971, pp. 613-615) recommended computational procedures for simple regression and uses double precision so that a high level of accuracy is achieved in the computation.

It is important to note that, both the main program and the MINSQ subroutine can, with a reasonable computational effort, be adapted to implement alternative approaches, variable number of departments, variable number of independent variables, as well as be extended to perform directly the linearity test of the models considered. Unfortunately, the pursuit of such aims is beyond the scope of this research, and, for practicality, the present version of the method was developed to the point necessary to conduct the shift-points analysis of the data set used in this research.

I believe that a better treatment of the subject is much needed, and I hope that in the future not only will I be able to make further contributions in this area, but also that other researchers will join me in this task.

****** SHIFT-POINTS BY DEPTS(1-7) ******

FRI	.05	.01	.001	.05	.01	.001	.05	.01	.001	.05	.01	.001	.05	.01	.001	.05	.01	.001	.05	.01	.001
44	3	1	1	1	1	0	3	3	3	0	0	0	0	0	0	3	3	3	1	1	0
45	3	1	1	3	1	1	1	0	0	3	1	0	1	1	0	0	0	0	1	1	1
46	3	1	1	3	3	1	1	1	0	3	3	0	1	1	0	2	0	0	1	1	1
47	3	3	1	3	3	1	1	1	0	1	1	0	1	1	0	3	2	0	1	1	1
48	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	0	0	0	3	0	0
49	1	1	1	1	1	0	0	0	0	3	1	0	3	0	0	0	0	0	0	0	0
50	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
51	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	1	1	0	3	3	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
54	1	0	0	3	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	1	0	0	3	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
56	1	0	0	3	3	3	3	3	3	0	0	0	0	0	0	3	3	3	1	0	0
57	1	0	0	3	3	2	3	3	3	0	0	0	0	0	0	2	0	0	0	0	0
58	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	2	0	0	0	0	0
59	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
62	3	0	0	0	0	0	0	0	0	3	3	3	0	0	0	3	0	0	0	0	0
63	3	0	0	0	0	0	0	0	0	3	3	2	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	2	0	0	3	3	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	3	2	0	3	2	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	3	3	0	3	2	0	0	0	0	0	0	0	0	0	0
67	0	0	0	1	1	0	3	3	0	3	3	2	1	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	1	1	0	1	1	0	0	0	0	3	3	0	3	3	0	2	0	0	0	0	0
77	3	1	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
78	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure A-6

**** SHIFT-POINTS ALL DEPTS ****

YEAR	.05 ALPHA	.05 BETA	.01 ALPHA	.01 BETA	.001 ALPHA	.001 BETA
44	5	3	5	2	3	2
45	6	3	5	0	3	0
46	6	4	6	2	3	0
47	7	3	6	3	3	0
48	6	1	4	0	2	0
49	4	2	3	0	1	0
50	3	0	2	0	0	0
51	2	0	1	0	0	0
52	2	0	1	0	0	0
53	4	1	2	1	1	0
54	3	1	1	1	0	0
55	4	1	1	0	0	0
56	5	3	3	3	3	3
57	3	3	2	2	1	2
58	1	2	1	1	0	0
59	1	1	1	1	0	0
60	0	0	0	0	0	0
61	1	1	0	1	0	0
62	3	3	1	1	1	1
63	2	2	1	1	0	1
64	1	2	1	1	0	0
65	2	2	0	2	0	0
66	2	2	1	2	0	0
67	4	2	3	2	0	1
68	1	1	0	0	0	0
69	0	0	0	0	0	0
70	1	1	0	0	0	0
71	0	0	0	0	0	0
72	0	1	0	0	0	0
76	4	3	4	2	0	0
77	2	3	2	0	0	0
78	1	1	0	0	0	0

Figure A-7

APPENDIX B

SDM DETAILED RESULTS

ALAMEDA

Auto-Regression Test
(d statistic)

Func. Regression	Police	Fire	Golf	Library	Streets	Parks & Recreation	Building Inspection	Results
LDDW	1.46077	1.44623	2.21831	1.67202	2.05826	1.25907[pa]	1.60618	1pa
LCPRI	1.11462[pa]	1.66955	1.71821	2.60023	2.57238	2.52496	2.14028	1pa
LDCFP	1.24519[pa]	1.78153	1.88495	2.38730	2.25757	1.97127	2.50637	1pa
DDW	1.29978[pa]	1.18759[pa]	1.82607	1.46578	2.4751	1.15143[pa]	1.73162	3pa
WBI	1.63325	.96231	1.78241	1.40337	2.20192	1.39107	1.53160	1pa
CPRI	0.75065[pa]	1.38657	1.4371	2.42483	2.53371	1.83223	2.54259	1pa
CGRI	1.63522	2.04671	1.31848	2.16752	2.65745	1.61173	2.12961	--
DCFP	.88132[pa]	1.54015	1.51532	2.41883	2.45911	1.80719	2.50266	1pa
TOTAL	5pa	2pa	--	--	--	2pa	--	9pa

SDM DETAILED RESULTS

ALAMEDA

Linear Analysis (ARSQ)

Dept. / Model	Golf	Library	Streets	Parks & Recreation	Buildings Inspections
DDW	.98208	.98030	.97986	.82526	.96667
WBI	.98146	.97959	.97979	.89344	.97057
CPRI	.26101	.40709	.34470	.32315	.36407
CGRI	.98642	.98868	.98211	.93195	.97891
DCFP	.21449	.34535	.26844	.23904	.31764

Non-Linear Analysis (ARSQ)

Dept. / Model	Police	Fire
SSLT	.8188	.7795
SSLI	.295707	.218558
RSF	.2903	.3534

SDM DETAILED RESULTS

<u>ALHAMBRA</u>

Auto-Regression Test
(d statistic)

Func. / Reg.	Police	Fire	Buildings & Planning	Streets	Sanitation	Library	Parks & Recreation	Results
LDDW	1.42672	1.09913^{pa}	2.53258	1.01963^{pa}	2.51347	1.43043	1.8224	2pa
LCPRI	2.62502	2.38536	1.65138	1.72273	1.76683	1.79085	1.14432^{pa}	1pa
LDCFP	2.41539	2.08695	1.70096	1.72769	2.50905	1.76925	1.18079^{pa}	1pa
DDW	1.13924^{pa}	.95785^{pa}	1.87394	.98745^{pa}	2.32185	1.22704^{pa}	1.21399^{pa}	5pa
WBI	1.32821	.87439^{pa}	1.31817	.81892^{pa}	2.02411	.94197^{pa}	.72948^{pa}	4pa
CPRI	1.08542^{pa}	.94315^{pa}	1.66144	1.5924	1.78193	1.53313	1.08073^{pa}	3pa
CGRI	1.81804	1.74341	2.21334	1.50318	2.36152	2.1248	1.34139	--
DCFP	1.11546^{pa}	.95296^{pa}	1.66179	1.39413^{pa}	1.77744	1.51235	1.08647^{pa}	4pa
TOTAL	3pa	5pa	--	4pa	--	2pa	6pa	20pa

SDM DETAILED RESULTS

ALHAMBRA

Linear Analysis
(ARSQ)

	Buildings & Planning	Streets	Sanitation
DDW	.91630	.78515	.99091
WBI	.97279	.85496	.99078
CPRI	-.02138	-.02835	-.02736
CGRI	.91538	.91503	.99067
DCFP	-.01874	-.02621	-.02648

Non-Linear Analysis
(ARSQ)

	Police	Fire	Library	Parks & Recreation
SSLT	.6739	.5661	.5927	.5613
SSLI	.29453	.1538	.0696	.0035
RSF	.3794	.3979	.5664	.5622

SDM DETAILED RESULTS

BERKELEY

Auto-Regression Test

(d statistic)

Func. / Reg.	Police	Fire	Health	Public Works	Recreation & Parks	Public Library	City Manager	Results
LDDW	1.91267	2.58625	1.55152	2.02108	2.65135	2.35297	2.02649	--
LCPRI	1.17673	2.66473	2.83175	1.26729	1.90412	1.56479	2.07173	--
LDCFP	1.36376	2.67366	2.97416[na]	1.93506	2.09426	2.03716	1.99979	1na
DDW	1.87563	2.31171	.90751[pa]	1.34488	2.60714	2.40241	2.00506	1pa
WBI	1.10428[pa]	2.14761	.72523[pa]	1.3241	2.48871	2.58087	1.45606	2pa
CPRI	.79409[pa]	2.63286	2.10459	1.28127	1.93118	1.42688	2.03111	1pa
CGRI	1.89936	2.39075	1.46284	1.46256	2.12891	1.96529	1.8545	--
DCFP	.74671[pa]	2.62834	1.88307	1.92203	2.09145	1.80103	1.88988	1pa
TOTAL	3pa	--	1na 2pa	--	--	--	--	5pa 1na