THE PATH-DEPENDENT CITY

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Urban policy making approximates the components of a path-dependent model—random selection and self-reinforcement—which suggests that cities get locked into suboptimal policies. Thus, despite rigid rules of individual and collective behavior posited by many urban theorists, identical cities can evolve along drastically different paths. The author shows how simple time-series models can overlook path dependence and demonstrates the trends of a path-dependent series using budget data from Chicago and New York. New York exhibited policy lock-in in the decades following the Great Depression, but Chicago did not.

The urban studies field is rich in theory and empirical work. It is often the case, however, that the deeper one goes into a city's variegated political, economic, and social history, the less useful is the array of theories available to place the city-specific processes one observes in a broader cross-sectional and temporal context. The result is a split in the literature between those who favor broad econometric analysis of general theories and those who eschew general theory building in favor of contextual analysis.

Although econometric models of urban processes and city-specific contextual histories seem to be at methodological odds with one another, both suffer similar external validity problems. When using general models to predict the predominance of business interests and development spending, for example, one must contend with contrary outcomes in a number of cities. Contextual accounts provide convincing explanations when general models fail, but they are often city specific to the point that they provide little guidance to those searching for general processes. What is worse, many urban studies are hindered by determinism, no theory of variation, or inadequate conceptualization of history as a constraining force.

In this article, I will explain how path-dependence theory applied to urban politics can ameliorate some of these problems. Path-dependence theory suggests that city governments can get "locked into" suboptimal policies

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enacted at a time when their future consequences are unclear. As I will illustrate, it allows for extensive intercity variation in the face of seemingly deterministic rules of individual and governmental behavior, and it reveals that identical cities can have drastically different historical paths. I also show how we can observe this process in time-series data from Chicago and New York. My analysis confirms Fuchs' (1992) account of the divergent paths of each city after the Great Depression.

URBAN THEORIES

Many urban theories are deterministic insofar as they envision a set of structural forces or personal characteristics that predominantly order the behavior of city political officials. Peterson (1981) argued that city officials must yield to the overwhelming imperative of economic development. Schneider (1989) found that city spending is quite vulnerable to intercity competition for a viable tax base. Pohlmann (1993) applied Marxist theory to a set of cities to explain their economic decline. Public-choice theorists (Croswell 1975; Niskanen 1971; Tullock 1965) have suggested that program expansion is a common governmental characteristic. The problem is that the actions of many city officials are clearly not governed by the forces these theorists envisioned.

In a related vein, many general theories of urban political economy do not address variation. Variation is viewed as stochastic or as the result of omitted variables. The theoretical models clearly cannot explain variation in city policies and outcomes, but many nondeterministic models have the same shortcoming. Ladd and Yinger (1991) controlled for the effects of external variables on city fiscal health and found substantial unexplained variation.[1] In a broad fiscal-crisis literature, many scholars blame some combination of declining federal aid, inflation, recession, and exogenous demographic changes for city problems (Bradbury, Downs, and Small 1982; Kamer 1983; Nice 1987), with limited consideration of cities in similar circumstances in which fiscal crisis is not experienced.

A number of scholars seek to explain variation by focusing on contextual forces rather than on general models. Yates (1977) showed the primacy of pressure groups in New York City, which suggests that city political and economic outcomes will vary according to the pressure group terrain. Elkin (1980) introduced the notion of urban regimes, which has driven a rich set of intensive studies of city-specific governing coalitions and their political and economic outcomes (DeLeon 1992; Elkin 1987; Stone 1989, 1993; Stone and Sanders 1987). Clark and Ferguson (1983) and McDonald (1984) focused on

local political culture to explain variation. Monkonnen (1984) revealed that city defaults on debt during national economic crises between 1850 and 1936 resulted from a variety of local and external forces operating in city-specific contexts. Waste (1989) argued that city policy making cannot be understood without reference to several internal contextual variables.

Scholars using contextual approaches to explain variations that general models usually do not address often seek proximate causes without fully analyzing the underlying processes that enable them, and the manner in which seemingly different contextual factors across cities in fact are related as a result of these underlying processes. In short, no general theory of variation exists, only an understanding that context produces variation. Finally, many of these urban models and paradigms either fail to account for history as a constraint on future choices by city policy makers or do not do so in an explicit and systematic fashion. I argue here that paying closer attention to history in the urban policy-making process yields a theory of urban political economy that remedies the aforementioned problems.

PATH DEPENDENCE

Path dependence is an emerging theory in economics and political science that explains current equilibria, such as the state of technological development, industry location, or a firm's organization, as a function of early random shocks in the decision process that led to the equilibrium (Arthur 1987, 1990, 1994; David 1985; Farrell and Saloner 1985, 1986; Katz and Shapiro 1986).[2] Path-dependence theory may provide insights into the actions and nonactions of public officials and the limits of government. In the urban setting, it explains why cities often stick with policies that are at odds with what general models and common sense would predict.

PATH DEPENDENCE DEFINED

Arthur (1987) developed applications of the Polya process, a mathematical example introduced by Polya and Eggenberger (1923) that demonstrates path dependence. To understand the Polya process, imagine an urn with infinite space containing one red ball and one white ball. If one were to randomly select one ball, there is a 50% probability that one would select a red ball and an equal probability that one would select a white ball. If one then proceeded to sample with replacement but with each replacement, added another ball of the same color as the ball replaced, one would be sampling with double replacement. Therefore, if one had selected a red ball in the first

round and after replacement, two red balls and one white ball were in the urn, the corresponding probabilities of selection are 66.6% and 33.3%.

If one repeatedly sampled with replacement, one would fluctuate for some time between different probabilities of selecting red and white balls, but Arthur (1987) showed that eventually, the probabilities will stabilize; because the effects of subsequent selections decline with each selection round, they eventually have no impact on the probability of selecting red or white.[3] Thus any number of equilibria can be derived between one and zero probabilities of red and white balls. Any particular equilibrium achieved depends on two things: the history of selection—specifically, on random events early in the history of selection—and the self-reinforcing nature of selection—that is, the fact that one samples with double-replacement.

Arthur (1987) demonstrated that nonlinear Polya processes, with several differently colored balls and complex functions describing the replacement process, also exhibit path-dependent properties, although in the form of attraction points rather than an eventual stable equilibrium. Thus, although the repeated selection in such a case does not result in a fixed probability of selecting a particular colored ball from the urn, it does result in a lesser, but arguably significant, state of stability.

Arthur (1987) suggested that one could apply path-dependence theory to events such as chemical reactions and firm location decisions. What is common about these path-dependent processes is that random perturbations early in the history of selection, coupled with the self-reinforcing nature of these selections, shape the subsequent outcomes. Most important, the influence of random shocks on the equilibrium of the system implies that equivalent units of analysis involved in similar selection processes may have divergent final equilibria or attraction points. Two similar city governments, for example, may have vastly different outcomes from a similar policy-selection process. Path dependence, then, is a general theory of variation.

Not surprisingly, a number of scholars have applied path dependence either formally or informally to political processes. Stinchcombe (1968) discussed the reinforcing nature of social and institutional structures. Liebert (1976, x) found "repeated evidence of limits on policy choices arising from continuity and tradition as major forces shaping city governments and local political cultures." Perry and Watkins (1977) presented a cumulative-causation argument to explain how cities prosper and decline on the basis of industries they develop and protect. Mollenkopf (1983) described a process whereby progrowth coalitions built by urban liberals contained the seeds of their own destruction. North (1990) applied path-dependence theory to the study of institutional change, and his argument about the importance of limited information as a factor to be considered in institutional analysis is compel-

ling. Baumgartner and Jones (1993) and Jones (1994) argued that policy subsystems are path dependent and can get locked into suboptimal equilibria. Jackson (1994) applied a path-dependence model to party competition.

A PATH-DEPENDENCE MODEL OF CITY GOVERNMENT

Although a few political scientists have already begun exploring the role of path dependence and most urban theorists recognize the role of history as a constraining force, none have provided an explicit demonstration of the connections between path-dependence theory and urban political decision making. I undertake such a demonstration because path-dependence theory produces implications that a recognition of its component parts alone does not provide. The two defining features of the Polya process described by Arthur (1987) are self-reinforcement (sampling with double replacement) and randomness. In this section, I show how city policy-making structures approximate both features.

Self-Reinforcing Policies

Urban policies, and public policies in general, are self-reinforcing. Stability is clearly a dominant characteristic of governmental institutions. Organization theory confirms the importance of institutional decision-making structures, routines, information streams, language, norms, and rules as constraints and shapers of individual behavior that serve to promote stability within the organization (Cyert and March 1963; March and Olsen 1984, 1989; March and Simon 1958). Theories derived from the concept of bounded rationality suggest that policy makers have an incentive to make only marginal adjustments in programs (Braybrooke and Lindblom 1963; Lindblom 1959; Wildavsky 1988, chap. 3) and to satisfice (Simon 1957), leading to limited solution searches (Cyert and March 1963).

The characteristics of a city's policy-making environment not only produce stability but also render policies resistant to change. Public-choice theory indicates that bureaucrats often have incentives to protect and to expand the programs under their administration (Croswell 1975; Niskanen 1971; Tullock 1965). City bureaucracies often operate according to their own rules and norms even when these conflict with the demands of city officials, especially demands for change (Lowi 1967). Furthermore, interest groups, businesses, and private citizens have varying amounts of influence on city policies (Banfield and Wilson 1963; Berry 1989; Dahl 1961; Stone 1989; Yates 1979) and will act to protect existing policies that benefit them.

This policy-making environment is self-reinforcing in that its characteristics are not solely exogenous; they are in part the products of the evolving policy-making system (Baumgartner and Jones 1993; March and Olsen 1989, 53-67; North 1990). Past policy decisions alter institutional constraints, perceptions, preferences, and norms. Programs take on greater meaning once they are implemented (Skocpol and Finegold 1982), and institutions resist elimination and control, especially as their linkages with other institutions grow (Krasner 1984). Policy solutions become preferred once policy makers have invested in them (Jones and Bachelor 1993, 206-207; Levitt and March 1988). Policy becomes its own cause as program growth fosters unforeseen consequences (Wildavsky 1987). Past decisions also affect the resource and organizational constraints facing private actors and the overall city resources available for allocation.[4]

City policies have consequences that constrain the set of choices available to city officials at a later date. They are self-reinforcing just as double-replacement is self-reinforcing in the urn example: a choice at time t makes a similar choice more likely at time $t + 1$ and makes alternative choices less likely. Once the city government invests in a subway system, implements a city pension plan, or enacts rent control, it embarks on a self-reinforcing policy path.

Random Selection

To see how random selection is related to city decision making, it is necessary to consider its place in path-dependence theory. Path dependence occurs when random shocks early in the history of a selection process influence the resulting equilibrium of that system (Arthur 1987). In fact, the process is path dependent because of this self-reinforcement, not because the draws are random. If one could determine which balls would be chosen by looking into the urn, the final equilibrium would still be the product of early choices because of double replacement. The only difference is that one can predict this equilibrium based on the selection rule.

Randomness is not essential for path dependence to operate, but it accounts for the final equilibrium of the system. The random component of the Polya process described by Arthur (1987) is what makes it interesting, because it provides variation. Because of random sampling, the Polya process can produce widely varied outcomes. If a deliberate-selection rule is used instead, the outcome will be the same (so long as the rule does not change) no matter how many times the process is repeated.

The question is how city decision making, which is purposive, can be described as random. Certainly city officials are "looking into the urn" when

they make their decisions, but suppose the hypothetical urn were filled not with red and white balls, but with dark blue and green balls.[5] Suppose further that the light was poor, the chooser was wearing sunglasses, and that the chooser had to supervise several screaming children while making selections. Finally, imagine that the chooser had limited time to choose in order to arrive at the preferred equilibrium. Would the chooser's goal be achieved?

City officials are purposive actors, but they face similar constraints. They have limited information, numerous distractions, and little time to make decisions. Imagine that instead of one person making selections from the urn, there was a committee in disagreement about the final goal and which balls to choose. The goal would become even harder to achieve. This is an even more suitable analogy to city policy making.

Thus although city decisions are certainly not random, they are made with imperfect information about their consequences. As the burdens on the chooser in the modified urn example are increased, the probability that the chooser will make the "right" choice from one to something less than one is changed—changed so that the "choice" becomes closer to what it would be were the chooser to choose blindly as in the original urn example. As the information and decision-making constraints on city officials increase, the more trouble they have making their optimal choice from the city policy "urn."

History as a Constraint

Given the self-reinforcing tendency of city policy and decision-making constraints on city officials, it becomes obvious how cities get locked into suboptimal policies. A number of consequences can flow from policy decisions. Unfortunately, officials cannot predict these consequences in all cases. This becomes a problem if subsequent information reveals that the consequences are suboptimal, given the goals of city officials. The self-reinforcing nature of city policies means that city officials are not free to act on this information because of the short-term costs or institutional barriers to change, which are themselves the products of the policies. The limited information is not simply a constraint that dissipates as more information becomes available; it is potentially a lasting constraint.

PUBLIC ENTREPRENEURS VERSUS LOCK-IN

Although path dependence can exist in many decision-making arenas, human societies have evidenced a tendency to overcome suboptimalities. Clearly, some agents or forces are at work to move economic systems out of the ruts that path-dependence theory predicts. Indeed, although path depen-

dence is used to explain the persistence of what appear to be suboptimal technologies (David 1985), Liebowitz and Margolis (1990) questioned the assumption that a market system often cannot be converted to more profitable technologies. They argued that the promise of profits will push private entrepreneurs to take on the costs of converting firms to better technologies.

The same claim has been made about the public policy arena, giving one reason to question whether path dependence poses a threat to cities. Teske and Schneider (1994) and Schneider and Teske (1995) demonstrated that entrepreneurs are an important source of change and innovation in public policy systems. They argued that just as the private entrepreneur has economic incentives to improve suboptimal technologies, the public entrepreneur has political incentives to improve suboptimal public policies.

According to Schneider and Teske (1995, 42), public and private entrepreneurs share three essential traits: They discover alternatives that can meet needs better than existing alternatives, they bear the risks of promoting changes under conditions of uncertainty, and they assemble coalitions to produce these changes. Although private entrepreneurs must convince providers of capital that their proposed innovations will yield economic profits, public entrepreneurs must convince voters (or their representatives) that a new policy will improve public welfare.[6] They accomplish this by reframing issues and political debates in a manner that enables them to build a winning political or electoral coalition.[7] For example, a public entrepreneur might use rhetorical and persuasive skills to reframe a city's recurring budget debate in terms of tax relief, creating electoral pressures for budget cutting where none existed before.

Schneider and Teske's (1995) work illustrates that not all policy environments are equally vulnerable to lock-in. They specified conditions for the likely emergence of public entrepreneurs that vary across municipalities, the absence of which implies a greater likelihood of lock-in. Some of these conditions, such as rapidly changing political preferences among citizens (p. 69) and persuasive ability on the part of potential entrepreneurs, are not easily measured. Others, pertaining to political structure and organization, can yield useful predictions about which city governments are more vulnerable to lock-in.

For example, Schneider and Teske (1995, 91-93) noted that public entrepreneurs must overcome a collective action problem in order to move a policy system to a new policy. As a result, they may find more success when operating at the neighborhood level because neighborhoods exhibit small-group homogeneity, which makes it easier to organize the coalition necessary to adopt a new policy. Cities with district elections may also make it easier for entrepreneurs to build local coalitions. In addition, Schneider and Teske argued that variables such as local interest-group structure (groups may serve

as springboards for entrepreneurs), a full-time mayor (who has much to gain from being an entrepreneur), and a city manager (who has the expertise to become a public entrepreneur) are important predictors of the rise of public entrepreneurs in a city.

Although Schneider and Teske (1995) provided convincing evidence of the conditions under which public entrepreneurism is likely to thrive, the corollary is that it is less likely where those conditions do not hold. Furthermore, there are additional conditions that can make public entrepreneurs less likely to emerge. It is clear, for example, that the nature and purpose of institutions is to resist change. As Schneider and Teske noted (pp. 41-69), this resistance grows with city size. They also explained (p. 76) that the "switching cost" of moving to the better policy can inhibit policy change, a point I will address further.

Finally, there are a few critiques of Schneider and Teske's (1995) analysis that undermine the claim that the potential for public entrepreneurism makes political lock-in unlikely. First, although technologies not selected in a path-dependent market process do not cease to exist,[8] policy options not chosen during the early history of a path-dependent political process might very well disappear because the chosen policy eliminates the alternatives.[9] If the development of a city's transportation infrastructure were modeled as a path-dependent process, for example, one might find that decisions about the location of roadways, bridges, and railways effectively negated the possibility of alternative locations (Kasarda 1985, 39; Small 1985).

Second, Schneider and Teske's (1995) analysis would benefit from a consideration of the difference between policy replacement and policy addition. They implied (p. 68) that much public entrepreneurialism involves sweeping away old policies in favor of better ones (they cited Schumpeter's [1942] creative-destruction analysis of free market economies to that effect). It is possible, however, that much of what Schneider and Teske counted as public entrepreneurialism amounts to policy addition, not replacement. The reason is clear: If the benefits to an entrepreneur from a new policy (increased authority, a new public-works program) equal the benefits from replacing an existing policy, given that the costs of enacting a new policy are probably lower than the costs of replacing an existing policy (which has those who want to protect it), rational entrepreneurs will seek a new policy.

DISCERNING PATH DEPENDENCE IN CITY DATA

The primary implication of path-dependence theory is that city governments may get locked into suboptimal policy paths. A city government that

is locked into a damaging set of policies via the process described earlier is substantively different from a city government that has more flexibility in its policy choices. The problem for the theorist is to discern this difference. I believe that simple time-series models, although useful for their parsimony and entirely adequate for the questions addressed, can lead to the obfuscation of path dependence. I demonstrate here how this is possible and suggest a simple method for detecting path dependence in time-series data.

Time-series analysis should serve two ends: prediction and substantive understanding. If an econometric model is an accurate depiction of the real world, then the coefficient attached to an independent variable reveals something about its contribution to the value of the dependent variable. Predictive ability flows from this understanding of the relationship. Any concern one might have about the impact of the past on the present is generally a concern about the effects of past values of independent and dependent variables on the present value of the dependent variable. Econometricians have developed a number of lagging techniques to deal with historical effect.

In conventional econometric analyses of time series, history is treated as a set of declining effects that contribute to the level of the current dependent variable. Path dependence contradicts such an assumption, but not mathematically. Consider a non-path-dependent time series:

$$Y_t = \beta X_t + \varepsilon_t, \tag{1}$$

where Y is a dependent variable, t represents time, X represents a vector of independent variables, and ε is an as yet unspecified error term. One has several options for modeling the effects of the past. Assume that theory and methodological concerns lead one to model the influence of the past in this time series with a lagged Y:

$$Y_t = \beta X_t + \gamma Y_{t-1} + \varepsilon_t, \tag{2}$$

where γ represents the effect of the previous Y on the current Y value, $\varepsilon_t = \rho\varepsilon_{t-1} + u_t$ (ρ representing the effect of the previous error term on Y and u representing a normally and identically distributed random variable with mean equal to zero and variance σ_u^2 that is independent of ε_{t-1}), and $-1 < \gamma < 1$ so that the series is not explosive.

It can be shown through substitution that this is equivalent to

$$Y_t = \beta X_t + \gamma Y_{t-1} + \gamma^2 Y_{t-2} + \ldots + \gamma^n Y_{t-n} + \rho\varepsilon_{t-1} + \ldots + \rho^n \varepsilon_{t-n} + u_t, \tag{3}$$

where n represents the number of observations. Because $-1 < \gamma < 1$, the most recent values of the lagged Y have the greatest weight.[10] But if a time series is path dependent, the early outcomes of the process, or the early values of

Y, determine the subsequent system equilibrium.[11] Although this theoretical twist yields a vastly different picture of the processes underlying the path-dependent time series than those underlying the non-path-dependent series generated by equation 3, the two models are structurally similar and mathematically equivalent. It is clear that if one wished to reflect a path-dependent time series, one would simply need to rearrange the weights attached to the past as shown in equation 4:[12]

$$Y_t = \beta Xt + \gamma^n Y_{t-1} + \gamma^{n-1} Y_{t-2} + \ldots + \gamma Y_{t-n} + \rho^n \varepsilon_{t-1} + \ldots + \rho \varepsilon_{t-n} + u_t. \quad (4)$$

What if it is not known that the time series is path dependent? The application of equation 3 to the series fits just as well, most likely better, than the application of equation 4.[13] A moment's consideration reveals why. Once the system settles down, all subsequent values of Y are strongly influenced by the first set of Y values. The series can be perceived as split between a small set of early determinative Y values, Y_E, and a longer second set of largely predetermined Y values, Y_{PD}. Although it is understood that the value of Y_{PDt} is determined for the most part by Y_E, the fact that Y_{PDt-1} is similarly determined means that the application of equation 3 to the series will indicate that Y_{PDt} is largely affected by Y_{PDt-1}. In short, incorrectly applying (from a theoretical standpoint) a first-order autoregressive structure, for example, to a path-dependent time series serves to attribute the bulk of historical determinative value to the immediately previous observation in the series, rather than to the first few values that actually determined the equilibrium of the system. Proximates are mistaken for ultimate causes.

I am not arguing that time-series models are inadequate for dealing with path dependence. A model such as equation 4 is just one example of how one might choose to model a path-dependent system explicitly. But there is no need to apply more sophisticated and arcane time-series analyses to account for possible path dependence with the data, because imposing a simpler time-series model on path-dependent data does no damage to the estimates of relationships between variables. One can study, for example, the effects of various city spending programs on a host of variables—such as city fiscal health, economic growth, and per capita income—and derive accurate estimates from simple time-series models, despite any path dependence in the data.

Because one can model the path-dependent process and obtain reliable and unbiased estimates of coefficients without considering this historical effect, one will reach a point at which prediction diverges from substantive understanding. Failing to detect the path-dependent nature of the data means that one will miss an important process underlying the values of the observed variables. What is worse, one will end up emphasizing the importance of

temporal proximity—evidenced by the predominance of first-order, geometric, and other declining lag structures in time-series analysis.

The problem arises when these simple models are used to infer or confirm ideas about decision-making processes. The good fit of the model may be perceived as a confirmation of theories about incremental policy making, for example. Or one might assume that officials in different cities are drawing from the same "distribution" of policy options and thus impute bad choices to a lack of information, intelligence, or caring. Most likely, although informational, institutional, and pressure-group constraints on policy making may be understood, inattention to the long-run behavior of the variables leads the researcher to miss a very interesting implication: that many cities may have evolved very differently if a few early choices had been different. Thus methodological concern lies not in explicitly modeling a path-dependent process but in identifying such a process to guide the theoretical approach to the system in question.

ANALYSIS OF NEW YORK AND CHICAGO DATA

Because Fuchs (1992) provided a comprehensive account of New York's and Chicago's budget histories, along with a painstaking review of 60 years of budget data from both cities, I use her data to illustrate the behavior of a path-dependent budget series.[14] Fuchs compared how Chicago and New York handled their respective fiscal crises in the 1930s to demonstrate her belief that "urban fiscal policy has varied from city to city and ultimately depends on complex, political interactions that are rooted in each city's particular history" (p. 4). She argued that although fiscal policy procedures were reorganized in the wake of Chicago's fiscal crisis, giving the mayor greater control over the budget and devolving some functions to surrounding jurisdictions, New York did not, which set the stage for its second fiscal crisis in the 1970s.

Fuchs (1992) used terminology that implies path dependence. She argued, for example, that fiscal policy structures in the two cities after the crises of the 1930s "were locked into place and reinforced by subsequent political interactions and policy decisions" (p. 72). She explained that Chicago officials managed to devolve authority for many functions to the governments of Cook County and the state of Illinois, freeing them from the potential burden these responsibilities can entail. New York's officials had no such luck. Furthermore, both local governments encountered pressure from reformers, which led, in New York's case, to the election of a series of mayors and council members who crippled the city's political machine. The "reformer" elected in Chicago after the depression actually strengthened the

political machine. These disparate election outcomes set the stage for Chicago's officials to be able to keep a tight lid on interest groups and municipal unions and New York's officials to lose control over the same.

Fuchs (1992) further argued that a combination of federal spending and mayoral preferences led to the primacy of non-common-function spending (hospitals and welfare, for example) over common-function spending in New York and that this "was simply reinforced over time making it extremely difficult for any individual mayor to change it" (p. 117). The interesting feature of her account is that in both cities, these decisions were the result of a combination of chance and imperfect information about their long-term consequences. Once made, these choices were reinforced, leading the cities down divergent paths.

Given Fuchs' (1992) account, one would expect New York's data to exhibit lock-in starting in the early 1950s, after the fiscal crisis spawned by the Great Depression.[15] This pattern should continue until its second fiscal crisis in 1975. Furthermore, by Fuchs' account, lock-in should be most evident in the data for New York's non-common-function spending, which was the focus of heated interest-group advocacy. Chicago officials, on the other hand, made fiscal institutional changes after the Great Depression that gave them greater ability than New York officials had to make yearly adjustments in program budgets.

A simple notion of a path-dependent budget is of a relatively stable series with few negative changes as program beneficiaries protect their turf. However, although equation 4 and the Polya process imply a stationary time series, when path-dependence theory is applied to political institutions, a nonstationary time series is not only consistent but expected.[16] A program budget may exhibit lock-in as a series of regular funding increases, because the groups and officials active in this policy area come to expect these increases and make it difficult for budgeters to do otherwise. Consider, for example, how program spending increases that are less than previous increases are protested by those affected as spending cuts. Declines in the rate of spending increase are a form of entitlement cut and can be as difficult to achieve as actual cuts or program elimination. After expressing the New York and Chicago fiscal data in real per capita dollars[17] to yield cross-sectional and temporal comparability, I converted them to yearly percentage changes to reflect this entitlement mentality.[18] Figures 1 and 2 show yearly changes in real common- and non-common-function spending[19] per capita for each city.

Both Chicago spending series reveal a greater number of negative yearly changes than do the New York series. Looking at the period of expected New York lock-in and Chicago budget autonomy, 1950-1974 reveals that Chicago

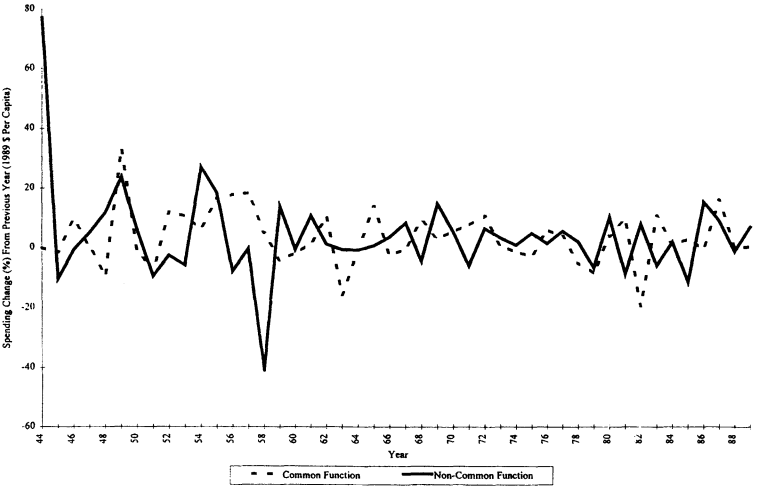

Figure 1: Changes in Chicago Common- and Non-Common-Function Spending, 1944-89

had 9 negative common-function and 11 non-common-function spending changes, compared to New York's 5 and 4 negative changes, respectively.

However, path-dependence theory predicts not only that city officials facing lock-in will have difficulty reducing spending but also that they will have little ability to vary even the spending increases. As a city's budget gets locked in, one should see declining variation in year-to-year budget changes as a result of increasing rigidities in policies and spending practices. With this in mind, I calculated a standard-deviation series for each city-budget-change series, using the standard deviation for the first five observations of spending changes (Y) as the first observation in the new series, then dropping the first Y and adding the sixth Y to yield the second standard-deviation series observation, and so forth. The result was a series of standard deviations from shifting sets of consecutive observations for each budget series.[20] This provides a picture of the evolution of each budget's yearly spending change variation.

The advantage of this measure over a simple examination of the direction of spending changes is that it controls for variation in the level of these changes. Increased spending on a category 9 times out of 10 will appear path dependent if only the direction of spending change is observed. If there are large variations in these levels, as I discussed earlier, there is less reason to

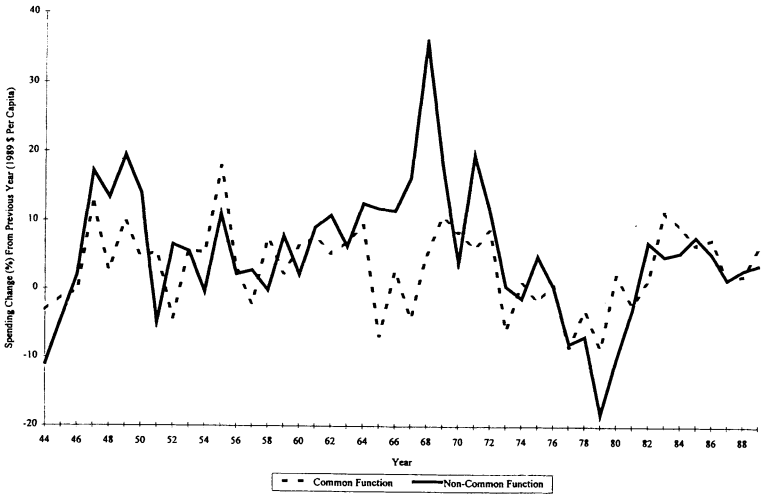

Figure 2: Changes in New York Common- and Non-Common-Function Spending, 1944-89

believe that a city is locked in because these change levels themselves are perceived by interested parties as an entitlement for which to fight. If a similar rate of spending increase occurs year after year even in the face of fiscal crisis (which will be discussed), this is a better sign of path dependence. The standard-deviation measure distinguishes between the two.

Figure 3 depicts the standard-deviation series for real common-function spending changes per capita for the two cities. The standard deviation in New York spending changes declines as expected, although it does exhibit a slight rise and plateau during the 1960s before declining until the fiscal crisis in the mid-1970s. Furthermore, it is generally lower than Chicago's spending change variation, especially given the sharp increase in Chicago's common-function budget variation in the 1950s. Still, the standard deviation in Chicago's common-function spending changes also exhibits a general downward trend, although not in a fashion nearly as drastic or as steady as that of New York. The two series converge after the mid-1970s, which reflects New York's resolution of its fiscal crisis and a downturn in Chicago's budget change variation.[21]

Because the accounts of Fuchs (1992) and others (Morris 1980; Savitch 1990; Shefter 1985) indicate that New York's non-common-function spending is very likely to exhibit lock-in if such a process is observable, a greater

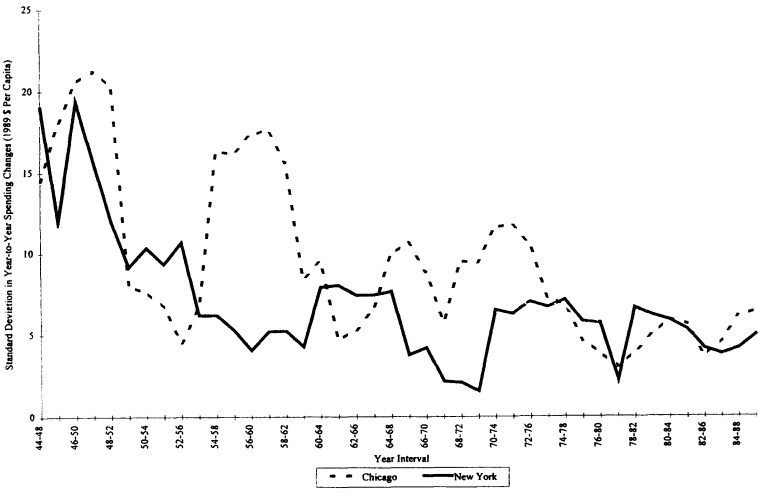

Figure 3: Standard Deviation in Common-Function Spending Changes: Chicago and New York, 1944-89 (five-year intervals)

difference may be observed between the two cities on that variable. Figure 4 depicts the standard-deviation series for noncommon-function spending changes per capita:[22]

In this case, the variation in Chicago's spending changes exhibits no downward trend for the period in question, and New York's variation decline is smoother than in its common-function series. The trends suggest that Chicago officials had much more discrepancy in year-to-year spending decisions than did New York officials, which is consistent with the arguments of Fuchs (1992) and others.[23]

EVALUATING THE PATH-DEPENDENCE MEASURE

Potential Bias

A problem exists with the assumption that the behavior of these series proves that New York's common-function spending is more locked in than is Chicago's. One may reasonably argue that such comparisons between cities are invalid if large differences exist in their spending levels, because equal budgetary changes between cities appear as unequal percentage changes insofar as the cities' budget bases differ. This applies to a time-series analysis

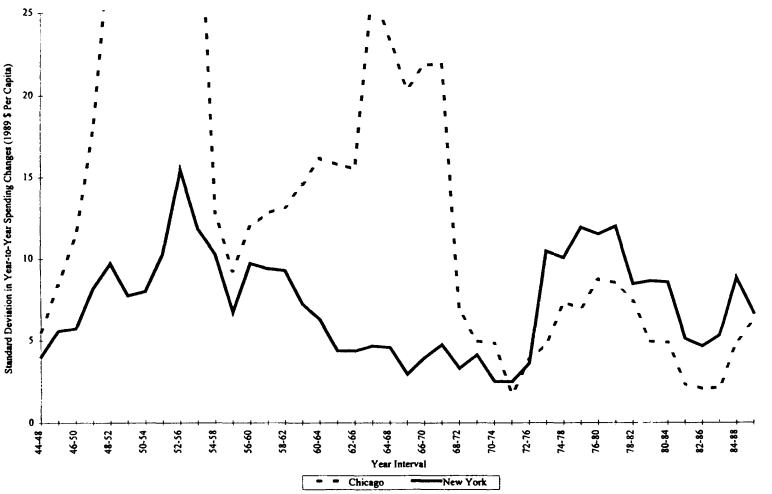

Figure 4: Standard Deviation in Non-Common-Function Spending Changes: Chicago and New York, 1944-89 (five-year intervals)

of a single city's budget variation as well. As the city's spending base grows, one might reasonably expect that spending changes as a percentage of that base will show a decline. A $200,000 program addition, for example, might reflect a 50% change or a 20% change, depending on whether the program budget is $400,000 or $1 million.

Suppose a city has a pattern of adding $200,000 a year to this program, but budget-conscious officials cut its funding one year. If that year is early in the series, the cut produces a larger standard deviation in budget changes than if the cut occurs later in the series simply because the overall budget has grown, hence reducing the portion added by each $200,000 increment. If it happens early in the city's history, what may count for budget autonomy gets obscured by the sheer weight of the budget in later years. If budget variation declines with budget size as the result of phenomena unrelated to the components of my path-dependence argument, then the standard-deviation series appears to be biased in favor of an indication of lock-in.

One must first consider the reasons why budget variation is expected to decline with budget size then ask whether they are distinct from path-dependence theory. From the previous example, one could ask why city officials do not increase the increments they allot to the program as its base grows. One reason may be that officials are more willing to experiment when

programs are very small and are thus more willing to make relatively large changes. Greater program size means that change entails greater monetary and opportunity costs and, hence, greater risk. A related reason may be that budget growth means budget constraints, so that new programs are less likely to be introduced, reducing budget variation compared to earlier years. Another reason may be that the portion of program spending taken up by capital maintenance and operation is a fixed cost. Yet another reason may be that program growth reflects satisfaction with its components, meaning that officials do not want to change their pattern of program funding.[24]

The first three reasons are consistent with path-dependence theory. In each case, reduced budget variation in the present results from past program decisions that constrain officials. Program growth becomes self-reinforcing because change is made more costly, and competing or complementary programs are delayed by budget constraints created by the original programs. The budget gets locked into a rhythm of steady growth that is evidenced by reduced variation. City officials do not increase the increments they allot to programs to keep pace with budget base growth because (1) unlike the percentage of the budget comprising each additional increment, the uncertainty that accompanies large projects does not diminish in inverse proportion to budget size; (2) budgets cannot grow indefinitely; and (3) they must operate and maintain the programs and infrastructure they already have in place.

Furthermore, this concern could be deemed irrelevant. In other words, the $200,000 program change in a city with a small budget is a bigger political event than an equivalent change in a large city budget, and stronger evidence of autonomy (lack of lock-in) is revealed in the small budget than in the larger budget. In that case, a measure of lock-in should reflect changes relative to the budget base. It is important to remember that I constructed the standard-deviation series from the budget changes across five-year intervals, so spending change variation at any point in the series is measured relative to other nearby changes in time, not to the whole series.

If these arguments are not persuasive, one can simply turn to the budget data for Chicago and New York. As Figures 1 and 2 indicate, neither city shows a marked tendency toward smaller percentage budget changes concomitant with budget-base increase during the period in question. New York's non-common-function spending change series, in fact, shows a sizable upward spike in the middle of the period during which I claim it is locked in.

Where Lock-In Should be Found

A useful test of the hypothesis that declining spending change variation is an indication of lock-in is to examine the shifting standard-deviation series

for each city's utility spending. Here, I use Fuchs' (1992, 300) definition and quantification of city utilities, which include city-owned and -operated water, gas, electric power, and transit systems. Utilities represent fixed spending commitments that are difficult to change. The variation in yearly utility spending changes for both cities can be expected to be large at first, reflecting the addition of utilities to the city budget, followed by a precipitous decline as the budget is trimmed down to utility maintenance. Once a utility is in place, a city is very unlikely to remove it, for all of the reasons associated with lock-in. Figure 5 depicts this measure. The variation is large early, as each city created its utilities, followed by extremely low variation reflecting the lock-in expected for this measure.

Lock-In Versus Satisfied Officials

One argument that might be raised against inferring lock-in from low spending-change variation is that city officials are able to change but are happy with their spending practices. In other words, how can one distinguish between a city that is locked into bad policies that officials would change if they could and a city that has a satisfactory set of programs? A reasonable way to do this is to examine the behavior of the variation in city spending changes in relation to changes in city short-term debt, which often corresponds to city fiscal stress. If a spending pattern is not locked in, then the variation should increase in response to recurring short-term debt. In other words, even if officials are happy with spending patterns, persistently high short-term debt should spark them to change these patterns, if only to ride out a few bad years. Figures 6 and 7 depict New York's real short-term debt per capita superimposed over the standard-deviation series for its common- and non-common-function spending.[25]

Despite escalating short-term debt, New York officials did nothing to change existing spending patterns, leaving it to emergency authorities appointed by state officials in 1975 to restructure the city's debt and rein in expenditures. In fact, as real short-term debt rose from $200 to more than $1,000 per capita, variation in New York's non-common-function spending patterns declined steadily. This is especially noteworthy given that the average per capita short-term debt of all other cities with populations over 400,000 in 1975 was $124.54 per capita.[26] By any standard, New York's persistent short-term debt was a problem, and the fact that it continued to grow made the situation worse.

This suggests that insofar as they cared about the fiscal health of their city, they were constrained from changing their spending patterns. There is clear case-study evidence that New York officials have been historically hampered

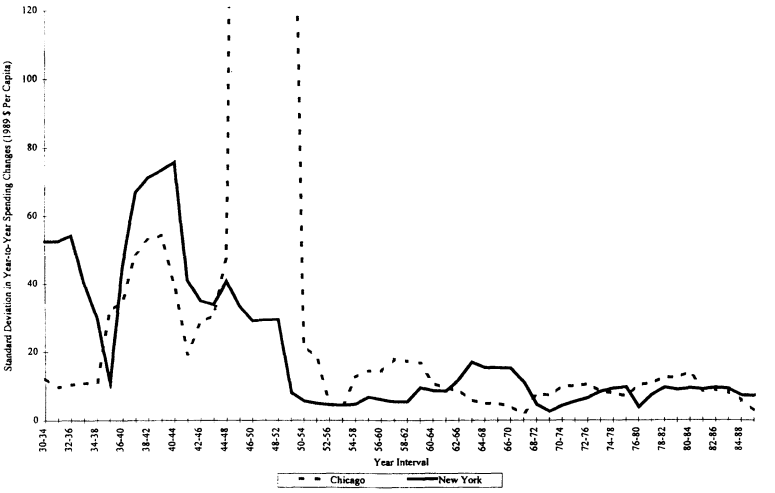

Figure 5: Standard Deviation in Utility Spending Changes: Chicago and New York, 1930-89 (five-year intervals)

by policy lock-in. As Fuchs (1992) illustrated, early institutional decisions made the city especially susceptible to policy lock-in compared to Chicago. Starting at roughly similar points after the Great Depression, Chicago and New York city officials made gradual institutional changes that insulated Chicago and exposed New York to a contentious interest group and political party environment. The officials had little foresight about the ultimate consequences. This turbulent New York environment in turn fosters policy lock-in. Given this situation and the budget crisis that followed in 1975, I believe that the foregoing analysis is strong evidence that path dependence is observable in city budget time-series data.

PATH DEPENDENCE AND URBAN THEORY

Path dependence can resolve the three theoretical problems I addressed in the beginning: determinism, no theory of variation, and inadequate conceptualization of history as a constraining force. If rigid general rules of behavior described all cities as in deterministic models, path dependence would still generate variation as limited information combined with contextual variables in early policy stages to approximate randomness, which can lead to policy lock-in.

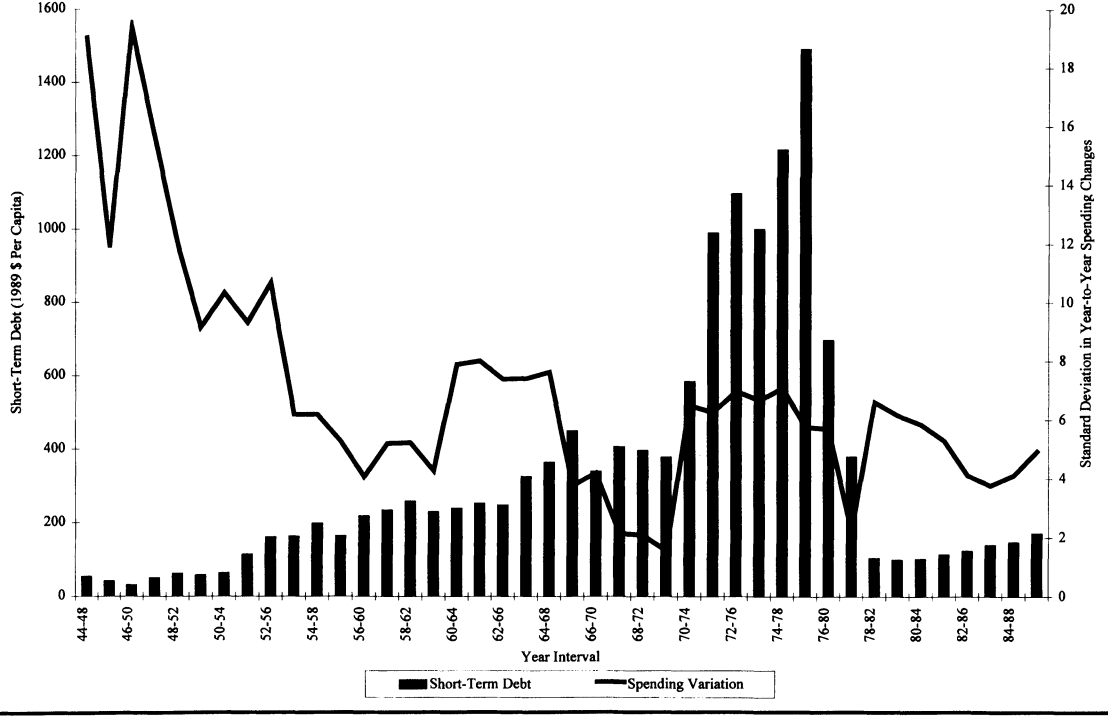

Figure 6: New York Common-Function Spending Variation and Short-Term Debt, 1944-88 (five-year intervals)

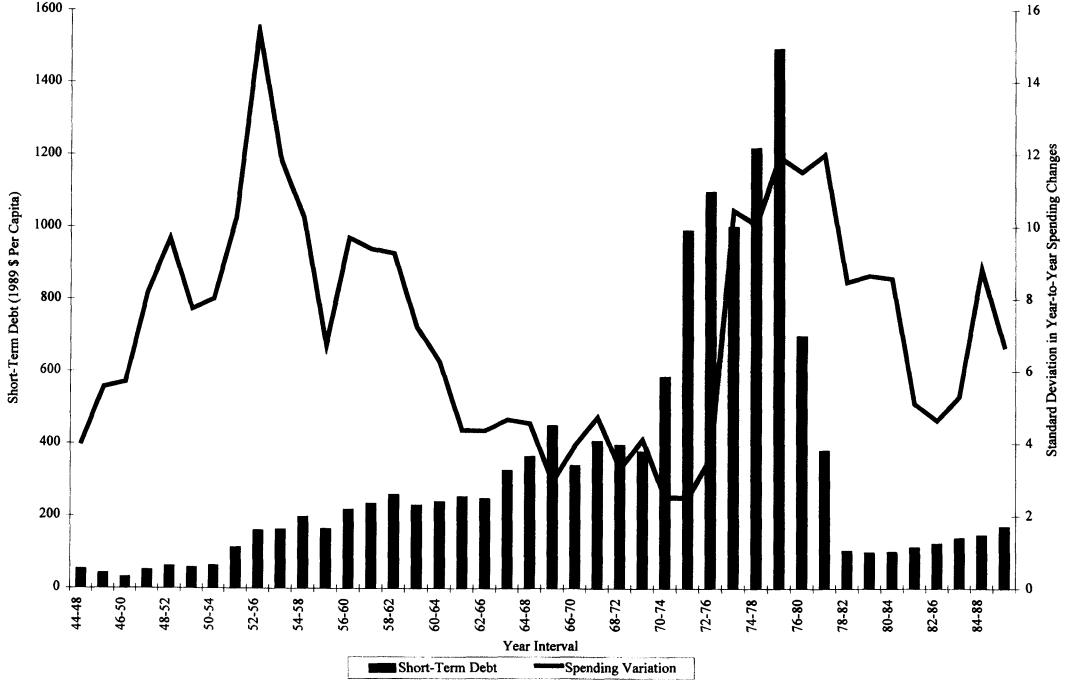

Figure 7: New York Non-Common-Function Spending Variation and Short-Term Debt, 1944-88 (five-year intervals)

Although other urban theories explain variation by abandoning their generalizability, path dependence allows the two to coincide by reconciling context and general theory and subsuming both into a theory of variation governed by general rules. The confluence of limited information and self-reinforcing policies explains why cities with similar political economic environments, interest-group terrains, and fiscal resources can embark on drastically divergent historical paths. These similarities might lead to equivalent aggregate preferences, but limited information about how best to achieve the goals resulting from these preferences leads to initial policy variation, which gets reinforced by the interaction of state and private actors and institutions. Even if the set of decisions made likely by the cities' policy-making environments are very similar, the timing of these decisions can lead to divergence for the same reasons.

The important point is that cities with similar initial characteristics or that are facing a similar crisis (e.g., the Great Depression) may evolve differently because of underlying differences that the researcher fails to identify. This is the claim of contextualists who dispute the usefulness of general econometric models. At the same time, the process underlying this context is generalizable, which many researchers either do not address or outright deny. Furthermore, the importance of context in the path-dependence model does not preclude a general model of relationships between variables. In a path-dependence model, context takes on importance not because it overpowers any potential generalizations of cause and effect across cities but because it affects the values of the variables in question. Small contextual differences can create lasting constraints that determine the values of the variables to which generalists attend.

Thus path-dependence theory can help bridge the theoretical gap between contextualists and generalists. It reveals that context is important because it encompasses the cumulative effects of history, which is important to all cities. At the same time, path-dependence theory does not deny the necessity of creating an econometric model of city fiscal health, because context indicates the source of variation and lock-in and the general model assesses the effects of the variables, shaped by context, on one another. Path-dependence theory is useful as a general theory of how cities can acquire the characteristics they exhibit, but that does not eliminate the necessity of modeling the impact of these characteristics.

Finally, path-dependence theory reveals history as a constraining force. It incorporates two primary components, limited information and self-reinforcing policies, which are viable explanations for two important dilemmas pertaining to city policies. First, city officials often enact policies that harm the city's fiscal and economic health as well as the political health of the officials in

question. A plausible explanation is that they have imperfect control over policy and operate with limited information about the future consequences of these policies. Second, even when the deleterious effects of certain policies become apparent, cities do not change them. A plausible explanation in this instance is the second key component of path-dependence theory: The policy-making environment facilitates self-reinforcing policies.

PATH-DEPENDENCE THEORY AND INCREMENTALISM

Path-dependence theory bears a strong resemblance to incrementalism. Both incorporate assumptions about limited information, organizational behavior, and feedback (Braybrooke and Lindblom 1963; Lindblom 1959). The difference between the two centers on the self-reinforcing nature of policy making. In the case of path-dependence theory, the potential for policies to self-reinforce and become entrenched presents the possibility of policy lock-in, or strong attraction. Early events have primary importance. For incrementalists, the most important period is that immediately preceding the present (Sharkansky 1967; Kamlet and Mowery 1987), and the process is portrayed as a bounded, rational way to pursue good policy. Path-dependence theory allows for incremental decision making in response to an uncertain environment. However, it also allows for early incremental decisions to shape the environment and for the environment in turn to shape organizational behavior. This means that some later incremental decisions become more likely than others, and optimization, or even changing bad policies, becomes very difficult.

QUESTIONS FOR FURTHER RESEARCH

Are All Cities Locked In?

Some might argue that although New York may have been locked into bad policies during the period in question, cities like Chicago are just as locked into their own set of policies.[27] Thus New York's lock-in is the result of a mix of pressure-group politics and bureaucratic decision making, and Chicago is locked in by its dependence on and responsiveness to market forces.[28] New York is locked in by political forces; Chicago is locked in by economic forces. This is problematic for the standard-deviation measure because it suggests that Chicago's greater budget variation is actually the result of market swings that only give the appearance of greater budget autonomy. This is a testable hypothesis that deserves further consideration. Although my measure is a

useful indicator of political lock-in, some adjustments may have to be made to test for economic lock-in, such as a correlation of the standard-deviation series with state and national economic indicators.

In any event, to equivocate the political-economic environments of New York and Chicago by calling them both locked in is to overlook a very important difference: Chicago's path is clearly much better than New York's, insofar as financial receivership is a troubling state of affairs for a city. Given these disparate conditions one must ask why. Why did New York's city officials pursue this disastrous path? Why do some city officials spend to the brink of financial disaster but others do not? Path-dependence theory and lock-in provide an answer and suggest answers for other cities.

Political Lock-In Versus Structural Lock-In

It may be useful to distinguish between two types of examples that I have used to illustrate path-dependent policy lock-in. The first type, political lock-in, includes suboptimal policies that, once implemented and found to be wanting, are difficult to change because of bureaucratic and interest-group resistance to them coupled with difficulties produced by the complexity of the policy environment. In this category, I would include rent control, overly generous municipal union contracts and pension plans, city hospitals that prove to be inefficient and duplicate the efforts of other medical centers, and the like.

The second type, structural lock-in, includes policies that do harm but simply cannot be undone. In this category belongs, for example, the placement of roads that change traffic patterns and destroy neighborhoods and retail districts such as the harmful effects on local retail and residential areas that were incurred with the placement of Boston's I-93, Detroit's Lodge Freeway, and Chicago's State Street pedestrian mall. Another example might be social welfare or educational policies that alter the behaviors of their intended beneficiaries in ways not easily reversible. Still another might be tax and regulatory policies that drive out small businesses and undermine neighborhoods.

In political lock-in, a city gets locked into a bad policy until a public entrepreneur can generate a switch to a better policy. This switch can be expected to eliminate at least some of the bad consequences of the suboptimal policy. Indeed, it is this promise of a better outcome that drives the public entrepreneur. This kind of lock-in is not as permanent as the urn example might suggest. In structural lock-in, the results of a city's bad choice do not disappear when the policy is changed. Once a city places a road or enacts a set of zoning rules that destroy a small neighborhood retail base, tearing up

the road or removing the zoning rules will not lure the businesses back, especially when destruction of the retail base brought about social problems such as crime.

System Origins

The word *path* implies a beginning and an end. A theory of path dependence should involve some consideration of these matters as well. The simple answer is that the process begins when the choices begin. For example, by Lotchin's (1972) account, San Francisco's growth began with the placement of an outpost during the Mexican-American War. The choices one considers and how one defines the path and lock-in depend on the level and focus of analysis. Path-dependence theory provides useful tools and insights whether one is considering the city's geographic growth or the evolution of particular programs.

In the case of time-series data, there is no need to decide beforehand where in the series to look for path dependence because it is relatively simple to examine the entire series. Such an examination might then guide the researcher's contextual analysis. For example, I noted earlier that Chicago's budget variation declines after the 1970s (see note 23), which may indicate the beginning of path-dependent tendencies as the Daley machine crumbled. In this instance, important details may be missed in a case study that would not be missed in an empirical analysis, although the opposite is usually argued.

It might also be the case that although New York City is fertile enough territory for a city-level path-dependence analysis, other cities are not. Consequently, the appropriate level at which to search for political or structural lock-in may be the program level—where streets are built, where zoning decisions are made, and so forth. Ultimately, the use of path dependence as a theoretical and analytical tool must be guided by the same question that sparked my interest in the subject: Why do they *do* that? The "that" is where the analysis should be applied, whether it be a single program, a web of interrelated policies, or city spending in general.

Can City Governments Break Out of a Bad Path?

The previously cited works by Jones (1994) and Schneider and Teske (1995) provide probably the best answer to this question. These scholars focused on the importance of reframing and relied on the work in this area by Tversky and Kahneman (1981), Riker (1986), and Baumgartner and Jones (1993). As I showed earlier, Schneider and Teske argued that public entre-

preneurs use their persuasive skills to reframe issues and debates in a manner that enables them to build a coalition in support of their proposed policy change. Presumably, city governments can break out of political lock-in when someone emerges in the political arena who can reframe the issue in question. Successful reframing becomes more likely, as Schneider and Teske and Baumgartner and Jones suggested, when a crisis is encountered that yields rapidly changing political preferences and increasing unmet demands on the part of voters. Baumgartner and Jones argued that this produces a pattern of punctuated policy equilibria, which is supported by their evidence.

Thus crisis may yield the impetus a city government needs to break out of a suboptimal set of policies. This certainly explains the behavior of the city officials in New York and Chicago following the crisis of national economic depression and the behavior of New York's city officials following the fiscal crisis in 1975. Falling back on the urn examples, perhaps lock-in gets broken when the city equivalent of a sudden influx or outflow of balls occurs. Thus economic or political crises may enable city officials to radically alter existing policies. These crises may be exogenous (e.g., the Great Depression) or endogenous (e.g., exposure of widespread political corruption).

An important characteristic of crises that prompts the emergence of public entrepreneurs is that they focus public attention on a problem and invite simplification of what otherwise is a complex policy environment. Once the city government can no longer pay its bills, complicated finance issues that usually exist outside the public eye become very simple, very quickly: bankruptcy. It is much easier for an entrepreneur to offer solutions in an environment in which *any* alternative appears to voters to be better than the current state than it is to offer solutions to problems that few voters understand.

The level of complexity in the policy environment, then, is an important determinant not only of the likelihood of lock-in but of the likelihood of breaking out of lock-in. Public entrepreneurs can only build a coalition for change when they can offer a clear vision of the problem and its alternative, just as private entrepreneurs can only attract capital from financiers when they can offer a clear vision of the path to future profits. In this regard, New York is a friendly testing ground for path dependence because of its size and complex network of interlocking policy units. Its housing policy, for example, is decided not only by a number of quasi-independent rent and zoning boards but also by local councils, an independent housing court, and several agencies within the city government. Surely this environment is much more likely to inhibit, for example, a public entrepreneur's attempt to eliminate rent control in New York City (especially given that such a change would

also require the support of New York state government) than would the environment in Berkeley, California.

Awareness of the importance of complexity should direct future research into path dependence applied to cities, but it should also temper any claims of universality one might derive from the foregoing comparative analysis of Chicago and New York. In short, although I believe there is ample proof of path dependence in New York, New York is, in many ways, an anomaly, given its size and complex, contentious policy environment. With that said, I believe even if little evidence of political lock-in is found outside New York and a few other large cities, there is plenty of reason to expect structural lock-in, with all this implies about variation and the importance of limited information in city decision making in any city.

WHY PATH DEPENDENCE THEORY?

A critic might insist that I have argued nothing that is not already widely acknowledged. History matters and is cumulative. Early choices can shape later options. Time and the order of events are important contextual variables. City officials can affect the cost and benefit structures that motivate and constrain their behavior. City officials are often ignorant about future consequences until it is too late to change their policies without heavy political costs. One may agree with each of these comments yet remain skeptical about the usefulness of path-dependence theory as a general tool with which to approach political institutions.

If one accepts these notions, however, one is already using path-dependence theory, which simply places them in a coherent framework and shows how they are related to one another. More important, path-dependence theory helps one to integrate the useful portions of disparate and seemingly conflicting theories into an urban research agenda that focuses on the local government's internal political processes, decisions, and history as possible explanations of the city's present circumstances. The advantage of considering the connections between the implications of path-dependence theory for social science and the mathematical/scientific applications of this theory is that further insights in the application can lead to unforeseen insights for the theory. That is precisely why academics from diverse disciplines have already begun to consider the applications of this theory as a means of facilitating the spread of an insight gained in one field to other fields (Waldrop 1992).

If a city's history is perceived as consisting of multiple sets of crossroads, many of which can lead to dead ends that are difficult to exit and must be

navigated at night, then the implications of path-dependence theory can be understood. Further attention to this theory, which is a powerful tool in other sciences, may further research into political institutions by providing a different way to view the evolution and equilibria of these institutions. I have only briefly touched on a few possibilities here, regarding one particular political institution, city government. Path-dependence theory not only provides a potential method of examining other political institutions but it might reveal something about the practical limits of government activity in general and about the ability of public officials to act consistently for the common good.

NOTES

1. Ladd and Yinger (1991) do not set out to explain intercity variation—they seek to illustrate the effects of external forces on that variation.

2. Cross (1988) and Bartik (1991) discussed a related, but less rigidly defined, concept, *hysteresis*, which is used to suggest that temporary shocks to an employment equilibrium change the long-run equilibrium.

3. When sampling with double replacement, as the number of balls in the urn increases, the effect of any one selection on the probabilities decreases.

4. Past decisions can also cause outside actions, such as a state legislature revoking some city privilege, which further constrain future city options. For example, Mollenkopf (1983) argued that the construction of an urban coalition by Democrats led to countermobilization by conservative Republicans.

5. I am grateful to John Kingdon for this idea and for the thinking that it inspired.

6. Politicians do not always have to convince voters to support a policy. Popular politicians can afford some unpopular policies. Also, the length of a term provides the opportunity for the politician to take out a "loan" by making unpopular decisions early. If these decisions push the political economic system out of a suboptimal rut by election time (e.g., temporary recession to end inflation, temporary job losses to increase trade), the politician pays off the loan successfully.

7. I will return to this notion of reframing later, in a discussion of the conditions under which city governments can break out of lock-in.

8. Their development, however, may be stunted by virtue of being passed over.

9. I discuss this possibility later, under the heading Political Lock-In Versus Structural Lock-In.

10. For treatments of the equivalencies, differences, and derivations of various time-series models see Kmenta (1986), McCleary and Hay (1980), and Mills (1990).

11. In other words, early Y values constrain the distribution of subsequent Ys.

12. Actually, because the early selections in a path-dependent process have a determinative power based on their joint distribution, a more accurate equation would reflect this with a variable set of weights attached to the first few observations of Y. Omitting this from equation 4 simplifies the discussion without loss of applicability.

13. As I will discuss later, equation 3 fits better than equation 4 because policy lock-in does not imply, as is implied in the Polya process, a constant value or mean for Y.

14. My thanks to Ester Fuchs for the generous provision of her data.

15. I discuss the question of the point at which a path-dependent system begins later.

16. Actually, path dependence implies a nonstationary series in all instances, because stationary means that the mean and variance of the series are constant or, at least, that the autocorrelations and autocovariances of the series depend only on the time lag. However, because examples of nonstationary time series in the literature deal with growth trends and increasing variance of series, as opposed to stable series, a Polya process could be said to be graphically stationary. New York spending data in most instances is neither technically nor graphically stationary.

17. I interpolate population between census years using the interest rate equation for compound growth: $b_1(1 + r)^t = b_t$, where b_1 represents the base in year 1, r represents interest rate, t represents time, and b_t represents the base in some future year t. Thus the city population in year $_{t+n}$ is estimated as $p_t(1 + g)^n$ $(0 \leq n \leq 10)$, where p_t is the population in census year t and g is the population change between year t and the next census year t + 10.

18. This is roughly equivalent to differentiating logged data. Differentiating is undertaken in ARIMA models to induce stationary effects. A plausible concern, given the adjustments I made to these data, is that I may have overadjusted them, which can introduce error into the series. An examination of the autocorrelation function for each real per capita spending series (i.e., before pseudo-differentiating), along with unit root tests, revealed nonstationary effects, which suggests that expressing the series in yearly percentage changes did not result in overadjustment or the introduction of error (see Mills 1990).

19. Common-function spending involves spending that is common to most cities. In my formulation, it comprises capital and operating expenditures for government administration, finance, and building maintenance, sanitation, sewers, roads and bridges, recreation, and fire and police safety. Noncommon-function spending comprises capital and operating expenditures for health programs, hospitals, welfare, libraries, and prisons. Chicago and New York had all of these programs for the years included in my analysis.

20. Adjusting the number of observations in the groups did not significantly affect my findings.

21. I discuss the implications of the declining Chicago budget variation below.

22. The vertical axis in Figure 4 truncates the Chicago series from 1947-1953, which plateaus at a value of 60 if the axis is extended. I did this to create a scale comparable to that of Figure 3 and to avoid obscuring the behavior of the New York series.

23. Although I am concerned here with the period 1950-1974, there is a clear change in each trend line beginning around the end of this period, which suggests something about the potential for a crisis (in New York's case, a fiscal crisis) to force a city out of path-dependent lock-in (which will be discussed later). After this point, Chicago's spending variation is much lower, which may indicate lock-in. If so, this could be related to the erosion of the Daley machine, culminating in his death in 1976. Without Daley's tight rein on pressure groups and given the sudden infusion of electoral competition, perhaps the city began to exhibit program lock-in as officials found it increasingly difficult to resist spending pressures.

24. I address this question and offer a way to evaluate such a possibility later.

25. Because Chicago's short-term debt during this period is small and relatively nonvarying and because it is New York's spending that I claim was locked in, I only present figures for New York.

26. The sample includes 28 cities (Washington, D.C., was excluded). Data are in 1989 dollars. The median short-term debt per capita for these cities was $68.59. Excluding the six cities with no short-term debt in 1975 yielded an average short-term debt of $159.78 per capita and a median of $117.71. An examination of short-term debt time series for these cities would also reveal that few had the kind of recurring debt that became New York's hallmark.

27. I am grateful to Bryan Jones for raising this possibility.

28. This is a matter of injecting regime theory into the discussion. Path-dependence theory is still useful here as an analysis of city regime origins.

REFERENCES

Arthur, W. B. 1987. Path-dependent processes and the emergence of macro-structure. *European Journal of Operational Research* 30:294-303.

———. 1990. "Silicon Valley" locational clusters: When do increasing returns imply monopoly? *Mathematical Social Sciences* 19 (June): 235-51.

———. 1994. *Increasing returns and path dependence in the economy*. Ann Arbor: Univ. of Michigan Press.

Banfield, E. C., and J. Q. Wilson. 1963. *City politics*. New York: Vintage.

Bartik, T. J. 1991. *Who benefits from state and local economic development*? Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Baumgartner, F. R., and B. D. Jones. 1993. *Agendas and instability in American politics*. Chicago: Univ. of Chicago Press.

Berry, J. M. 1989. *The interest group society*. 2d ed. New York: HarperCollins.

Bradbury, K. L., A. Downs, and K. A. Small. 1982. *Urban decline and the future of American cities*. Washington, DC: Brookings Institution.

Braybrooke, D., and C. E. Lindblom. 1963. *A strategy of decisions: Policy evaluation as a social process*. New York: Free Press.

Clark, T. N., and L. C. Ferguson. 1983. *City money*. New York: Columbia Univ. Press.

Cross, R., ed. 1988. *Unemployment, hysteresis, and the natural rate hypothesis*. New York: Basil Blackwell.

Croswell, R. 1975. Self-generating growth in public programs. *Public Choice* 21 (Spring): 91-97.

Cyert, R. M., and J. G. March. 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Dahl, R. A. 1961. *Who governs*? New Haven: Yale Univ. Press.

David, P. A. 1985. Clio and the economics of QWERTY. *AEA Papers and Proceedings* 75 (2): 332-37.

DeLeon, R. E. 1992. *Left Coast city*. Lawrence: University Press of Kansas.

Elkin, S. 1980. Cities without power: The transformation of American urban regimes. In *National resources and urban policy*, edited by D. Ashford. New York: Methuen.

———. 1987. *City and regime in the American republic*. Chicago: Univ. of Chicago Press.

Farrell, J., and G. Saloner. 1985. Standardization, compatibility, and innovation. *Rand Journal of Economics* 16 (Spring): 70-83.

———. 1986. Installed base and compatibility: Innovation, product preannouncements, and predation. *American Economic Review* 76 (December): 940-55.

Fuchs, E. 1992. *Mayors and money*. Chicago: Univ. of Chicago Press.

Jackson, J. E. 1994. Political methodology and a road not taken. Paper presented at the annual meting of the Political Methodology Section of the American Political Science Association, Madison WI, July.

Jones, B. D. 1994. *Reconceiving decision-making in democratic politics: Attention, choice, and public policy*. Chicago: Univ. of Chicago Press.

Jones, B. D., and L. W. Bachelor. 1993. *The sustaining hand*. 2d ed. Lawrence: University Press of Kansas.

Kamer, P. M. 1983. *Crisis in urban public finance*. New York: Praeger.

Kamlet, M. S., and D. C. Mowery. 1987. Influences on executive and congressional budgetary priorities, 1955-1981. *American Political Science Review* 81 (March): 155-78.

Kasarda, J. 1985. Urban change and minority opportunities. In *The New Urban Reality*, edited by P. E. Peterson. Washington, DC: Brookings Institution.

Katz, M. L., and C. Shapiro. 1986. Technology adoption in the presence of network externalities. *Journal of Political Economy* 94 (August): 822-41.

Kmenta, J. 1986. *Elements of econometrics*. 2d ed. New York: Macmillan.

Krasner, S. 1984. Approaches to the state: Alternative conceptions and historical dynamics. *Comparative Politics* 16 (January): 223-46.

Ladd, H. F., and J. Yinger. 1991. *America's ailing cities: Fiscal health and the design of urban policy*. Baltimore, MD: Johns Hopkins Univ. Press.

Levitt, B., and J. G. March. 1988. Organizational learning. *Annual Review of Sociology* 14:319-40.

Liebert, R. J. 1976. *Disintegration and political action: The changing functions of city governments in America*. New York: Academic Press.

Liebowitz, S. J., and S. E. Margolis. 1990. The fable of the keys. *Journal of Law and Economics* 33 (April): 1-26.

Lindblom, C. E. 1959. The science of muddling through. *Public Administration Review* 19:79-88.

Lotchin, R. 1972. San Francisco, 1846-56: The patterns and chaos of growth. In *Cities in American history*, edited by K. T. Jackson and S. K. Schultz. New York: Alfred A. Knopf.

Lowi, T. 1967. Machine politics—old and new. *Public Interest* 9 (Fall).

March, J. G., and J. P. Olsen. 1984. The new institutionalism: Organizational factors in political life. *American Political Science Review* 78 (September): 734-49.

———. 1989. *Rediscovering institutions*. New York: Free Press.

March, J. G., and H. A. Simon. 1958. *Organizations*. New York: John Wiley.

McCleary, R., and R. A. Hay, Jr. 1980. *Applied time series analysis for the social sciences*. Beverly Hills, CA: Sage.

McDonald, T. J. 1984. San Francisco: Socioeconomic change, political culture, and fiscal politics, 1870-1906. In *The politics of urban fiscal policy*, edited by T. J. McDonald and S. Ward. Beverly Hills, CA: Sage.

Mills, T. C. 1990. *Time series techniques for economists*. Cambridge, UK: Cambridge Univ. Press.

Mollenkopf, J. H. 1983. *The contested city*. Princeton, NJ: Princeton Univ. Press.

Monkonnen, E. 1984. The politics of municipal indebtedness and default, 1950-1936. In *The politics of urban fiscal policy*, edited by T. J. McDonald and S. Ward, 125-57. Beverly Hills, CA: Sage.

Morris, C. R. 1980. *The cost of good intentions: New York City and the liberal experiment*. New York: Norton.

Nice, D. C. 1987. *Federalism: The politics of intergovernmental relations*. New York: St. Martin's.

Niskanen, W. 1971. *Bureaucracy and representative government*. Chicago: Aldine-Atherton.

North, D. C. 1990. *Institutions, institutional change and economic performance*. New York: Cambridge Univ. Press.

Perry, D. C., and A. J. Watkins. 1977. Regional change and the impact of uneven urban development. In *The rise of the sunbelt cities*, edited by D. C. Perry and A. J. Watkins. *Urban Affairs Annual Reviews*, Vol. 14. Beverly Hills, CA: Sage.

Peterson, P. E. 1981. *City limits*. Chicago: Univ. of Chicago Press.

Pohlmann, M. D. 1993. *Governing the postindustrial city*. White Plains, NY: Longman.

Polya, G., and F. Eggenberger. 1923. Ueber die statistik verketteter Vorgaënge. *Math. Mech.* (3): 279-89.

Riker, W. 1986. *The art of political manipulation.* New Haven, CT: Yale Univ. Press.

Savitch, H. V. 1990. The federal impact on city politics. In *Urban politics: New York style*, edited by J. Bellush and D. Netzer, 245-67. New York: M. E. Sharpe.

Schneider, M. 1989. *The competitive city: The political economy of suburbia.* Pittsburgh: Univ. of Pittsburgh Press.

Schneider, M., and P. Teske, with M. Mintrom. 1995. *Public entrepreneurs: Agents for change in American government.* Princeton, NJ: Princeton Univ. Press.

Schumpeter, J. 1942. *Capitalism, socialism, and democracy.* New York: Harper & Row.

Sharkansky, I. 1967. Economic and political correlates of state government expenditures. *Midwest Journal of Political Science* 11 (May):173-92.

Shefter, M. 1985. *Political crisis, fiscal crisis.* New York: Basic Books.

Simon, H. 1957. *Models of man: Social and rational.* New York: John Wiley.

Skocpol, T., and K. Finegold. 1982. State capacity and economic intervention in the early New Deal. *Political Science Quarterly* 97 (Summer): 255-78.

Small, K. 1985. Transportation and urban change. In *The new urban reality*, edited by P. E. Peterson. Washington, DC: Brookings Institution.

Stinchcombe, A. L. 1968. *Constructing social theories.* Chicago: Univ. of Chicago Press.

Stone, C. N. 1989. *Regime politics: Governing Atlanta: 1946-1988.* Lawrence: University Press of Kansas.

———. 1993. Urban regimes and the capacity to govern: A political economy approach. *Journal of Urban Affairs* 15 (1): 18-22.

Stone, C. N., and H. T. Sanders, eds. 1987. *The politics of urban development.* Lawrence: University Press of Kansas.

Teske, P., and M. Schneider. 1994. The bureaucratic entrepreneur: The case of city managers. *Public Administration Review* 54 (July/August): 331-40.

Tullock, G. 1965. *The politics of bureaucracy.* Washington, DC: Public Affairs Press.

Tversky, A., and D. Kahneman. 1981. The framing of decisions and the psychology of choice. *Science* 211:453-58.

Waldrop, M. M. 1992. *Complexity.* New York: Simon & Schuster.

Waste, R. 1989. *The ecology of city policymaking.* New York: Oxford Univ. Press.

Wildavsky, A. 1987. *Speaking truth to power: The art and craft of policy analysis.* New Brunswick, NJ: Transaction.

———. 1988. *The new politics of the budgetary process.* Boston: Scott, Foresman.

Yates, D. 1977. *The ungovernable city.* Cambridge: MIT Press.

———. 1979. The mayor's eight-ring circus. *New York Affairs* 5 (Spring): 10-28.

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