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CITIZEN COPRODUCTION AS A MODE OF PARTICIPATION: CONJECTURES, MODES, AND COCKROACHES

by

Rick Wilson
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Indiana University
814 East Third
Bloomington, IN 47405

Rick Wilson
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Introduction

Like traditional theories of political participation, descriptive-empirical work of participation has focused on a narrow range of citizen activities. Voting, campaign mobilization and financing, and office-seeking behaviors fall under this rubric. On the other hand, political scientists have increasingly turned their attention to the dynamics of local service delivery and the involvement of citizen-consumers in this process. Some literature, based on citizen contacting of local officials, has attempted to bridge the traditional accounts of public participation with service supply. This paper will examine citizen activity in service delivery, sketching an additional facet to the concept of participation. The bulk of the paper will rely on developing an institutional approach to understanding coproduction as an important mode of citizen participation. The model will then be subjected to an empirical test of citizen provisioning strategies. The data, based on services supplied in apartment complexes, was collected by the author and colleagues as a field experiment to understand the nature of institutional effects on coproduction.

Participation: Its Role

Before extending the concept of participation we must first understand those fundamental elements which comprise it. A primary disagreement

by political theorists focuses on the political role of participation. Theorists such as Rousseau and G. D. H. Cole argue that participation is an end, valued in itself. Others, such as Mill and Schumpeter, representing a liberal-democratic tradition, view participation as a means. These views conflict, resulting in significantly different claims for the value of participation, and the role it occupies in the study of politics (see Pateman, 1970; Dahl, 1956; Mcpherson, 1977; Pennock, 1979). Although this conflict occupies a primary place in political theory, the dominant focus by political scientists has been to regard participation as a means to some end. This is primarily derived from the liberal values pervasive in American society but seldom examined.[1]

Typical of this liberal conceptualization are the definitions offered by Milbrath and Goel (1977) and Verba and Nie (1972). Milbrath indicates:

> Political participation may be defined as those actions of private citizens by which they seek to influence or to support government and politcs (p. 2).

Verba and Nie echo this by stating:

> Political participation refers to those actions by private citizens that are more or less directly aimed at influencing the selection of governmental personnel and/or the actions they take (p. 2).

And, they further insist that:

> For us, participation is a means to an end, an activity whereby citizens attempt to affect governmental activity in ways that will benefit them (p. 11).

Participation allows each individual to make a clear expression of his/her interests. Participation in this respect serves to provide a forum for the expression of preferences, something which liberal-democratic theory informs us cannot be undertaken by others.

Third, it is argued that participation serves as an educative device for a citizenry. Decision making involves an ability to emphathize with another's position, forces a discussion of alternative positions, and generally requires some degree of compromise. A facility for decision making comes with experience which is thought to be obtained through active participation. There is disagreement over the level at which such participation should take place. However, Tocqueville and Mill both argue that participation in local affairs is the best training ground (see Mill, Representative Government, especially Chapter 15; also, Tocqueville, I., Chapter 5). Recent arguments by participatory democrats echo this point (see Pateman, 1970). Participation, then, produces a capable citizenry likely to engage in "better" decision making.

Finally, it is argued that participation serves as a symbolic form of activity contributing to the maintenance of the political system (Edleman, 1971). In other words, some narrow avenues of participation are tolerated in a polity as they relate to encouraging the norms of the polity. Participation then becomes the representation of an ideal form of behavior. From the perspective of a rational calculus of voting, that participatory act (where the costs of voting far exceed the probability of an individual's vote swaying an election) could be interpreted as a symbolic expression of committment to a particular political system.

Emprical-descriptive work has focused primarily on participation as a means of ensuring official responsibility. The literature relating

voting to participation has generally been concerned with the relations of citizens with officials. While Verba and Nie in their study of participation are concerned with the pressure and information that different types of activists provide an official, the primary thrust is with ensuring official responsibility. They argue, " [p]articipation is, to us, most importantly an instrumental activity through which citizens attempt to influence the government to act in ways the citizens prefer" (p. 102). In fact, for them "an act of participation involves a hypothesis on the part of the participants that his act will lead to a desired response by the government" (p. 103). Thus, their different modes of participation concentrate on participation as a means of forcing official compliance with the "interests" of citizens.

The focus of more recent studies tying a citizen's vote to policy formation varies from imputing the strength of a vote (Popkin, et al., 1976) to attempting to directly measure the effect of a citizen's vote (Kuklinski and Stanga, 1979). Similarly, studies of other traditional modes of participation have attempted to infer the relationship between activity and official response. The recent study by Brown, et al., (1980), draws some conclusions as to the effect of campaign contributions on the responsiveness of elected officials. Like Verba and Nie before, it appears that participatory activists in this mode are white and upper-middle class. The question of whether some perceived official responsiveness is derived from this type of activist or whether it is because of the congruence between these individuals and the characteristics of the official elected, is something unanswered.

Increasingly scholars are turning their attention from the traditional concerns of participation, to examining the way in which citizens gain the

outcomes of collective decision processes. This new direction sees politics as not only involving the allocation of values, but is concerned with the distribution of goods. The distribution of goods and services in a community is a highly political event. As Herbert Jacob (1972) has noted, an important, neglected element of government "concerns the degree to which people obtain valued goods and services from their governments" (p. 124). The obvious political implication of the delivery of services is in its distributional nature. Citizens, in requesting goods (or bundles of services) act to redistribute goods for their own benefit. The redistributive point is well taken since all divisible, publically provided goods (or services) are finite in their provision.[2]

An entire literature concerning behavioral responses to citizen contacts has emerged (see Eisinger, 1972; Jacob, 1972; Jones, et al., 1977; Vedlitz, et al., 1980). This literature equates a nonelectoral mode of participation-contacting-with a mode of behavior important to the community. As Jones, et al. (1977), and Vedlitz, et al. (1980), have noted, this mode of behavior is crucial for cueing officials. However, what is not clear is whether this cueing mechanism results in responsiveness to citizens (the evidence is mixed) or whether it is an alternative mechanism for the expression of preferences. It will be argued that coproduction is a broad form of participation concerned with the supply of services while satisfying such varied functions as inducing official responsibility, enabling citizens to express their preferences and serving as an instructive information gathering device for citizens.

Coproduction as Participatory Behavior

Coproduction is a technical term developed by colleagues at the Workshop in Political Theory and Policy Analysis which characterizes a certain mode

of production. This term may briefly be introduced by resorting to some tools from elementary microeconomics.[3]

Coproduction is a crucial albeit ignored element of most service delivery systems. It characterizes a transformation process whereby inputs from both a hired producer and the consumer are necessary for the production of some good (or service). A few examples will illustrate the simplicity and usefulness of such a concept. In the provision of neighborhood security (a subset of goods provided by police patrol)., police officers can only incompletely produce security unless the active participation of citizens is forthcoming. As neighborhood citizens act to report suspicious activity, as they leave outside lights on, and as they take simple precautions against crime the patrol by police officers becomes more effective, Similarly, in providing "education," teaching is a futile exercise without the active [4] cooperation of students.

Coproduction, then, is part of a production process binding together a hired producer and a consumer producer. In this context we will define a hired producer to be an individual (firm or bureau) whose "wage" is derived from the production of a specific good (or service). A consumer producer, obviously, is an individual (or collection of individuals) who derive their primary benefit in the consumption of that specific good (or service). We can characterize the production of the good as joint production (see Alchian and Demsetz, 1972). Very simply, the mix of inputs can be represented by:

$$(1)\quad Q = aC_p + bH_p + C_pH_p$$

where:

Q = quantity output of a good

C_p = consumer inputs

H_p = hired producer inputs

a,b = marginal outputs of consumer and hired producers, respectively

d,e = output elasticities of consumer and hired producers, respectively

If the mixture of intputs is substitutive between consumers and hired producers, then output elasticities equal zero and the last term drops out leaving a simple linear relationship among intputs described by:

(2) $Q = aCp + bHp$

Equation 1 represents the case where the mixing process entails joint marginal productivities in inputs.[5] Coproduction, then, is this mixing of consumer and hired producer inputs to the production of a good.[6]

Coproduction as Participation

Coproduction serves as an elemental linkage between the citizen-consumer and the producer. This is derived from the active relationships citizens must engage in with officials. Whitaker (1980) notes that there are three ways in which this coproductive relationship manifests itself. First, citizens actively request assistance from public agents. This requires the citizen to contribute to production by pinpointing the level and/or the manner in which a service is to be delivered. The costs to the consumer are real. Contacting a public agent requires investments of time and energy (which can be conceptualized as foregone opportunity costs to the consumer). Second, citizens variously provide assistance to public agents. This is more closely related to joint production whereby consumer and hired producers affect the output level of a good via their share of resource inputs. For the consumer producer this may be as simple as buying a light-timing device for a home or as costly as joining a nightly neighborhood patrol to provide security. Third, citizens interact with public agents to adjust their service expectations. Her consumers resort to investments of their own

resources in an effort to augment some fixed level of service provisioned by a public agent. These conceptions of coproduction easily fit the functions of participatory activity drawn out above.

Whitaker's first type of coproductive activity subsumes the "contacting" mode of participation. Coproduction in this case involves citizens requesting services of officials. It is argued that contacting public officials is an important linkage between citizens and local officials (Verba and Nie, 1972: 113; Hansen, 1975: 181; Jones, et al., 1977: 198). If officials are not perceived as satisfactorally responding to citizen preferences then contacting is an alternative means by which citizens can attempt to force compliance. The primary argument for contacting as a participatory activity follows from. the definition by Almond and Verba in The Civic Culture (1963) to the effect that if citizen activity affects policy, then it is participation. In this instance citizen activity is presumed to affect policy in two ways. First, if service provisioners are responsive, then citizen requests will change the distribution of services. Second, if service provisioners are not responsive, citizens will change the provisioners. However, this type of citizen activity does not explicitly transform the production of a good. As such it should not be considered coproduction, but rather is akin to provisioning of services. It is an important form of participation, but will not be considered coproduction in the framework of this paper.

Whitaker's second type of coproduction is an important participatory activity with regard to service delivery. It involves joint production of public agents and citizens, with both providing inputs in order to produce some good. The primary argument that this is a form of participation is related to its ensuring official responsibility. If consumers partially produce a service, that activity monitors the behavior of hired producers.

The consumer's activity then influences the hired producer's provisioning policies.[7] Where the output of a product is dependent on the inputs of two different producers, then it is likely that both parties will maintain some vigilance over the efforts of other parties. This will particularly be the case with consumer producers who are being serviced. They are then likely to constantly be aware in an effort to assure responsibility on the part of hired producers.

Whitaker's third type of coproduction -- adjustments by citizens to service levels — is a participatory activity contributing to the expression of preferences and also serves an instructive value. It is a participatory activity in that this type of citizen behavior influences policy through introducing the unique considerations of individual citizens to the service activities of hired producers. This type of coproduction is first a demand revealing mechanism. If public sectors increase their own investments in joint production, this is an indication to hired producers for the need for increased supply. When citizens increasingly become active in the supply of a service, this signals the hired producer that the good is being under-supplied. If we assume hired producers are rational, calculating individuals, they are likely to use such messages to increase their own budgets and prevent encroachment on their mode of delivery by citizens (see Niskanen, 1971). Second, this type of coproduction is instructive for the citizen-consumer. In order for citizens to adjust their service level,, they must begin to. understand how that service is provided. Only then can they adopt successful strategies for investments of their own resources. If an individual desires to increase the level of safety in his/her own neighborhoods keeping a baseball bat under the bed will only be marginally beneficial. Leaving one's porch light on and keeping alert to activities in the neighborhood are

likely to be more productive. Citizen-consumers, then, through a process of adjustment, learn a substantial amount about the type, quality, and level of the service being provided. They also learn some of the production mechanisms that lead to supply of the service.

What Constrains Coproductive Behavior?

Although coproduction can be seen as a potentially important way in which citizens can meet their own service requirements, develop greater information and signal their preferences, it is obvious that coproduction does not occur everywhere. This raises the relevant empirical question of this paper. What constraints coproductive behavior?

The coproduction process is constrained by three elements: technological feasibility, economic feasibility, and institutional limits on the production process. These first two elements have been well-developed in Parks, et al. (1981). Technological feasibility relates to whether the technical capabilities for production can match an expected output. If a production frontier can be defined that prescribes the mixture of inputs to produce some quantity of a service,, then technical feasibility is met. Economic feasibility concerns whether a fiscal allotment of factor intputs will allow the production of some desired quantity of a service.

The least developed set of elements concerns institutional constraints on production. Institutional constraints are clearly the most "politically" relevant set of constraints. (Appendix 1, using basic conceptions of microeconomics, traces one way of understanding institutional constraints on coproduction.) The process of service delivery has been understood as similar to the production process within an industrial firm (Bish and Ostrom, 1973). Treating the process as an industry informs us that production minimally requires inputs, a transformation process, and outputs. But, more

importantly, this process is conducted within a particular institutional structure (see Reekie, 1979). Through examining the institutional arrangements in which individuals participate, we can begin to understand the constraints on the participatory behavior of individuals. In order to do so, we need to carefully study those elements which characterize institutional arrangements.

Institutional Structure

In recent work on urban service delivery the concept of institutional structure has taken on an importance as a dependent variable in analyzing service provisioning. The upshot of this work is that mechanisms for service production (institutional arrangements) have identifiable compositional characteristics. These characteristics can be understood as sets of rules which constrain the behavior of individuals interacting in those arrangements. We will examine the effect of these rules sets on coproductive behavior.

Most institutions, particularly service delivery systems, have a similar typology of structural components which characterize them. Although typologies are descriptive organizing tools, not theoretical statements, they are useful in reducing complexity which creates a parsimonious framework aiding the development of theoretical statements. A useful way of looking at institutional structure involves considering six identifiable compositional elements. These appear as distinct rule sets, including: information rules, procedural rules, aggregation rules, position rules, boundary rules, and scope rules. At this point it is crucial to note that it is the full configuration of the rule set that shapes the constraints and incentives extant in any institution. Examining a single rule without regard to the contextual impact of other rules is misleading. However, for ease of exposition, these rule sets will be separately (and briefly) conceptualized.

(For a fuller, more comprehensive treatment of institutional rule structures and configurations, see Kiser and Ostrom, 1980.)

Information Rules

Information is basic to activity in that it provides the means for choosing among a set of known alternative strategics. Information varies with the **capacity** of channels relaying data, the language used in transmitting messages, and the context within which information is transmitted (see **Hurwicz,** 1973). Information rules are concerned with who is authorized to transmit messages and the manner in which they are transmitted. Depending on who is authorized (whether all or few), this affects an individual's agenda setting powers. The manner in which information is relayed has different consequences if it must be relayed to all or whether it remains private between a few individuals.

Procedural Rules

Procedural rules are central to an institution by demarcating when and where individuals have a potential for input into decision making. Input to a proposal is not the same as enacting a proposal. The latter characterizes aggregation rules, while the former concerns constructing the proposal itself. Some institutions have structured times when input is authorized, while others are more flexible -- allowing input at any time. Specifying where individuals engage in decision making activity defines the particular mechanism(s) at which input can be made. This includes whether some action can be appealed, whether optional decision points are available, and whether decision points are arrayed hierarchically. In sum, procedural rules define the type and number of decision points to which individuals have access.

Aggregation Rules

Aggregation rules simply concern the means by which collective decisions are arrived at (see Buchanan and Tullock, 1962; Badger, 1972), All institutions, whether autocratic or democratic, have well understood means by which choices are made. In the former case, a. single individual makes all decisions. Typically in democratic institutions, most collective decisions are made by a majority of those voting. The type of aggregation rule employed makes an enormous difference for the type of proposal enacted.

Position Rules

Position rules are concerned with the distribution of authority among individuals to affect decisions within arrangements. We know through experience and observation that most institutions are characterized by Inequalities In the relative power of individuals to affect collective decisions. Often these inequalities stem from the internal structure of the decision making institution. Representatives and other officials with formally defined sets of action not granted others, inequalities often arise. Recent observers have remarked this process results in the entrenchment of officials, which in turn further strengthens those official's position (Fiorina, 1980; Niskanen, 1971).

Boundary Rules

Boundary rules are crucial to delimiting the structure of an institution. Boundary rules simultaneously take into account the requirements on membership for entering some institution and the limits on exiting (forfeiting) membership (Tiebout, 1956; Hirschman, 1970). If institutions are regarded as rule structures providing behavioral constraints

and Incentives in order to foreclose failures in collective action, then a clear conception of who is to share in the costs and benefits of any action is basic to averting such failure.

Scope Rules

Scope rules meanwhile include both the domain of decision making held by an institution and the admissable extent of "power" wielded by the institution. Obviously, Institutions are limited in their domain of action. The school board of Elm Springs, South Dakota, does not have the authority to make decisions concerning the placement of missile sites around the United States, while Congress cannot order that school board to use specified texts.

Theoretically, this typology of structural rules provides a starting point for comparing dissimilar institutions. It also provides a foundation for interpreting the constraints provided by institutions on behavioral strategies. In this case we can use this outline of structural elements to answer the question: What constrains coproductive behavior? More importantly this approach will provide insights as to the types of institutional arrangements in which we are likely to find coproductive behavior.

Analysis

In order to make adequate comparisons of the effects of institutional structure on coproductive behavior it is necessary to use a most similar design model (Ostrom, Parks, and Smith, 1973), This means finding similar sets of institutions, controlling across rule sets, then making comparisons in a pair-wise fashion across changes in a single rule set. This allows the researcher to impute changes In coproductive activity to

the change along a single rule set. Unfortunately, data sets allowing such tests are seldom available. However, during the spring 1980, such a quasi-experiment was undertaken by colleagues at the Workshop in Political Theory and Policy Analysis at Indiana University. The focus was on the provisioning of services in apartment complexes.

The Data

The Apartment Services Study entailed a two stage survey conducted in Bloomington, Indiana, during the spring, 1980. The first stage of the study was a census of all apartment complexes with greater than 50 units serving the Bloomington SMSA. This instrument was aimed at getting a sense of the institutional structure of each complex. Managers or owners of complexes were asked a detailed set of questions ranging from rental rates and lease conditions to the number of full- and part-time employees at the complex. The rationale was that these Individuals would have a clear perception of the way their complex operated -- those limits which were placed on tenants for entering or exiting, the degree to which tenants have information about the services provided, the range of services provided, etc. In all, 28 different complexes fit the requirement of greater than 50 units.

An intermediate stage of the project was to devise a coding scheme for these complexes on the basis of their rule structures. Due to financial and time constraints, the researchers decided only half of the units would be subject to the second stage of the project, a resident survey. This meant the complexes were to be differentiated on the basis of theoretically important sets of rules in which comparisons could take place.

Eventually this resulted in the selection of 10 complexes (see Appendix 2 for a detailed description of the coding procedure and matrix fitting of these complexes).

The second stage of the project was a random telephone survey of residents in the 10 apartment complexes selected for the project. The aim of this survey was to tap whether residents had coproduced or relied on hired production for a set of services common to all the complexes. In developing the sample the local telephone book was used to pinpoint a universe of residents for each complex. From these universes a random sample was drawn for each complex. Comparing the number of units in each complex with the number of nonrepetitive phone numbers for each complex, the sampling universe averaged 91.3 percent. This ranged from a low of 69.2 percent to a high of 100 percent. The lower figure was obtained in. university-owned housing in which large numbers of foreign students resided. This might introduce some underrepresentation bias, as these units had the smallest percentage of residents owning phones. Even this relatively high figure for the universe of the sample might be biased given the 6 month lapse time between when the phone book was issued and when the sample was selected due to individuals moving or incorrect listings. Even so, the response rate averaged 72.3 percent for the initially drawn sample. This response rate figure ranged from a low of 58.3 percent to a high of 85.7 percent. Additional tenants were then randomly selected to fill in those who were not contacted.

In developing the apartment resident surveys we were specifically interested in resident production of services. We were concerned with two types of services: the production of pest control and security within the complexes. These services were chosen as they are homogeneously supplied

in all complexes. Similarly, both types of services have public goods characteristics. The supply of pest control, to be successful, must be extended to the entire complex. A single holdout can breed disaster for all others. Security is even more of a public good in that it is not an easily divisible product, nor is exclusion feasible.

For the supply of pest control (cockroaches, ants, etc.), technologies are pretty much standard across apartment complexes. All of the complexes we are interested in have their units sprayed at regular intervals — generally by an outside contractor. Initially the research team was convinced that the level of pest infestation was pretty much standard across all complexes. This conjecture was subjected to empirical test by asking individuals how satisfied they were with pest control in their complex. These responses were compared across each of the four types of apartment arrangements (see Appendix 2 for the selection of these types of arrangements). This yielded a measure of association indicating that the general level of satisfaction or dissatisfaction with pest control was fairly evenly spread across all complexes (tau c = .141, p = .005). The exception, raising the association value, was found in arrangement 5, where a third of the respondents were generally dissatisfied with pest control (compared with an average of 15 percent dissatisfaction in the other three apartment arrangements).

For the supply of security, most apartment complexes rely on a combination of patrol by the local police department and the apartment complex manager/owner. Here the technology is basically the same. Again comparisons were made among apartment types by asking individuals to rate security in their complex and comparing this across the clusters of apartments. The distributions of responses are similar, with a tau c coefficient equal to -.058 (p = .07).[8]

At least on the hired producer supply side of these services, there appeared to be few differences among clusters of apartment arrangements. on the other side it was necessary to measure coproduction of these services. For pest control, coproduction was operationalized by whether individuals purchased and used some means of pest control for their household over a specified period of time. If so, individuals were assumed to be adjusting their level of service, and hence, coproducing. With security, a more complex measurement was used. If individuals installed extra locks on their doors, purchased a light-timing device or locked their doors during the day as precautions against crime, we argued they were engaged in coproduction in the supply of security. Individuals who do not engage in coproduction of either pest control or security were considered to depend solely on the regular means of production for these services.

Hypotheses

The research project is designed to test two things. First, whether institutional structure has any effect on coproduction. The underlying theory suggests that institutional structure is a major explanatory variable for productive activity. Second, institutional theory suggests that rule structures constrain behavior in predictable ways. Coproduction is a particular form of behavior not in evidence everywhere, so understanding the type of structural configurations conducive to coproductive behavior is important.

In order to understand the production relationships that emerge in each of the four apartment arrangement types, we need to understand the constraints imposed on production by each of the three rule sets this study is concerned with. First we will consider each rule set separately as to its effect on particular modes of production. Note, however, these separate

rules may be more or less important when combined together under particular institutional configurations. Second, we will develop a set of hypotheses comparing institutions in order to gauge the effect of particular institutional changes on production strategies.

Entry Rules

Operationally, entry rules have been dichotomized as to whether entry into an apartment complex is strict or lax. Strict entry constrains the ease with which individuals can enter an apartment complex. In effect this services as an incentive for coproduction. Individuals before renting will have some idea of the bundle of services provided to the complex. Before selecting into a complex with strict entry conditions (which impose relatively high costs on individuals), we can assume that potential tenants will carefully consider the bundle of services offered. It then stands to reason that individuals will be more likely to adjust (coproduce) hired service production if some parts of the service bundle fail to meet their needs and yet they select to enter the complex.

Lax entry rules provides a converse set of incentives. Under lax entry, individuals are less likely to coproduce. Lax entry does not constrain renting an apartment, and as a result individuals have fewer incentives to understand the bundle of services when entering. They may coproduce if services do not meet their needs. However, coproduction in this case is an additional cost within the complex which individuals have not anticipated from the outset. Most likely this will result in requests for changes in service delivery by hired producers within the complex, which is cheaper than investing one's own resources. Relatively, then strict entry rules are likely to provide greater incentives for coproduction than are lax entry rules due to foreknowledge of the costs and supply of goods within

a complex.

Exit Rules

Exit rules too have been operationally dichotomized according to whether the ability to exit an apartment complex is lax or strict. Strict exit constrains the ease with which individuals can leave an apartment complex. This serves as an incentive for coproduction. Again the argument pertains to the mobility of tenants. If an institution is characterized by strict exit, then individuals are unlikely to have great latitude in leaving. If service levels need to be adjusted, coproduction is a likely candidate as a means of adjustment.

With lax entry rules, if services need to be adjusted, departing the institution is a likely remedy instead of investing one's own resources. Although exiting is costly, investing in coproduction is not worthwhile if leaving is a possibility. Similarly, the threat of exiting can serve as a powerful means of forcing changes in service delivery on the part of hired producers. This threat is likely to be cheaper than is coproduction. Strict exit relative to lax exit, then provides greater incentives to coproduce due to the constraints on departing from the complex.

Information Rules

Information too has been operationally dichotomized as to whether information about service delivery is difficult or easy to obtain. Theoretically we have argued that coproduction is an information generating mechanism. By the same token, it is dependent to a large extent on whether information is easy or difficult to obtain. Alchian and Demsetz (1972) in their work on the production process argue that where information is difficult to obtain, producers contributing inputs to a product have incentives to shirk. This

is especially the case where the productive process is characterized by interdependent contributions. Coproduction of most goods and services is generally characterized by such production. Therefore, where information is easy to obtain, individuals are more likely to coproduce. Easily obtained information about the production of goods provides a means for individuals to monitor the contribution of others (especially hired producers) to the production of a service.

On the other hand, difficult information conditions constrain individual's assessments as to the contribution of others. Where such monitoring is difficult, tenants have difficulty in assessing the contribution by hired producers to service delivery. Similarly, services with public goods characteristics provide individuals with incentives to "free ride." Since monitoring the contributions by consumer-producers is difficult, incentives exist for each individual to contribute little or nothing to the production of the service. Therefore, we are likely to find a greater degree of coproduction under easy information conditions relative to difficult information conditions due to an individual's ability to assess the contributions by others to the production process.

Given these constraints provided by each rule, we can now develop hypotheses about the effects of institutional structure on coproduction by comparing apartment complexes across changes in rule configurations. The research design, as discussed in Appendix 2 detailed four clusters of apartment arrangements. These clusters provided both comparisons across rule changes and large enough samples to permit testing differences in coproduction. Along the three selected institutional rule dimensions (entry, exit, and information) the clusters of apartments fell as in Figure 1.

FIGURE 1 ABOUT HERE

This eight celled matrix has entires in cells 1, 4, 5, and 6. In turn, five comparisons are made. The simplist comparisons are those between cells 1-5 and 5-6 in which we find two of the rules constant with a change over only a single rule. Three more complex comparisons can be made between cells 1-6, 1-4, and 4-6. Here only a single rule is constant, with changes differently occurring in the remaining two rules. Coupled with these five comparisons, we can derive five hypotheses. These hypotheses concern the effects of changes in rule configurations on coproductive behavior. It cannot be argued that these rule configurations determine the type of production that will occur in any particular arrangement. Instead, these configurations contribute to the behavioral strategies individuals will employ in production. As a result in constructing these hypotheses we Will only be concerned with probabilistic statements. In other words we will attempt to ascertain the probability that changes across rule sets will change the likelihood of coproductive behavior.

Briefly these hypotheses can be stated as follows:

Hypothesis 1 can be expressed in probabilistic terms as:

$$(H_1) \qquad P(Cp)_1 < P(Cp)5$$

This says that the probability of coproduction in apartment arrangement 1 is is less than in arrangement 5. The rationale for this is that there are no changes along the constant rules of lax entry and easy information. The only change is from lax exit to strict exit. Above it was argued that strict exit constrains individual mobility and that individuals in such an institution are more likely to coproduce than individuals in institutions characterized by lax exit. This hypothesis permits a test of this assertion.

Hypothesis 2 can be expressed:

$$(H_2) \qquad P(Cp)_5 > P(Cp)_6$$

Here both apartment arrangement 5 and arrangement 6 have similar rules across two dimensions: lax entry and strict exit. The change is from easy information in arrangement 5 to difficult information in-arrangement 6. As argued above, easy information is more likely to produce coproductive behavior than is difficult information given that the other two rules remain constant.

Hypothesis 3 can be represented by:

$$(H_3) \qquad P(Cp)_1 \gtrsim P(Cp)_6$$

This states the probability of coproduction in arrangement 1 is (weakly) more likely than in arrangement 6. Both apartment arrangements share a common rule type -- lax entry. In arrangement 1 the apartments are characterized by both lax exit and easy information. This particular configuration of rules should produce weak incentives to coproduce. The entry and exit conditions combined provide incentives for mobility, something not conducive to coproduction. However, the ease with which information can be generated provides some incentives for coproduction. In arrangement 6 strict entry and difficult information yields an interesting configuration mixture. Strict exit constrains an individual's ability to withdraw, providing incentives for self-adjustment of services. However, difficult information works to negate this incentive. It is unclear whether this interaction provides any positive incentives for coproduction. What incentives exist are likely to be small. We are then likely to see a tendency for greater coproduction in arrangement 1 than in arrangement *6.*

Hypothesis 4 can be expressed:

$$(H_4) \qquad P(Cp)_1 > P(Cp)_4$$

Here lax exit is a common feature to both apartment arrangements. The apartments in cell 1 are characterized by lax entry and easy information.

While lax entry and exit conditions provide disincentives for coproduction due to potential mobility, easy information provides some incentives for coproduction. Arrangement 4, however, has fewer incentives. Strict entry requires individuals take into account service patterns before entering and to adjust service levels via coproduction if necessary. However, difficult information conditions work against the likelihood that individuals will coproduce (and possibly- against the knowledge of service levels individuals had before entering the arrangement). Therefore, given these two different configurations, we are likely to find greater coproductive activity in arrangement 1 than in arrangement 4.

Finally, hypothesis 5 can be represented by:

$$(H_5) \qquad P(Cp)_4 = P(Cp)_6$$

This says there is likely to be little difference in the amount of coproduction between individuals in these two arrangements. Both apartment types are constrained in coproducing by difficult information. Arrangement 4 is characterized by strict entry and lax exit, while arrangement 6 is the converse. Due to the interaction between entry and exit rules, it is difficult to say which institution will exhibit a greater likelihood of coproduction. For arrangement 4, strict entry and lax exit will provide small incentives for coproduction, but difficult information is likely to negate those incentives. For arrangement 6 lax entry and strict exit will provide some incentives for coproduction, but difficult information is likely to negate those incentives. For arrangement 6 lax entry and strict exit will provide some incentives for coproduction, but again the effect of difficult information conditions is likely to negate those incentives. Therefore, the probability of coproduction in these arrangements should be similar.

Results.

Log-linear analysis was used in order to test each of these hypotheses. Such an analytic device has the merit of being a simplified means for understanding relationships among categorical variables. Log-linear analysis consists of two steps that correspond to the two distinct tests at which this project was aimed. The first step enables a researcher to use the odds and conditional odds of categorical variables in multicell contingency tables in order to select the most parsimonious and theoretically interesting model from a set of hierarchical models. This corresponds to the project's interest in determining whether institutional structure makes any difference for the type of production strategy that individuals use. The second step involves estimating the strength and direction of the relationships among the variables in the selected model. A linear additive model (a logit model) is used to compare the magnitudes among those additive parameters in order to ascertain the effects of various independent variables. Further, such a model yields a log odds ratio of a specified dependent variable. This corresponds to the project's interest in testing predictions as to the probability of coproduction occurring in one type of apartment arrangement vis-a-vis another.[9]

Four variables were of concern in this analysis. These included the dependent variable, coproduction, and independent variables comprising the apartment arrangements, the length of residence in an apartment complex and the income of the tenant household. The operationalization of coproduction has already been discussed above. The apartment arrangements were those apartments appearing in the appropriate cells for each hypothesis (see Figure 1). We argue that the length of residence variable is appropriate because individuals with a longer period of tenancy in a complex should

have a greater investment in seeing that proper service levels are supplied in the complex. To some extent this variable should also capture a network of informal arrangements that long-term residents have with one another, which also might contribute to differences in levels of coproduction. This variable was treated as a dichotomous variable, differentiating between individuals who had been tenants for less than 1 year and those who had been for greater than 1 year. Given that there is a great deal of mobility among residents in apartment complexes (partially due to the transient student population of the community) and the fact that the survey was conducted 8 months after the beginning of a new school year, the 1 year dichotomy seemed appropriate. The final variable was income. Again this was dichotomized, with the division made between households with less than or greater than $10,000 income. This division fell along the median income for respondents, and served not only to estimate income effects on coproduction, but also to distinguish the student and nonstudent population (the student and low income variable had a simple correlation coefficient of .48 with $p = .001$). This set of variables yielded a four dimensional two-way contingency table from which log-linear models and logit estimates were derived. A different table was constructed for each hypothesis.

Hypothesis 1

The first step in testing hypothesis 1 was to select an appropriate and parsimonious model describing the relationships among the dependent variable, coproduction, and the three independent variables. Table 1 lists a number of theoretically interesting models. Since coproduction is the dependent variable, the simplist model is (ARI)(Cp) which fits

only the marginals of the dependent variable, hypothesizing that there is no significant relationship between any of the independent variables and coproduction. At the other extreme is the (CpARI) model, the "saturated" model that includes all four variables and all possible interactions. This model, of course, best "fits" the table, as the fitted marginals of the table are equivalent to the observed marginals of the table.

Identifying the "best" model involves selecting the most parsimonious (and theoretically relevant) model that also fits the data. The appropriate test for identifying the "best" model involves taking differences of the calculated likelihood ratio chi-square value (L^2s) of two models and comparing their differencences to differences in degrees of freedom. Unlike the usual convention of searching for large chi-square and small p-values log-linear analysis does the opposite . In comparing models we are testing a null hypothesis that there is no difference between models. A good starting point for model selection is to take the most complicated model with the smallest chi-square and compare this with *a* less complex model (a more parsimonious model). As can be seen from Table 1 the mode 1 (CpA)(CpR)(CpI), which includes relationships between each independent variable and coproduction provides a very good fit with an L^2 = 2.60 and 4 degrees of freedom. However, with a gain of only L^2 = .30 and an extra degree of freedom, the less complicated model (CpA)(CpR) fits extremely well. With an additional gain of L^2 =1.18 and another degree of freedom the (CpR) model fits very well. Other less complicated models do not fare as well, with additional comparisons (differences in L^2 compared with differences in degrees of freedom) becoming significant at an a level of .05.

From Table 1 we are left with deciding between three models: (CpR), (CpA)(CpR) and (CpR)(CpI). All three provide reasonably good fits to the

observed marginal frequencies of the original contingency table. The general rule of thumb in selecting among such models is to select the most parsimonious model. However, this strategy is contingent on the theoretical interest of the researcher. In this case, the model (CpA)(CpR) was selected as it included a variable of great importance -- the institutional structural variable. This model says that first there is an observed interaction among all three independent variables. Second, coproduction is related with institutional structure. Third, coproduction is related with the length of residence. Basically the model tends to support the contention that institutional variables have a relationship with coproduction. The magnitude of this relationship can be estimated using a logit model.

A logit model is simply a transformation of the additive parameters (the marginal distributions of each variable) contained in the model. In turn it is possible to estimate the magnitude of these parameters (or their relative contribution) to the dependent variable. Using the notation of Goodman (1972), the logit model for (CpA)(CpR) can be expressed:

$$\phi_i^{Cp} = \beta_i^{Cp} + \beta_i^{CpA} + \beta_1^{CpR} + \beta_{111}^{ARI} \qquad \text{where i = the apartment arrangement}$$

In this case Φ^{Cp} is the log of the conditional odds of coproducing, β^{Cp} is similar to the intercept term in regression and the other parameters represent the contribution of effects of each parameter to the calculation of the conditional odds.[10]

The calculated parameters for each arrangement are:

$$\phi_1^{Cp} = 3.412 - .236 - .456 + .070$$

$$\phi_5^{Cp} = 3.412 + .236 - .456 + .070$$

The effect parameters for β^{CpA} tell us that the apartment arrangement in cell 1 of Figure 1 (lax entry, lax exit, and easy information) contributes

negatively (although somewhat weakly) to the likelihood of coproduction. Length of residence has a stronger effect, with shorter periods of tenancy contributing negatively to coproduction. Finally, the interaction of all three independent variables contributes only slightly to the overall effect. Note that in the two equations above, the only change in the beta parameters is with a change from -.236 to +.236. Since these parameters reflect the probability that an individual will be in one cell of a fitted table rather than another, and since the apartment arrangement variable is a dichotomy, the probabilities must sum to zero.[11] If we compare the log odds for coproduction in the two apartment arrangements, we find that:

$$\phi_1^{Cp} < \phi_5^{Cp} \qquad \text{where: } \phi_1^{Cp} = 2.79 \text{ and } \phi_5^{Cp} = 3.262$$

This is in accordance with hypothesis 1. However, it should be noted that the difference in log odds is not considerable, and as previously noted, the effect of the institutional parameter is weaker than that of the length of residence variable.

Hypothesis 2

The same procedure was used in testing hypothesis 2 as in hypothesis 1. The first step involved identifying the "best" fitting model. As can be seen from Table 2, the most complicated model, (CpA)(CpR)(CpI) provides a very good fit. However, a more parsimonious model is the (CpA)(CpR) model, with an increase of only $L^2 = .05$ at the cost of an additional degree of freedom. Another, more parsimonious model is the (CpR) model. As can be seen from Table 2, the "cost" of moving from the (CpA)(CpR) model to the (CpR) model is $L^2 = 3.52$. This is significant at the .06 level, which is very close to the .05 value used in this research to reject the null hypothesis that there is no difference in the change of chi-square values

between two models. Since the primary parameter of interest is the relationship between institutional structure and coproduction, and since the (CpA)(CpR) model fits the marginal table quite well, this model was selected. Other comparisons with this model fare even less well. This model indicates that coproduction is affected by both institutional structure and length of residence.

If we turn to a logit of this model, we can again estimate the effects of these parameters on the dependent variable, coproduction. Again, our model is:

$$\phi_i^{Cp} = \beta^{Cp} + \beta_i^{CpA} + \beta_1^{CpR} + \beta_{111}^{ARI} \qquad \text{where } i = \text{the apartment arrangement}$$

The comparison across apartment types under hypothesis 2 was between apartments 5 and 6. The corresponding logit equations are:

$$\phi_5^{cp} = 2.664 + .470 - .228 - .348$$

$$\phi_6^{Cp} = 2.664 - .470 - .228 - .348$$

Here it can be seen that for the apartment arrangements, institutional structure has a strong main effect on coproduction. For arrangement 5 this effect is positive, and negative for arrangement 6. The effect of length of residence is weak and negative. This states that a shorter period of residence contributes negatively to the log odds of an individual coproducing. Finally, the interaction of all three independent variables is substantial and negative. Comparing the log odds of coproducing in various arrangements yields:

$$\phi_5^{Cp} > \phi_6^{Cp} \qquad \text{where: } \phi_5^{Cp} = 2.558 \text{ and } \phi_6^{Cp} = 1.618$$

This comparison of the log odds is consistent with the prediction of hypothesis 2. The effect of the institutional parameter in this model is fairly strong as can be observed from the difference in odds.

Hypothesis 3

As seen from Table 3, three models appear to fit the marginal values quite well. The most parsimonious is the (CpR) model. The other two models have two interaction terms, the (CpA)(CpR) model and the (CpR)(CpI) model. Again we have selectedthe (CpA)(CpR) model on the grounds that it contains one of the parameters of interest for this study. Again, this model shows that institutional structure is related to coproduction as well as length of residence.

The logit of this model is represented by:

$$\phi_i^{Cp} = \beta^{Cp} + \beta_i^{CpA} + \beta_1^{CpR} + \beta_{111}^{ARI} \quad \text{where: } i = \text{the apartment arrangement}$$

The corresponding logit parameter values for apartment arrangements 1 and 6 are:

$$\phi_1^{Cp} = 2.636 + .260 - .458 - .424$$

$$\phi_6^{Cp} = 2.636 - .260 - .458 - .424$$

Institutional structure has a slight main effect on coproduction. For arrangement 1 this effect is positive and for arrangement 6 it is negative. The more important effects are found in length of residence (again a shorter period of residence contributes negatively to coproduction). Similarly, the interaction of all three independent variables contributes substantially (and negatively) to the log odds of coproducing. A comparison of these odds yields:

$$\phi_1^{Cp} > \phi_6^{Cp} \qquad \text{where: } \phi_1^{Cp} = 2.014 \qquad \text{and } \phi_6^{Cp} = 1.494$$

This comparison of the log odds is consistent with the prediction of hypothesis 2. The marginal contribution of the institutional effects on coproduction seem to be weak, while the change in the log odds ratios is slight.

Hypothesis 4

The set of models for hypothesis 4 are found in Table 4. As can be seen from the Table, none of the models provides a very good fit for the data. The most complex model involving main effects for the three independent variables -- (CpA)(CpR)(CpI) -- has an $L^2 = 10.67$. The null hypothesis that this model is not significantly different from the saturated model is upheld undertaking the difference of chi-squares and comparing for the difference of degrees of freedom ($\Delta L^2 = 10.67$, df = 4, significant at .030). As a result we are unable to test this hypothesis with any degree of confidence.

Hypothesis 5

The models for hypothesis 5 are found in Table 5. As seen from the table, again the models do not fit the marginal odds of the observed frequencies too well. The null hypothesis that the most complex model -- (CpA)(CpR)(CpI) -- is not significantly different from the saturated model is only barely disconfirmed ($\Delta L^2 = 8.51$ df = 4 significant at .074). Only two models have a small enough likelihood ratio compared to their degrees of freedom with which to begin selecting a model. These are the (CpR)(CpI) and the (CpI) models. The interesting thing to note is that in neither of these models is there a main effect between institutional structure and coproduction. While this does not allow us to develop a logit based on the relationship between structure and coproduction, this supports the hypothesis that there would be little difference in coproduction between apartment arrangement 4 and arrangement 6 based on the structural variables of these arrangements.

• Discussion

As seen from above, the directions of four out of five hypotheses were substantiated. This lends support to the contention that institutional structure contributes to the likelihood of an individual coproducing. From the hypotheses it appears that both exit and information conditions have strong effects on the level of coproduction. The results with regard to entry rules is mixed. The remaining structural rules that are thought to characterize institutions remain untested. Apartment complexes appear too similar along dimensions of aggregation rules, decision points and position rules. What these contributions are, and how they interact with the other rules, remains something to be tested.

Something to note in this series of tests is the consistent presence of length of residence effects. In each of the logit models we find that short-term residence in an apartment complex is negatively related to the probability of coproducing. The effect appears to be that individuals with an investment of time in an apartment may be constrained from exiting by this investment. Also it may be that exogeneous variables such as the location of the complex or design of the floorplan serve as obstacles to exit. Individuals then find coproduction a relatively cheap means of augmenting services. If so, this does not obviate an institutional model. Instead,, it indicates a measurement problem in operationalizing the institutional rules.

Lacking in the analysis is an effect of income on coproduction. Even where a (CpR)(CpI) model was rejected in favor of the (CpA)(CpR) model, the magnitude of the β^{CpI} parameter was never larger than .115 (and averaged .083). This appears to indicate that income effects (and those relationships attendent with income) had little to do with the likelihood of coproduction.

It is obvious that studying coproduction in apartment complexes is somewhat removed from the political sphere. Even so, coproduction remains an important variable of interest. Individuals expend real resources to transform the production of pest control and security. Admittedly the interest of this project is not to detail those types of apartment complexes that best encourage coproduction. Apartment arrangements provided a useful set of institutions in which a variety of arrangements existed and provided a tractable empirical test. The concern instead is whether differences in institutional configurations make any difference for coproduction. The results indicate there is some utility in pursuing a theory of institutional constraints on coproduction. The next step for such a project ought to be the further development of those theoretical constraints. Shepsle (1979) has outlined one rigorous means of proceeding.. Only after further theoretical development should we pursue additional testing. After that point we might wish to extend an institutional theory of coproduction to a general theory of participation.

Conclusion

The bulk of this paper has concentrated on developing those institutional constraints that affect coproduction. This is motivated by a reaction to traditional accounts of participation that hold that the presence or absence of participation is only associated with the sociological characteristics. of various populations. The extension of this point yields unjustified conclusions on the nature of participation. If we see participation preponderately engaged in by upper-middle class whites, and if we ascribe to such individuals a practice of civic virtue, the implication which follows is the danger posed by mass participation (see Joseph's critique of

democratic elitism, 1981).

The alternative explanation offered here is that participation should be conceived as an activity partially dependent on the structural rules that frame the behavioral options open to individuals. If such is the case (and this paper provides some initial empirical support) then a discussion of the presence or absence of participation must also account for those obstacles inherent in institutional orderings. The observed unequal SES skew for participation may in fact reflect an institutional ordering which constrains a particular set of individuals in their participatory activity.

More narrowly, this paper gives some insights into the concept of coproduction. It was argued that coproduction contains the classical attributes of other forms of participation. It affedts the redistribution of goods and services in society, thereby affecting the types of policies which public agents implement. Also, coproduction leads to control over public agents through monitoring activities. Coproduction serves as a demand mechanism, enabling individuals to signal their preferences for service supply via their own contributions to the production of the service. Finally, coproduction helps inform individuals as to the process of service production. Presumably, individuals armed with knowledge of the production process ought to be able to make clear decisions for preferred levels and quality of services.

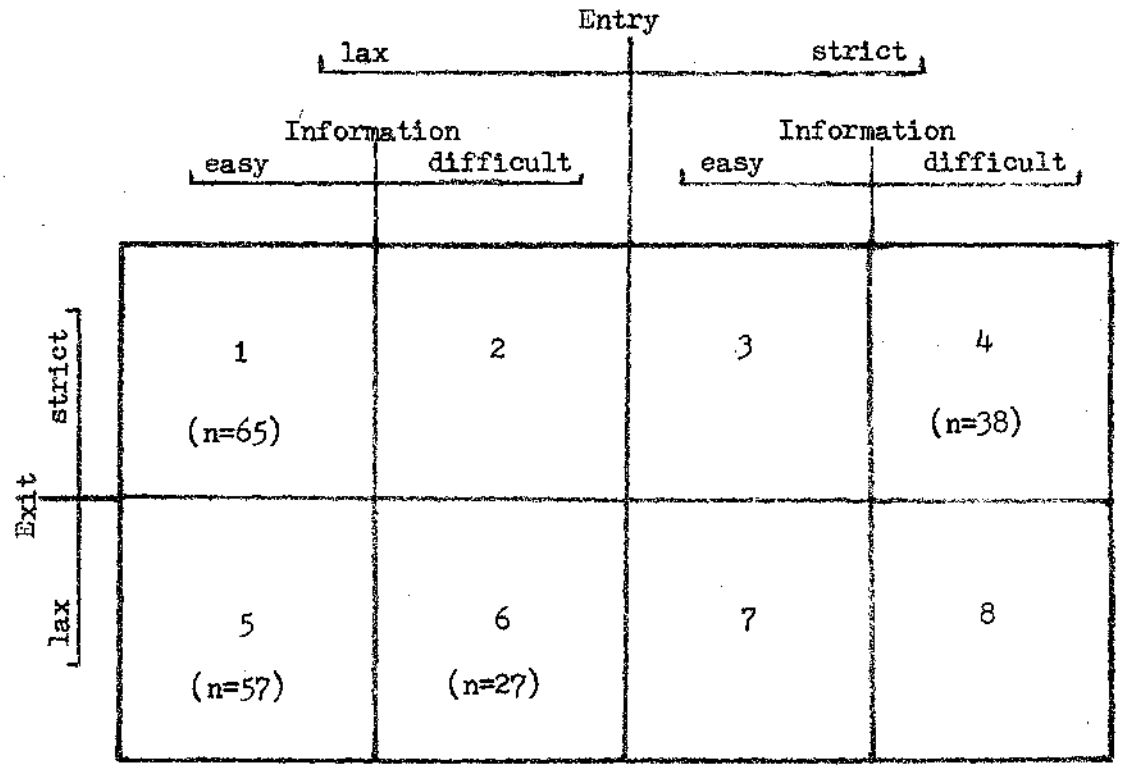
More importantly, coproduction is a means of enabling individuals to come to grasp with their own environment. Coproduction (where it is possible) allows an individual to transform a product into something which is better suited to his/her own needs and unique circumstances. Similarly, where coproduction is encouraged;, individuals may adjust service supply to levels

they prefer. Finally, citizen coproduction may be valuable in augmenting the scarce supply of services by a producer. This latter point may become extremely important for individuals (or communities) attempting to maintain a constant level of service supply given shrinking budgets.

From a normative perspective, coproduction (like participation more generally) may serve to heighten citizen interest in the society which envelops them. This, as Tocqueville argues, is the foundation of democracy. Interested citizens will curb both the self-interested excesses of leadership and their own self-interest. Even something as mundane as coproducing cockroach control may be elemental to an interested, participatory citizenry.

Figure 1

Apartment Arrangements by
Institutional Configurations



Note: total n=187

Table 1: Models for Coproduction (Cp), Apartment Arrangement (A), Length of Residence (R) and Income (I)

Model	L^2	df	p-value
(CpARI)	.000	0	---
(ARI) (CpA) (CpR) (CpI)	2.60	4	>.5
(ARI) (CpA) (CpR)	2.90	5	>.5
(ARI) (CpA) (CpI)	7.38	5	.194
(ARI) (CpR) (CpI)	3.46	5	>.5
(ARI) (CpA)	7.38	6	.287
(ARI) (CpR)	4.08	6	>.5
(ARI) (CpI)	7.91	6	.245
(ARI) (Cp)	7.98	7	.334

Table 2: Models for Coproduction (Cp), Apartment Arrangement (A), Length of Residence (R) and Income (I) *

Model	L^2	df	p-value
(CpARI)	.000	0	---
(ARI) (CpA) (CpR) (CpI)	0.35	4	>.5
(ARI) (CpA) (CpR)	0.40	5	>.5
(ARI) (CpA) (CpI)	5.66	5	.340
(ARI) (CpR) (CpI)	3.82	5	>.5
(ARI) (CpA)	6.65	6	.375
(ARI) (CpR)	3.92	6	>.5
(ARI) (CpI)	10.31	6	.112
(ARI) (Cp)	10.38	7	.168

*To account for a random zero in this model, a value of 0.5 was added to each cell.

Table 3: Models for Coproduction (Cp), Apartment Arrangement (A), Length of Residence (R) and Income (I)*

Model	L^2	df	p-value
(CpARI)	0.000	0	---
(ARI) (CpA) (CpR) (CpI)	2.52	4	>.5
(ARI) (CpA) (CpR)	3.19	5	>.5
(ARI) (CpA) (CpI)	6.86	5	.231
(ARI) (CpR) (CpI)	3.36	5	>.5
(ARI) (CpA)	6.87	6	.333
(ARI) (CpR)	4.20	6	>.5
(ARI) (CpI)	8.84	6	.183
(ARI) (Cp)	8.86	7	.262

Table 4; Models for Coproduction (Cp), Apartment Arrangement (A), Length of Residence (R) and Income (I)*

Model	L^2	df	p-value
(CpARI)	.000	0	---
(ARI) (CpA) (CpR) (CpI)	10.67	4	.030
(ARI) (CpA) (CpR)	10.74	5	.057
(ARI) (CpA) (CpI)	12.06	5	.034
(ARI) (CpR) (CpI)	14.31	5	.014
(ARI) (CpA)	12.34	6	.055
(ARI) (CpR)	14.58	6	.024
(ARI) (CpI)	16.48	6	.011
(ARI) (Cp)	17.27	7	.016

*To account for a random zero in this model, a value of 0.5 was added to each cell.

Table 5: Models for Coproduction (Cp), Apartment Arrangement (A), Length of Residence (R) and Income (I)*

Model	L^2	df	p-value
(CpARI)	0.00	0	---
(ARI) (CpA) (CpR) (CpI)	8.51	4	.074
(ARI) (CpA) (CpR)	10.50	5	.062
(ARI) (CpA) (CpI)	9.92	5	.077
(ARI) (CpR) (CpI)	8.57	5	.127
(ARI) (CpA)	13.30	6	.038
(ARI) (CpR)	10.87	6	.092
(ARI) (CpI)	9.94	6	.127
(ARI) (Cp)	13.60	7	.059

*To account for a random zero in this model, a value of 0.5 was added to each cell.

Footnotes

[1]For an excellent paper tracing the connection between liberal assumptions and empirical work on participation, see Mason, 1980. Also see Mcpherson, 1977, for a general survey of the implications of liberal-democracy. This paper will consciously examine the concept of coproduction in light of these liberal-democratic assumptions.

[2]Nondivisible publicly provided goods appear to have a similar dynamic. Such goods are characteristic of pure public goods. Olson (1965) has noted some of the incentives at work in the provision and supply of such goods.

[3]Much of the discussion at this point follows from Parks, et al., 1981.

[4]For a range of activities that might be considered coproduction, see Percy, 1978; Sharp, 1980a, 1980b; Whitaker, 1980.

[5]This case is subject to debate. Seldom will one find a good or service subject to jointness in production where either a hired or consumer producer will solely produce the good. More ordinarily we will find an interdependent relationship of the following form:

$$Q' = aCp^{d} * bHp^{e}$$

This simply indicates no amount of the good will be provided without the involvement of either a hired producer or a consumer producer.

[6]When thinking of consumer inputs, we are concerned with inputs to the supply of some good, not inputs that are requisite to the provisioning of a good. The difference relates more or less with proximity to production. Provisioning activities relate to a host of nonproductive activities -- paying taxes, user fees, or even contacting local officials. Supply activities are those which directly affect the production and supply of a good (transforming that good). My taking my garbage to the curb (or hiring a neighbor to do so) is elemental to the production of solid waste removal. Meanwhile, user fees result in the good being produced regardless of whether I contribute or not. Such fees are important to the supply of the good, but are akin to provisioning.

[7]Where coproduction is substitutive, monitoring costs are relatively inexpensive. Within such a production function the marginal contributions of either type of producer is readily obtained. Shirking can then be easily detected. Such is not the case with interdependent production. Here the marginal contributions by consumer and hired producers are joint. As a result, shirking is difficult to detect. Monitoring becomes difficult, providing incentives for both producers to shirk. See Alchian and Demsetz, 1972.

[8]Tau c is a measure of independence for rectangular tables. Like pearson correlation coefficients, they vary between -1 and 1, measuring associations between variables.

[9]Log-linear techniques are an extension of contingency table analysis. The basic thrust of the technique is to develop a saturated hierarchical model that accounts for all effects, and then try to develop equally good models (in a statistical sense) which incorporate parsimony and theoretical soundness. To take a simple example, imagine all possible relationships among 2 dichotomous variables, A and B. This yields a 2 dimensional table with 4 cells. The entries in each cell can be estimated from a model of the form:

$$F_{ij} = \eta \tau_i^A \tau_j^B \tau_{ij}^{AB}$$

where: i = the categories of A
j = the categories of B
η = the geometric mean of the number of cases in each cell of the table
τ^A, τ^B = the marginal distributions of the variables A, B
τ_{ij}^{AB} = the conditional distribution of a category of A given a category of B

F_{ij} then becomes the expected cell frequency. In the case of the saturated model above (where all of the main effects on interactions are included) the expected frequences would equal the observed frequencies. If we drop one of the effects (which would indicate that there is no relationship of that effect to the others), we can test how well our expected frequencies under the new model compare with the observed frequencies. For good, brief surveys of this technique and its applications, see Knoke and Burke (1980) and Fienberg (1977).

[10]For an excellent article describing the use and value of logit models, see Goodman (1972).

[11]The "beta" parameter values are a log transformation of the expected odds ratios -- usually designated τ. This transformation takes 2 times the natural log of τ. Since the product of the expected odds ratios for a dichotomized τ is equal to 1, the corresponding sum of the $2\text{Ln}\tau$ (the betas) should be zero. See Goodman, 1972. It should also be noted that in the logit equations we are only interested in the effect of the institutional structure on coproduction -- the hypotheses are not concerned with regular production nor the length of residence. As a result, we have arbitrarily set the levels of the length of residence and income variables to the first category. There would be no change in the direction of the expected log odds of coproduction if we took the second category for length of residence. Note:

$$\phi_1^{Cp} = B^{Cp} + B_1^{CpA} + B_2^{CpR} + B_{111}^{ARI} = 3.412 - .236 + .456 + .070 = 3.702$$

and

$$\phi_5^{Cp} = B^{Cp} + B_5^{CpA} + B_2^{CpR} + B_{111}^{ARI} = 3.412 + .236 + .456 + .070 = 4.174$$

In this case the log odds of coproduction in apartment arrangement 1 is still less than the log odds of coproduction in apartment arrangement 5.

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