INTERSTATE VARIATIONS IN AFDC BENEFITS: A GAME THEORETIC APPROACH

by

Patricia Kay Smith

Dissertation submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Economics

APPROVED:

Stephen Sheppard, Chairman

Herve Moulin

Firouz Gahvari

Barbara J. Craig

Richard Steinberg

June 1986

Blacksburg, Virginia

INTERSTATE VARIATIONS IN AFDC BENEFITS: A GAME THEORETIC APPROACH

by

Patricia Kay Smith

Chairman: Stephen Sheppard
Economics

(ABSTRACT)

This dissertation examines the nature of states' choice of AFDC benefit levels in order to determine the sources of interstate variations in AFDC benefits. Like previous studies, a state's financial and demographic characteristics are modeled as playing a significant role in the benefit choice. This study extends the literature by also formally modeling the role of the financial and demographic characteristics of a neighboring, or rival, state.

The characteristics of another state are expected to influence the state's benefit choice for the following reason. Each state wishes to provide some minimum living standard for its citizens (the AFDC benefit level). The provision of this minimum living standard costs the state not only in terms of the dollar value of the offered benefit, but also in terms of increased total financial obligations if the chosen benefit level attracts recipients from the rival state. Each state, therefore, accounts for this "caseload" price of the benefit level by incorporating the level of interstate migration induced by any feasible benefit level, taking that of the rival as given, into its benefit decision.

This interstate AFDC benefit-setting competition is modeled as a two state generalized game. The model's implication are derived and

empirically tested. The results of the empirical tests support the game theoretic model; The observed pattern of interstate variations in the AFDC benefit level is consistent with the model's implications. The data further suggest that the degree of competitiveness, as indicated by the significance of the rival's characterisitics in a state's benefit decision, varies inversely with the distance between the competing states.

The model is then used to simulate the impact of the "New Federalism" proposal on the AFDC benefit level. These simulations indicate that, if enacted, the proposed "New Federalism" changes will significantly lower the average per recipient AFDC benefit level. The simulations also indicate that the greater the degree of competition between the states, the larger will be the magnitude of the decline in the benefit level.

ACKNOWLEDGEMENTS

To all those who have offered support and assistance in the completion of this dissertation I would like to extend my sincere thanks. Foremost, I thank my parents, and , for their tremendous and unending support over all these years. Many other members of my family have also given much appreciated moral support throughout my graduate career. I would especially like to thank my sisters, and , and my grandmothers, and .

I have also been blessed to have many faithful and supportive friends. In particular I would like to thank , , , , , , , , , and , whose kindness and caring have indeed been a great help.

This dissertation could not have been completed without the expertise and dedication of my committee members: Herve Moulin, Firouz Gahvari, Richard Steinberg, and Barbara Craig. and also provided much appreciated advice and guidance. Special thanks to for her typing skills, friendship, and consistently excellent advice throughout my graduate career.

Finally, I owe a great debt of gratitude to my chairman, Stephen Sheppard. His enthusiasm for and dedication to my dissertation seemed to be without bound. His kindness and respect helped me achieve the level of confidence necessary to successfully complete this endeavor.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

A. Introduction to the General Problem

Aid to Families with Dependent Children (AFDC) was created in 1935 under Title IV of the Social Security Act. The program was originally intended to be temporary and to provide income assistance to children deprived of adequate parental support due to divorce or the death of, or desertion by, the father. AFDC has since evolved into one of the largest welfare programs in the United States. Program coverage has expanded to include children up to age 21, fetuses, and families in which the father is incapacitated for at least a month. Furthermore, twenty-six states now provide AFDC assistance for two-parent families if both parents are unemployed. By 1983 nearly eleven million Americans, approximately 7.1 million children and 3.7 million adults, received AFDC benefits totalling some $3,838 million.

Federal, state, and local governments currently provide funding for state AFDC programs. Local governments contribute primarily to the program's administrative costs while state governments finance the actual benefit payments. The federal government assists the states by providing matching funding for benefit payments. It specifies the maximum state payment that will be matched and the rate at which matching aid is provided.

Administration of the program, however, takes place predominantly at the state level. State programs are required to meet only four general requirements in order to qualify for federal matching grants:

1. The program must operate state-wide and be available to all eligible American citizens.

2. The program must be administered by a single state agency.

3. That agency must make periodic reports to the federal government.

4. The state must provide funding.

All other program parameters lie within the states' jurisdiction. Specifically, state governments determine the standard of need, the percent of that need that will be met (states are not required to meet their own need standards), eligibility requirements, benefit levels, administrative procedures, and all matters regarding state program personnel.

The substantial state control of the design and administration of state AFDC programs gives rise to the possibility that benefits will vary across states, and indeed they do. For example, in 1979 the average monthly per family benefit ranged from $370.30 in New York to $83.89 in Mississippi. First, it seems odd, and perhaps "unfair," that the amount of assistance a typical family receives varies so greatly from state to state. Second, such benefit differentials suggest that recipients could significantly increase their assistance incomes by simply moving to higher benefit states.

The suspicion that generous welfare benefits may attract poor persons to a particular location is neither new nor limited to academicians and politicians. Furthermore, numerous empirical studies have been undertaken to formally test this belief and the majority find that public assistance does indeed significantly and positively influence the level of migration (e.g.; Cebula, 1979; DeJong and Donnelly, 1973; and Sommers and Suits, 1973). Given this pervasive suspicion and the supporting empirical evidence one would expect beneficent governments to anticipate the impact of their benefit choice on the migratory behavior of the poor. However, the formal incorporation of such behavior in models of welfare expenditures and benefit level determination has yet to be made. Herein lies the novelty of this study:A state's choice of an AFDC benefit level is modeled in terms of a simple game between two states. The optimal benefit level will depend not only on a state's "preferences" and budget, but also on the amount of migration (by the poor) induced by the state's benefit level, given that offered by its neighbor. Thus, variations in states' AFDC benefits may arise not only from differences in states' own characteristics, but also from differences in the characteristics of neighboring states.

B. Research Objectives

The primary objective of this dissertation is to expand our understanding of how states choose their AFDC benefit levels and thus determine the sources of interstate variations in these benefits. The general approach taken in this study is to think of AFDC benefit determination as a process in which states incorporate into their benefit decisions anticipated changes in their program caseloads due to induced migration by potential recipients.

Each state bases its expectation of the level of migration induced by its chosen benefit level from observation of the variables which influence the individual potential recipient's migration decision. Simply put, individuals will migrate if the increment in expected income due to relocation exceeds the costs of migration. Hence, a state anticipates the migratory impact of its benefit level by observing its employment, earnings, and welfare income opportunities and those of a neighbor, or rival, state.

Because the level of expected migration and thus a state's choice of AFDC benefit level depends in part on the benefit level chosen by its neighbor, the benefit-setting process constitutes an economic game. As in the standard Cournot-Nash game, the payoff function (utility) of each player (state) depends on the rival player's strategy (benefit level), which each player takes as given. This game differs from the classic duopoly case however in that each player's set of feasible strategies will also depend on the rival's behavior. Accordingly, the AFDC benefit-setting game is more accurately described as a generalized game.[1]

Note that this view of the benefit-setting process assumes that a state behaves as if it were maximizing some utility function. The major criticism of this approach is, as summarized by Heins (1971), that "the state of knowledge about the process of collective action does not allow us to make inferences about the nature of voters' preferences and certainly not that they work like indifference curves." What we do know is that when a finite group, of at least three members, decides among at least three alternatives under a non-dictatorial rule which is independent of irrelevant alternatives there may be no determinant outcome (Arrow, 1963; Plott, 1967).

Despite significant progress in the study of group, particularly legislative, decision-making, a satisfactory model relating individual preferences to a group decision has yet to be proposed (Shepsle, 1979a, 1979b; Denzau and Mackay, 1983). In order to analyze observed legislative budget decisions one must, therefore, make some simplifying assumptions about the nature of group decision-making (e.g.; Tresch, 1975; Moffitt, 1984).

Here a state's decision is simplified to a single dimension, the annual per recipient AFDC benefit level. State expenditure on other consumption will be determined residually, assuming the states are required to maintain balanced and exogenously given budgets. The level of AFDC benefits is determined by majority vote by state legislators who are assumed to have single-peaked preferences over the benefit level. Thus, the model meets Black's conditions and the state's legislators will, as a group, have a transitive, single-peaked preference relation over the benefit level, the peak of which coincides with that of the median legislator. Hence the problem can be reduced to a single utility function, that of the median legislator.

This particular way of viewing the AFDC benefit-setting process is formally modeled and empirically tested. The general hypothesis examined is that the observed pattern of AFDC benefit levels results, at least partially, from a competitive interstate benefit-setting game. This hypothesis is tested by deriving a set of implications from a game theoretic model of the AFDC benefit choice process and using standard econometric techniques to determine if these implications are consistent with the available data.

Once the game theoretic model is established as a sound explanation of the observed pattern of benefit levels it can be used to analyze the impact of changes in independent variables. The federal-to-state matching rate is an independent variable of particular interest which may be changing radically during the next decade. Under the proposed "New Federalism" package total financial responsibility for the AFDC program will be shifted to the state governments in a two stage process.[2] In the first stage the federal government will eliminate all matching aid and will instead give the states a lump sum grant designed to be of equivalent value. The second stage consists of the elimination of this "transition" aid; states will receive no federal aid for their AFDC programs. In exchange for the states' assumption of full financial responsibility for AFDC the federal government will assume such responsibility for the states' Medicaid programs. The second objective of this dissertation is to use the game theoretic model simulate the impact of each stage of the "New Federalism" legislation on the average AFDC benefit level.

C. Dissertation Structure

Chapter 2 presents a review of the literature on state welfare expenditures and interstate variations in public assistance payments. Chapter 3 develops a game theoretic model of the state's benefit-setting decision. Section A describes the general approach to modeling the benefit-setting process. Section B of Chapter 3 then formalizes the relationship between a state's benefit level and net interstate migration of potential AFDC recipients. This relationship is a critical component in the generalized benefit-setting game described in Section C. Existence of an equilibrium for this game is proven in Section D and the comparative statics of a specific version of the game are derived in Section E.

Chapter 4 provides various empirical tests of the model implications derived in Chapter 3. The game theoretic model is then used in Chapter 5 to simulate the impact of the "New Federalism" legislation, assuming the package passes essentially as proposed. Finally, Chapter 6 summarizes the findings and conclusions of this study and discusses future extensions the model.

FOOTNOTES

[1]Debreu (1952) also refers to this particular game as a "social system." Ichiishi (1983) calls this type of game an "abstract economy."

[2]Major Themes and Additional Budget Details, Fiscal Year 1983 (GPO, 1982) fully describes the "New Federalism" package as proposed by the Reagan administration in January 1982.

CHAPTER 2

LITERATURE REVIEW

Two different veins of literature discuss interstate variations in welfare, primarily AFDC, expenditure and benefit levels. The first examines how AFDC expenditures, and thus benefit levels, are determined. The second explores how AFDC benefit differentials may affect interstate migration. Both branches of literature are obviously relevant to and will be brought together by the present study.

The bulk of studies which address interstate variations in state welfare expenditures and benefit levels fall into one of two categories: "determinants of" studies and public goods analyses. "Determinants of" studies examine how a state's budget is allocated among various expenditure categories, one being public welfare. The theoretical foundation for many of these studies lies in consumer theory (e.g.; Gramlich, 1969; Tresch, 1975). State expenditure on a particular category is explained as the demand for that category as derived from the constrained optimization of some state or community utility function. A number of these determinants studies, for example Fisher (1961), Horowitz (1967), and Pogue and Sgontz (1968), do not present the formal theoretical grounding and are strictly empirical investigations. Typically, total state expenditure on a particular category; e.g. welfare, is regressed on a variety of demographic variables.

These analyses of the determinants of state expenditure generally find that the percent of the population living in a female-headed household, the average number of children per family, and other variables which increase the AFDC caseload exert a significant and positive impact on total state welfare expenditure. In addition, Fisher (1961) and Pogue and Sgontz (1968) find that the greater the proportion of the state's population living in an urban environment the higher is state welfare expenditure, ceteris paribus.

Determinants studies which include federal aid as an exogenous variable report conflicting results with respect to the significance of that variable. Tresch (1975) regresses state AFDC expenditure on various demographic variables, the price of a marginal dollar spent on AFDC, and lump sum welfare grants. He finds that neither federal lump sum nor matching aid significantly influences the state welfare budget. This result, however, may be criticized as being subject to simultaneity bias. The federal assistance formula is such that the federal matching rate is inversely related to both the benefit level and state per capita income.[1]

Gramlich (1969) presents a model of state expenditures determination designed specifically to account for the simultaneity between expenditure and revenue policies. He derives the demand for expenditures and tax revenue from the maximization of the state's utility function subject to the state's budget constraint. Federal grants-in-aid are a component of this constraint. These two demand functions are then estimated using Indirect Least Squares. The results suggest that federal aid does not significantly increase state expenditure on welfare. He finds that states increase expenditures on aided programs to the extent required by the matching schedule and then reduce their expenditures on other transfer programs, releasing dollars for other purchases.

Pogue and Sgontz (1968), on the other hand, find that federal aid does significantly influence state welfare expenditures. They hypothesize that state expenditures from all sources is a linear function of various demographic variables and federal aid. Then, by subtracting the federal aid variable from both sides of the regression equation they show that an aid coefficient greater than one indicates that federal aid has a stimulatory effect on state welfare expenditure from own funds. Their empirical tests show that the aid coefficent is significantly greater than one; i.e., federal aid does stimulate state expenditure on AFDC. Pogue and Sgontz do caution that the estimated magnitude of the impact of federal aid on state welfare expenditures is biased upwards as their OLS analysis does not account for the simultaneity between these two variables.

Studies of the determinants of state expenditures made by political scientists tend to rely heavily on factor analysis.[2] These studies generally find that state welfare expenditure depends positively on voter turnout, party competition, and legislative professionalism (e.g.; Sharkansky and Hofferbert, 1963; Dawson and Robinson, 1963; Uslaner and Weber, 1975). The fundamental question addressed by this literature is do politics matter in the determination of state budgets? While these studies usually find that state per capita income is the most influential variable, legislator preferences are also found to exert significant influence in the budgetary process. Thus political scientists tend to conclude that "politics" matter.

This result can also be interpreted as lending support to the "state as a single consumer" modeling approach. The fact that legislators' preferences are significant factors suggests that the state's choice of welfare expenditures can be appropriately modeled as the maximization of a single standard utility function: that of the median legislator.

Two more recent economic studies attempt to model the interaction of political and economic forces in state budget determination. First, Sloan (1977) presents a study based on two models, a caseload model and a state political utility model. The first explains state welfare liabilities given program parameters and state demographic characteristics. The second translates state expenditures and legislator and constituent preferences into a somewhat vague measure of political leadership utility. I say "vague", as Sloan does not formalize the relationship between these variables and constituents' voting behavior.

Sloan finds that the larger the proportion of the population living in a female-headed household, the higher the price of AFDC (in terms of caseload and therefore total financial obligations) and the lower the demand for welfare expenditures. He also reports that higher degrees of political conservatism in the state legislature significantly lower average state AFDC expenditures, ceteris paribus.

Perhaps the most comprehensive examination of state budgeting to date is that of Craig and Inman (1985). Their attempt to incorporate politics into the state budgeting process is based not upon vote-getting theories, but upon the roles of legislative institutions, as modeled by Shepsle (1975). While Craig and Inman do control for the influence of variables such as agenda-setting authority and jurisdictional arrangements, it should be noted that their model cannot explain the independent impact of variations in these legislative institutions on state expenditures.

Craig and Inman estimate a three equation system, via Generalized Least Squares, in which state education and welfare expenditures and state own revenue are the dependent variables. They find the usual demographic variables--the number of children per family and the percent of the population which is black--to be significantly positive variables in the explanation of total state AFDC expenditure. Ten of the state dummy variables designed to measure the influence of variations in legislative institutions, are significantly different from zero. Finally, Craig and Inman find that the various forms of federal aid significantly influence state welfare expenditures. In particular, higher federal matching rates and larger lump sum welfare grants lead to greater state welfare expenditures.

Like Gramlich, the Craig and Inman analysis reveals a general pattern of state budgeting behavior in which states tend to transfer aid dollars to other expenditures or to tax relief whenever possible. In short, increasing federal aid tends to raise state AFDC expenditure, but less effectively the less structured is the federal assistance program.

The second general approach to analyzing states' AFDC expenditures and benefit levels is to treat the benefit level as a public good. The choice of the level of provision of this public good is then typically assumed to be made by majority rule voting of the state's current citizens. A state's AFDC benefit level is thus determined as the level demanded by the median voter at his given tax price.

These studies produce results similar to those of the determinants studies. Such similarity would not be theoretically unexpected. The "determinants" studies assume that a state behaves as if it were maximizing some utility function. The public goods studies simply take this assumption one step further. They assume that the utility function being maximized is specifically that of the median voter.

The best known of the public goods analyses is that of Orr (1976). He finds that taxpayer income, the ratio of taxpayers to recipients, altruistic preferences, and the federal matching rate are all positively and significantly related to the level of state AFDC expenditures. Also, the greater the proportion of the recipient population made up by "preferred"; e.g. white recipients, the greater the state AFDC budget. Finally, he finds that the greater the absolute number of recipients, the lower will be state AFDC expenditures. It should be noted that Orr derives these results using a two-stage estimation process which incorporates the the simultaneity between the federal matching share and the AFDC benefit level.

Spall (1978) extends Orr's public goods model to account for the affect of the progressivity of the state tax structure on AFDC expenditures. He concludes that when the mean state income exceeds the median, the level of AFDC expenditures preferred by the majority of taxpayers increases with the progressivity of the state tax structure. This result may, however, obtain simply because states with a preference for income redistribution are also likely to prefer progressive tax structures.

A second branch of literature explores the impact of welfare opportunities on interstate migration. The theoretical studies, such as Buchanan and Goetz (1972) and Pauly (1973), tend to view AFDC benefits as a public good and explain migration resulting from benefit differentials in terms of the Tiebout sorting process. These studies usually concentrate on the efficiency of Tiebout outcomes. The empirical studies generally examine the effect of income opportunities on migration behavior and not so much the effects of migration on the provision of public goods (see Liu, 1975; Kalunzy, 1975; Sommers and Suits, 1973; and Gallaway, 1967).

The empirical studies typically present a discussion, rather than a formal theoretical model, of why we would expect migration to be influenced by income opportunities, one being welfare benefits. Sjaastad's (1962) model of human migration as an investment is the theoretical basis of these expectations. This model formalizes the notion that an individual will migrate if doing so will increase his expected income net of migration costs. On this basis migration is frequently hypothesized to be a linear function of various income opportunities. This specification is then estimated (OLS) and the significance of variables such as average earnings and welfare benefits is tested. This literature generally concludes that these variables positively and significantly affect the level of interstate migration.

Cebula (1975) and Chao and Renas (1976) extend their empirical studies to include tests for feedback from migration to welfare benefit levels. Cebula finds that higher AFDC benefits attract nonwhite immigrants to SMSAs and that there is positive feedback from this migration to the benefit levels. Chao and Renas repeat the experiment for white migration and conclude that the migration decision of whites is not significantly influenced by AFDC benefit levels. White migration does, however, significantly influence the level of AFDC benefits: the more white in-migration, the lower, on average, are AFDC benefits.

In summary, two related veins of literature examine the nature of state AFDC benefit levels. The first studies how states choose the level of AFDC expenditure and per recipient benefits. There appears to be consensus that the number of AFDC recipients and variables which increase the program caseload are related positively with states' AFDC expenditures and inversely with the benefit level. State income, political conservatism, and altruistic preferences are also often found to be influential. Early studies report that federal-to-state aid does not significantly influence state welfare expenditures. Typically, however, these conclusions are based on estimation procedures which are inappropriate given the simultaneity between state welfare expenditures and state income and the federal matching share. More recent studies use simultaneous systems estimation techniques and generally conclude that federal aid is stimulatory.

The second vein of literature examines the empirical relationship between migration and welfare benefit levels. This literature finds that the higher a jurisdiction's benefit level the greater is in-migration. There is also empirical evidence this migration can, in turn, significantly influence the chosen benefit level. This study will bring together these two veins of literature by incorporating the recipients' migration decision into the state's choice of AFDC benefit levels.

FOOTNOTES

[1]See Appendix A.

[2]Factor analysis examines coefficients of correlation to identify variables which are closely related to each other, but not so much with other explanatory variables. These related variables presumably share a common characteristic, or factor. The "loading" of a factor is the coefficient of correlation between that variable and an underlying factor. The variable with the highest loading is considered to be a close approximation of this factor.

CHAPTER 3

A GAME THEORETIC MODEL OF AFDC BENEFIT DETERMINATION

This chapter develops a model of an AFDC benefit-setting game played by two states. Section A presents the general framework of the model. The expected migration function, a critical component of the general framework, is derived in Section B. Section C fully describes the game played by the two states and proof that an equilibrium exists is presented in Section D. Finally, in Section E the comparative static properties of the game theoretic model are derived, assuming Cobb-Douglas utility functions.

A. General Framework

Consider a nation consisting of two states. Each state must decide how to allocate its resources between the provision of a minimum living standard for poor residents, the AFDC benefit level, and the provision of all other publicly provided goods. Both the AFDC benefit level and the composite alternative are assumed to be pure public goods. Each state derives utility from total expenditure on the "all other goods" composite and the level of average monthly per recipient benefits. Finally, each state behaves as if it were a single consumer maximizing some utility function, $u_i(c_i,b_i)$, subject to the budget constraint:

$$(1)\quad I_i = c_i + (1 - s_i)(1 - \tau_i)\, b_i(P_i + G_i(b_i;b_j)) \ ,$$

where:

P_i = initial, pre-migration, poor population of state i.

I_i = annual income of state i, assumed exogenous.

c_i = annual consumption of all other publicly provided goods in state i, constrained to be non-negative. The price of this composite public good is normalized to unity.

b_i = average annual AFDC benefits per recipient in state i.

b_j = average annual AFDC benefits per recipient in state j.

τ_i = the probability of employment in state i.

s_i = the share of the benefit state i offers paid by the federal government, assumed exogenous at this stage of the analysis.

$G_i(b_i;b_j)$ = net migration from state j to state i as a function b_i, given b_j.

Each state maximizes its utility by providing the combination of the two goods such that the standard equalization of the respective marginal utilities per unit cost is achieved.

The marginal cost of providing the minimum living standard will not be strictly standard in nature, however. Specifically, the cost of paying an additional dollar per recipient will in general be more than $(1-s_i)$ times the number of current recipients. The increase in the AFDC benefit level may induce in-migration, thus increasing total AFDC obligations. For example, if state i sets its benefit level much higher than state j's, many of the poor in j may be able to increase their expected incomes by moving to i. Because a state must make AFDC payments to any eligible applicant, whether a long-time resident or a recent immigrant, state i will be obligated to spend not $(1-s_i)(1-\tau_i)b_iP_i$, but $(1-s_i)(1-\tau_i)b_i(P_i$ + in-migrants). Thus, the marginal cost depends on the state's chosen benefit level; i.e. the marginal cost of b_i is endogenous. To make a rational choice of benefit levels each state will therefore incorporate expected migration responses into its decision.[1]

B. The Net Migration Function

Each poor resident will consider whether the present discounted value of the gain in expected income, from either AFDC benefits or earnings, exceeds the monetary and nonmonetary costs of migration.[2] The nonmonetary or psychic costs of migration reflect utility differentials among various locations. These costs may arise from preferences over landscapes and climate, location of and emotional attachment to friends and family, the general discomfort associated with moving and so forth. The psychic cost of migration can be measured as the amount of income above a resident's expected income gain from moving (net of monetary costs of moving) necessary to actually induce his migration (Sjaastad, 1962; Deaton, Morgan, and Anschel, 1982).

Assuming that the poor are risk neutral, the decision of each poor resident of state i can be formulated as:

$$\text{(2)} \qquad \begin{array}{ll} \text{if } \rho(\tau_j \varepsilon_j + (1 - \tau_j)b_j - \tau_i \varepsilon_i - (1 - \tau_i)b_i) & \\ \qquad - cd_{ij} - M_i(n) > 0 & \text{migrate to } j \\ & \\ \text{otherwise} & \text{remain in } i \end{array}$$

Where:

$\tau_{i,j}$ = the probability of employment in state i,j.

$\varepsilon_{i,j}$ = average annual earnings a poor resident of state i,j.

ρ = the discount factor, assumed constant among the poor.

c = the monetary cost of migration per mile, assumed constant and symmetric.

d_{ij} = the distance between states i and j, in miles.

$M_i(n)$ = the economic measure of the nonmonetary, or psychic, cost of migration of resident n of state i.

Eligibility requirements and taxpayer migration will, for the present, be ignored.

$M_i(n)$ is taken to be a random variable which is uniformly distributed over each state's poor population with a maximum of K_i.[3] The probability density that a randomly chosen resident's psychic cost migration, $M_i(n)$, is a given value will then be $\frac{1}{K_i}$ (Figure 3.1).

Recall that a state i resident will find it profitable to migrate to j if the discounted income differential exceeds the total cost of migration. An equivalent form of this condition is that the discounted income differential net of the monetary costs must exceed the psychic costs of migration:

$$(3) \quad M_i(n) < \breve{m} \quad ,$$

where:

$$(4) \quad \breve{m} = \rho(\tau_j\varepsilon_j + (1 - \tau_j)b_j - \tau_i\varepsilon_i - (1 - \tau_i)b_i) - cd_{ij}.$$

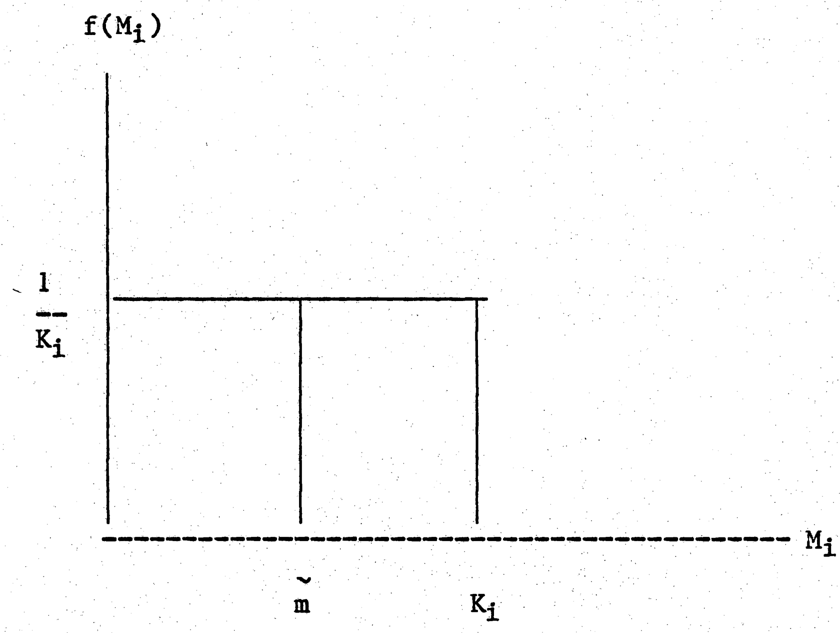

FIGURE 3.1

Uniformly Distributed Psychic Costs and the Probability of Migration

Thus, the probability that a randomly selected poor resident of state i can increase his expected net income by migrating equals the probability that his psychic cost of migration is some $M_i(n)$ less than $\tilde{m}$. In the case of uniformly distributed psychic costs, this probability is simply $\frac{\tilde{m}}{K_i}$ for $\tilde{m} > 0$ and 0 otherwise (refer to Figure 3.1).

Each state "knows" the migration condition (2) and the distribution of psychic costs over the poor. More precisely, each state knows how its benefit level affects $\tilde{m}$, the expected income differential, and hence the probability that the benefit level will induce a randomly selected poor resident, from either state, to move given its rival's benefit level and the other migration parameters. A state can then calculate the expected amount of migration associated with any level of its own benefit, given that of its rival.

For example, suppose state i sets b_i much lower than b_j. This pair of benefit levels, along with the migration parameters, will determine some $\tilde{m}$. The amount of out-migration state i expects to be induced by b_i is the probability that a randomly selected resident can improve his expected net income by moving from i to j times the number of poor residents currently in state i: $P_i(\frac{\tilde{m}}{K_i})$ for $\tilde{m} > 0$.

In general, migration from state i to j will be:

$$(5) \quad \text{mig}(i \to j) = \max\{0, \frac{P_i}{K_i}(\rho(\tau_j\varepsilon_j + (1 - \tau_j)b_j - \tau_i\varepsilon_i - (1 - \tau_i)b_i) - cd_{ij})\}$$

By similar reasoning, migration from state j to i is:

$$(6)\quad mig(j \rightarrow i) = \max\{0, \frac{P_j}{K_j}\,(\rho(\tau_i\varepsilon_i + (1 - \tau_i)b_i \;-\; \tau_j\varepsilon_j - (1 - \tau_j)b_j) - cd_{ij})\}.$$

Let $G_i(b_i;b_j)$ be the relationship between the annual per recipient AFDC benefit in state i and net migration to i, given b_j and the other migration parameters:

$$(7)\quad G_i(b_i;b_j) = mig(j \rightarrow i) - mig(i \rightarrow j).$$

First, note that because the psychic cost of migration is uniformly distributed over a state's poor there will be no jumps in migration in response to a small change in b_i or b_j. That is, $G_i(b_i;b_j)$ is continuous for all non-negative b_i and b_j, as is clear from inspection of (5), (6) and (7). Second, we would expect that higher benefit levels in state i attract more poor migrants, ceteris paribus, but at a non-increasing rate. That is, $G_i' > 0$ and $G_i'' \leq 0$. There is, however, no reason to expect that the level of benefits at which in-migration becomes zero is the same level of benefits at which out-migration becomes zero. In fact, as long as migration costs are positive there will be, for any given b_j, a range of b_i's for which no migration will occur.

First, consider $mig(i \rightarrow j)$. Setting $\tilde{m}$ equal to zero and solving (5) for b_i produces the value of b_i, b_i^{low}, for which the probability that any poor resident will migrate from i to j is zero.

$$(8)\quad b_i^{low} = \frac{\rho(\tau_j\varepsilon_j - \tau_i\varepsilon_i + (1 - \tau_j)b_j) - cd_{ij}}{\rho(1 - \tau_i)}$$

For b_i less than b_i^{low} migration from i to j will be a positive linear function of the level of state i's benefits:

$$(9)\quad \frac{\partial mig(i \rightarrow j)}{\partial b_i} = \frac{P_i}{K_i}\rho(1 - \tau_i) > 0,\ b_i < b_i^{low}$$

The level of b_i for which migration from j to i becomes zero can be determined in like fashion:

$$(10)\quad b_i^{up} = \frac{\rho(\tau_j\varepsilon_j - \tau_i\varepsilon_i + (1 - \tau_j)b_j) + cd_{ij}}{\rho(1 - \tau_i)}$$

For $b_i > b_i^{up}$ in-migration from state j is a positive linear function of state i's benefit level.

$$(11)\quad \frac{\partial mig(j \rightarrow i)}{\partial b_i} = \frac{P_i}{K_i}\rho(1 - \tau_i) > 0,\quad b_i > b_i^{up}$$

Note that b_i^{up} exceeds b_i^{low} by $\frac{2cd_{ij}}{\rho(1 - \tau_i)}$. This is the no-migration range of b_i, for any given b_j.

Substituting (5) and (6) into (7) shows that net migration, $G_i(b_i;b_j)$, is a continuous non-negative function of state i's benefit level which can be divided into five distinct regions (Figure 3.2). In Region 1 state i "exports" poor residents, the magnitude of these exports increasing at a rate of $\frac{P_i}{K_i}\rho(1 - \tau_i)$ persons per dollar reduction in annual benefit. The expected income differential in Region 2 is such that no migration is induced, so G_i has zero slope. Finally, in Region 3 state i "imports" state j's poor, the magnitude of these imports

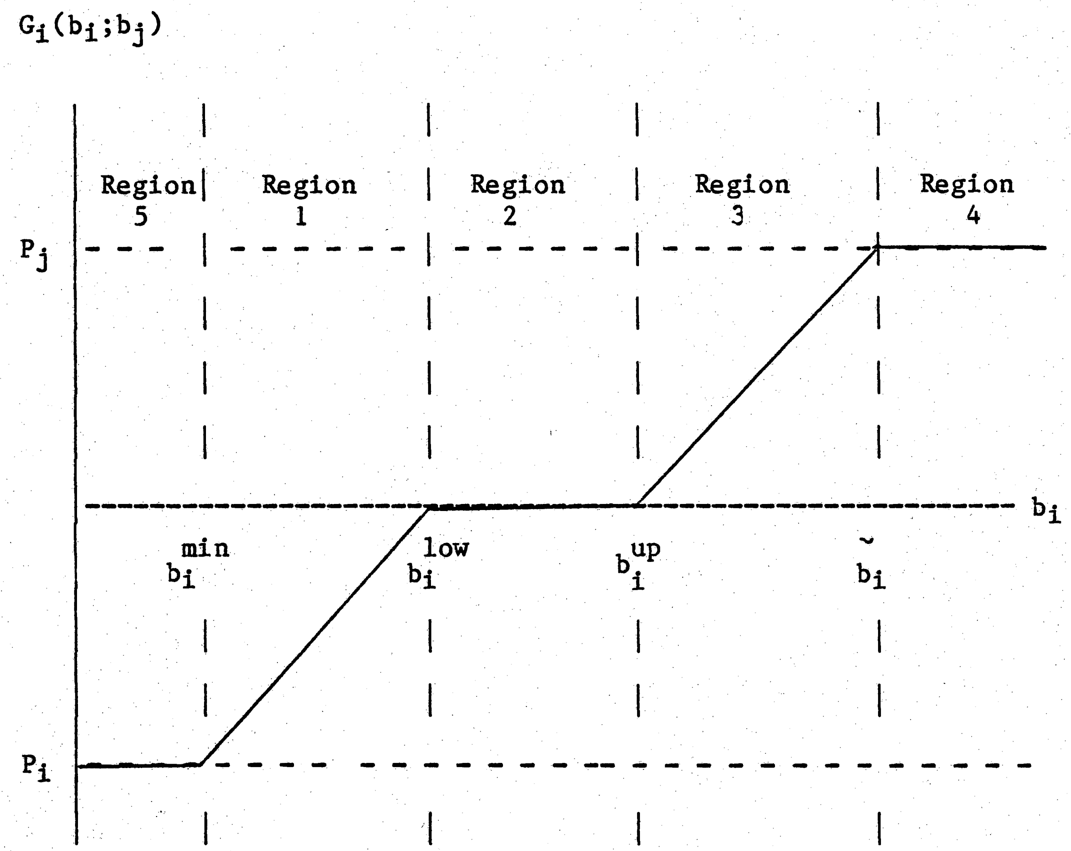

FIGURE 3.2

Net Migration to State i as a Function of b_i, given b_j

increasing at a rate of $\frac{P_j}{K_j}\rho(1 - \tau_i)$ persons per dollar increase in its benefit level. In Region 4, b_i is such that all of state j's poor migrate to i and in Region 5 all of state i's poor migrate to j.

The function relating state j's benefit level to net migration to that state can be similarly derived.

$$(12)\quad G_j(b_j;b_i) = \max\{0,\frac{P_i}{K_i}(\rho(\tau_j\varepsilon_j + (1 - \tau_j)b_j - \tau_i\varepsilon_i - (1 - \tau_i)b_i) - cd_{ij})\} - \max\{0,\frac{P_j}{K_j}(\rho(\tau_i\varepsilon_i + (1 - \tau_i)b_i - \tau_j\varepsilon_j - (1 - \tau_j)b_j) - cd_{ij})\}$$

The graph of $G_j(b_j;b_i)$ looks much the same as that of $G_i(b_i;b_j)$ and can be similarly subdivided. Notice that in this two state model the amount of in-migration (out-migration) from i to j just equals the amount of out-migration (in-migration) from j to i by construction. Also, to be sensible the level of net migration is restricted to be less than or equal the relevant initial stock of poor. That is,

$$(13)\quad G_i(b_i;b_j) \leq P_j \quad \text{for } G_i > 0 ,$$

$$(14)\quad |G_i(b_i;b_j)| \leq P_i \quad \text{for } G_i < 0 ,$$

$$(15)\quad G_j(b_i;b_j) \leq P_i \quad \text{for } G_j > 0 ,$$

$$(16)\quad |G_j(b_i;b_j)| \leq P_j \quad \text{for } G_j < 0 .$$

As long as the marginal utility from the benefit level is positive, any benefit level below b_{min} will lower utility from the provision of AFDC support without increasing the utility obtainable from other consumption. Thus, a benefit level in Region 5 will never be chosen and restrictions (14) and (16) will be superfluous. It may be rational for the state to offer a benefit greater than $\tilde{b}_i$ and restrictions (13) and (15) will then hold at equality.

The piecewise linearity of the migration function introduces an interesting nonlinearity into the state's budget constraint (Figure 3.3). For $b_i < b_i^{low}$ the budget constraint can be written as:

$$(17)\quad c_i = I_i - (1-s_i)(1-\tau_i)b_iP_i(1 - \frac{1}{K_i}(\rho(\tau_j\varepsilon_j + (1-\tau_j)b_j - \tau_i\varepsilon_i - (1-\tau_i)b_i) - cd)),$$

which has slope:

$$(18)\quad \frac{\partial c_i}{\partial b_i} = -(1-s_i)(1-\tau_i)P_i(1 - \frac{1}{K_i}(\rho(\tau_j\varepsilon_j + (1-\tau_j)b_j - \tau_i\varepsilon_i - 2(1-\tau_i)b_i) - cd)).$$

Notice that this slope is less negative the greater is b_j.

For b_i such that there is no migration, $b_i^{low} < b_i < b_i^{up}$, the budget constraint is:

$$(19)\quad c_i = I_i - (1-s_i)(1-\tau_i)b_iP_i\ ,$$

and has a constant slope of $-(1-s_i)(1-\tau_i)P_i$.

Lastly, for bi $> b_i^{up}$ the budget constraint is:

$$(20)\quad c_i = -(1-s_i)(1-\tau_i)b_i(P_i + \frac{P_j}{K_j}(\rho(\tau_i\varepsilon_i + (1-\tau_i)b_i - \tau_j\varepsilon_j - (1-\tau_j)b_j) - cd)),$$

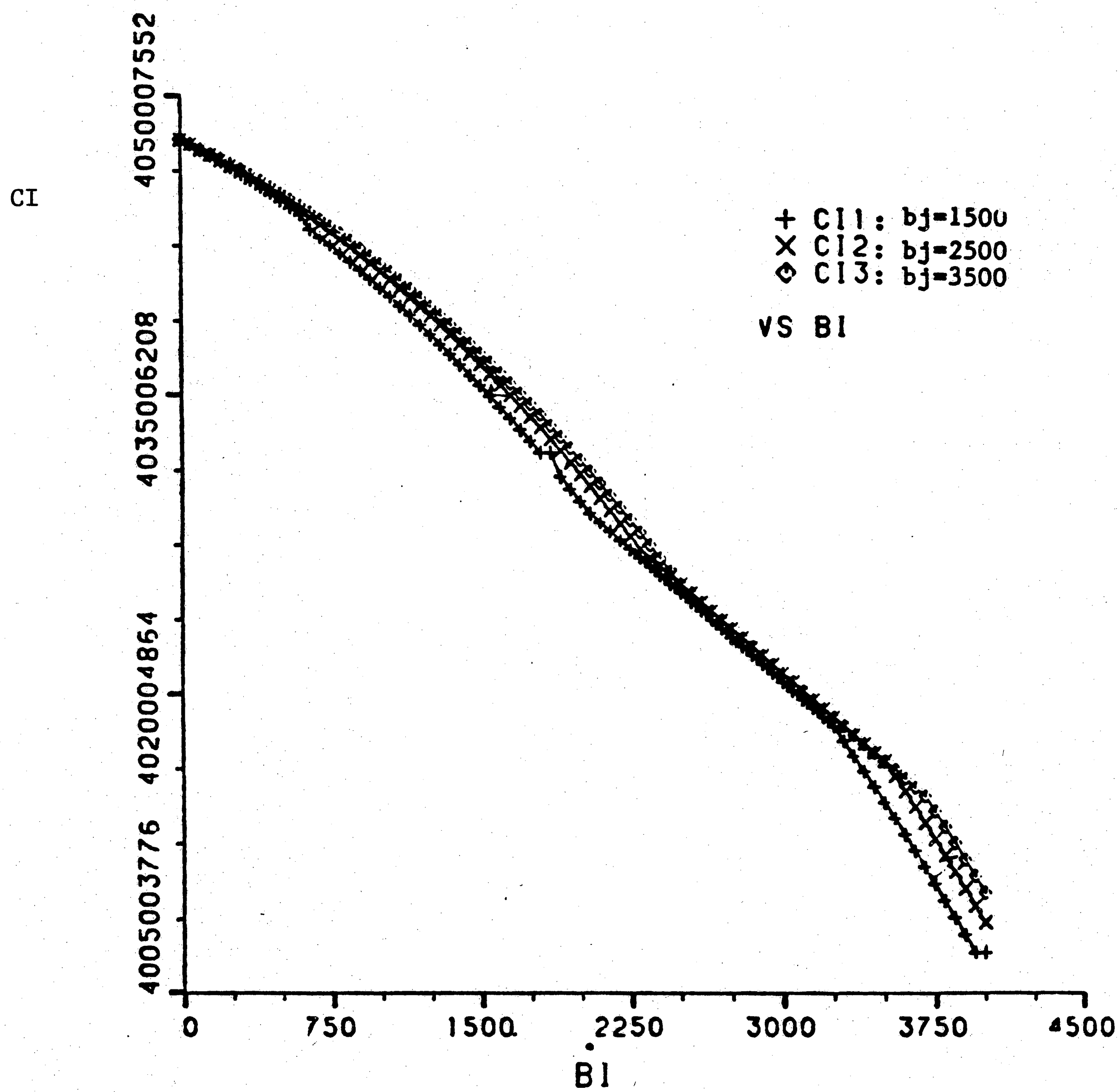

FIGURE 3.3

Examples of State i's Budget Constraint and Choice Set for Various Levels of b_j

and has slope:

$$(21)\quad \frac{\partial c_i}{\partial b_i} = -(1-s_i)(1-\tau_i)(P_i + \frac{P_j}{K_j}(\rho(\tau_i \varepsilon_i + 2(1-\tau_i)b_i$$

$$- \tau_j \varepsilon_j - (1-\tau_j)b_j) - cd)).$$

This slope also is less negative the greater is b_j.

This segmentation of the budget constraint raises a question as to the convexity of the state's choice set. The second derivatives of each segment of the budget constraint indicate that the choice set is convex over each segment. The convexity of the choice over all benefit levels depends on the relative slopes of each segment. If the slope is progressively more negative for each segment (as b_i increases) the choice set will be convex. Otherwise the choice set will be nonconvex, possibly giving rise to irregularities in the state's best response function.

To determine the conditions under which a state's choice set will be convex the slopes of each segment of the budget constraint are compared. First, consider the slopes of the segments $b_i \varepsilon (0, b_i^{low}]$ and $b_i \varepsilon (b_i^{low}, b_i^{up})$. Setting (18) to be less than (19) and solving for b_i yields the condition under which the slope of the first segment is more negative than the slope of the second segment:

$$(22)\quad \rho(\tau_j \varepsilon_j + (1-\tau_j)b_j - \tau_i \varepsilon_i - (1-\tau_i)b_i) - cd > \rho(1-\tau_i)b_i.$$

When the discounted expected income increment obtained by moving from state i to state j, net of monetary migration costs, is greater than the discounted expected AFDC income, the choice set over $b_i \varepsilon (0, b_i^{up})$ is not convex.

Next consider how the level of b_j affects this condition. Recall that as b_j increases the slope of the budget line over the out-migration segment, $b_i > b_i^{low}$, becomes less negative. Further, as b_j increases, the left hand side of (22) increases and the choice set will tend to become convex. Thus the convexity of the state's choice set depends on the strategy of; i.e., the benefit offered by, the rival.

Second, consider the slopes of the no-migraton and in-migration segments. Setting $-(1-s_i)(1-\tau_i)P_i$ to be greater than (21) and simplifying produces the condition under which the choice set from b_i^{low} to $\dfrac{I_i}{(1-s_i)(1-\tau_i)(P_i+G_i)}$ is convex:

$$(23) \quad \rho(\tau_i\varepsilon_i - \tau_j\varepsilon_j + (1 - \tau_i) - (1 - \tau_j)b_j) - cd > -\rho(1 - \tau_i)b_i.$$

The left-hand side of (23) is always positive as bi $> b_i^{up}$ by assumption, so (23) always holds.

In sum, the analysis of the relative slopes of each segment of the budget constraint produces a single convexity condition, equation (22). Simply interpreted, this condition means that the state's choice set will fail to be convex if the potential migrant can more than double his expected income by moving.

C. The Noncooperative Generalized Game

Recall that each state behaves as if it were maximizing its utility over the AFDC benefit level and other consumption subject to an exogenous budget and given the migration parameters. Furthermore, each state regards the other's benefit level as one of these given parameters, the standard Nash behavioral assumption. Further recall that because a state is obligated to make AFDC payments to any eligible resident, whether a long time resident or recent immigrant, the state's budget constraint is:

$$(1) \quad I_i = c_i + (1 - s_i)(1 - \tau_i)b_i(P_i + G_i(b_i;b_j)),$$

where $c_i \geq 0$. Note that the interdependence of the choice variables, b_i and b_j, in this case will not only affect the agents' payoff (utility) functions, but also their respective sets of feasible strategies (benefit levels). Due to this feature this game may be more precisely described as a generalized game (Debreu, 1952) or an "abstract economy" (Ichiishi, 1983).

In normal form the game consists of two players (states), i and j. Associated with each is a set of potential, or possible, strategies (benefit levels), B_i. The lowest potential b_i, or b_j, is obviously zero. To determine the largest potential b_i and b_j consider the joint budget constraint when both players expend all their income on AFDC: $b_iP_i + b_jP_j \leq I_i + I_j$. The largest potential b_i and b_j are then $\frac{I_i + I_j}{P_i}$ and $\frac{I_i + I_j}{P_j}$ respectively. Thus, $B_i = [0,\frac{I_i + I_j}{P_i}]$ and $B_j = [\frac{I_i + I_j}{P_j}]$.

To be feasible, a strategy b_i must be such that $(1-s_i)(1-\tau_i)b_i \cdot (P_i + G_i(b_i;b_j)) \leq I_i$. Thus, by selecting a given strategy, b_j, the j^{th} player restricts the set of feasible strategies available to i to a non-empty strict subset of B_i. Let $\psi_i(b_j)$: $B_j \rightarrow B_i$ denote the correspondence from state j's set of potential strategies to the set of feasible strategies for player i. Taking b_j, and therefore $\psi_i(b_j)$, as given, player i chooses the feasible strategy which maximizes his utility. That is, player i chooses an element of:

$$(24) \quad \mu_i(b_j) = \{b_i \in \psi_i(b_j) \mid u_i(b_i,b_j) = \max_{y \in \psi_i(b_j)} u_i(y,b_j)\},$$

The equilibrium pair of benefit levels is a point $b^* = (b_i^*,b_j^*)$ in the set of jointly feasible strategies such that neither player can increase his utility, given the other player's strategy. Let $\mu(b) = \mu_i(b_i) \times \mu_j(b_j)$. Then b^* is an equilibrium if and only if $b^* \in \mu(b^*)$; i.e., if b^* is a fixed point of the correspondence μ.

D. Existence of Equilibrium

Debreu (1982) proves that if for every player the set of potential strategies is non-empty, compact, and convex, and if the payoff function is continuous on the space of jointly potential strategies and quasi-concave in own strategy, and if the correspondence defining the set of feasible strategies is continuous and convex-valued then the generalized game has an equilibrium. Thus, to establish that an equilibrium in the game described by $(B_i,\mu_i,\psi_i)_{i\in N}$ exists we must demonstrate that it satisfies each of Debreu's conditions.

Clearly, the sets of potential strategies, B_i and B_j, are non-empty, compact, and convex as they are merely intervals on the real line. Further, we assume that the payoff functions are continuous on B and quasi-concave in b_i.

The correspondence $\psi_i(b_j)$: $B_j \to B_i$ is non-empty as b_i=0 is always feasible. Also, for any given b_j, ψ_i is simply an interval and is therefore convex-valued. To determine if ψ_i is also continuous we must first precisely describe the correspondence ψ_i:

(25) $\psi_i(b_j) = \{b_i \in B_i | \; I_i - (1 - s_i)(1-\tau_i)b_i(P_i + G_i(b_i;b_j)) \geq 0\}$.

To establish that ψ_i is continuous on B we shall first demonstrate that it is upper semicontinuous. The correspondence is then shown to be lower semicontinuous also.

<u>Theorem</u>: The correspondence ψ_i, which relates the rival's benefit level to state i's set of feasible benefits, is upper semicontinuous.

To be upper semicontinuous it is sufficient for ψ_i to have a closed graph and a compact range. Accordingly, the proof of upper semicontinuity is made up of two parts. First, the graph of ψ_i is shown to be closed. Second, the range of ψ_i is shown to be compact.

<u>Proof</u>:

Part 1: Let $F(b_i,b_j) = I_i - (1 - s_i)(1 - \tau_i)(P_i + G_i(b_i;b_j))$. The graph of ψ_i, $gr(\psi_i) = \{(b_i,b_j) | \; F(b_i,b_j) \geq 0 \}$, being closed means that for any sequence b_i^n converging to $\bar{b}_j$ and any sequence b_j^n converging to $\bar{b}_j$, where $b_i \varepsilon \psi_i(b_j)$ for all n, $\bar{b}_i \varepsilon \psi_i(\bar{b}_j)$; i.e., $F(\bar{b}_i,\bar{b}_j) \geq 0$. Note that by assumption $F(b_i^n,b_j^n) \geq 0$. Since F is continuous and has a minimum of zero, $F(b_i,b_j) \geq 0$ globally. Thus $F(\bar{b}_i,\bar{b}_j) \geq 0$, meaning the graph of ψ_i is closed.

Part 2: To be compact, the range of ψ_i must be bounded and closed. Recall that $\psi_i(b_j) = \{b_i \in B_i | \; I_i - (1 - s_i)(1-\tau_i)b_i(P_i + Gi(b_i;b_j) \geq 0\}$.

Let $\breve{b}_i \in \psi_i(\breve{b}_j)$ and $\hat{b}_j > \breve{b}_j$. The former means that,

$$I_i - (1 - s_i)(1-\tau_i)\breve{b}_i(P_i + G_i(\breve{b}_i,\breve{b}_j)) \geq 0.$$

Because G_i is non-increasing in b_j, $G_i(\breve{b}_i,\hat{b}_j) \leq G_i(\breve{b}_i,\breve{b}_j)$. Thus, $\hat{b}_i \in \psi_i(b_j)$, which implies that ψ_i is monotonic. Because ψ_i is monotonic range$(\psi_i) = \psi_i(b_j^{max}) = \psi_i\left(\frac{I_i + I_j}{P_j}\right)$, which is closed and bounded.

In sum, ψ_i has a closed graph and a compact range and is therefore upper semicontinuous.

<u>Theorem</u>: The correspondence ψ_i is lower semicontinuous.

For ψ_i to be lower semicontinuous it must be that for any $\bar{b}_i \in \psi_i(\bar{b}_j)$, $(\bar{b}_i,\bar{b}_j) \in B$, and any b_j^n converging to $\bar{b}_j$ there exists a sequence b_i^n converging to $\bar{b}_i$ such that $b_i^n \in \psi_i(b_j^n)$, for all n. That is, there must exist a sequence $b_i^n \rightarrow \bar{b}_i$ such that $F(b_i^n,b_j^n) \geq 0$.

<u>Proof</u>:

Consider first the case in which $F(\bar{b}_i,\bar{b}_j) > 0$. Let $b_i^n = \bar{b}_i$ be a sequence converging to b_i. Because F is non-increasing in b_i, $F(b_i, b_j) \geq 0$ and thus $F(\bar{b}_i,\bar{b}_j) \geq 0$ for n large enough.

Second consider the case when $F(\bar{b}_i,\bar{b}_j) = 0$. Because G_i, and hence $F(b_i,b_j)$, is piecewise linear in b_i and b_j the implicit function theorem may be applied to define b_i as a function of b_j near (b_i,b_j): $b_i = f(b_j)$. Let $b_i^n = f(b_j^n)$. Then $(b_i^n,b_j^n) \in B$ by construction of f. The limit of b_i^n as n goes to infinity is $\bar{b}_i$ as f is continuous. Thus there is a sequence $b_i^n \rightarrow \bar{b}_i$ such that $F(b_i^n,b_j^n) \geq 0$; i.e., $b_i^n \in \psi_i(b_j^n)$ and ψ_i is lower semicontinuous.

Establishing the continuity of ψ_i completes the set of Debreu equilibrium conditions, thus :

Corollary: Assuming that the payoff function is continuous and quasi-concave in b_i, an equilibrium in the AFDC benefit-setting game described by (B_i, μ_i, ψ_i) exists.[4]

E. Model Comparative Statics: The Case of Cobb-Douglas Utility Functions

To facilitate the comparative static analysis of the model, let us consider a specific case. Suppose each state behaves as if it were maximizing a Cobb-Douglas utility function:[5]

$$(26) \quad u_i(c_i, b_i) = c_i^{\gamma_i} b_i^{1-\gamma_i} .$$

Assuming that u_i is monotonic the state's choice can be reduced from a pair (c_i, b_i) to simply b_i, given b_j. Substituting the budget constraint for c_i produces:

$$(27) \quad u_i(b_i, b_j) = (I_i - (1-s_i)(1-\tau_i)b_i(P_i + G_i(b_i;b_j)))^{\gamma_i} b_i^{1-\gamma_i}$$

Because G_i is continuous in b_i and b_j, the payoff function (27) will be continuous in b_i. Furthermore, it can be shown that if the choice set is convex $u_i(b_i, b_j)$ is quasi-concave in b_i. If the choice set is not convex u_i may not be quasi-concave and an equilibrium may not exist.[6] Thus, restricting our attention to convex choice sets, the game assuming Cobb-Douglas utility functions satisfies the established conditions for existence of an equilibrium.

Maximizing (27) with respect to b_i yields the following first order condition:

$$(28)\quad (1 - s_i)(1 - \tau_i)b_i(P_i + \gamma_i b_i \frac{\partial G_i}{\partial b_i} + G_i) - (1 - \gamma_i)I_i = 0.$$

Solving (28) for b_i produces state i's reaction, or best response, function:

$$(29)\quad b_i^* = \frac{-(P_i+G_i) + \sqrt{(P_i+G_i)^2 - 4\gamma_i \frac{\partial G_i}{\partial b_i} \frac{(\gamma_i - 1)I_i}{(1-s_i)\ (1-\tau_i)}}}{2\gamma_i \frac{\partial G_i}{\partial b_i}}$$

However, G_i is a function of b_i. To solve for b_i^* we must substitute in the appropriate segment of the migration function. State i will accordingly have a reaction function comprised of three parts, each part describing the utility maximizing benefit level given the migration parameters and the migration region.[7] For a given b_j, state i will calculate its best response in each region. The benefit which state i will offer is the feasible best response which yields the highest utility.

The simplest situation is the response function segment for Region 2, the region of no migration. Because both $G_i(b_i;b_j)$ and $\frac{\partial G_i}{\partial b_i}$ are zero the general first order condition (29) reduces to:

$$(29')\quad (1 - s_i)(1 - \tau_i)b_iP_i - (1 - \gamma_i)I_i = 0.$$

The optimal benefit level, or best response, is then $b_{i2}^{*} = \dfrac{(1 - \gamma_i)I_i}{(1-s_i)(1-\tau_i)P_i}$.
The comparative static properties of the equilibrium benefit level when there is no migration between the states can now be easily determined:

$$(30) \quad \frac{\partial b_{i2}^{*}}{\partial \gamma_i} < 0, \quad \frac{\partial b_{i2}^{*}}{\partial I_i} > 0, \quad \frac{\partial b_{i2}^{*}}{\partial s_i} > 0, \quad \frac{\partial b_{i2}^{*}}{\partial P_i} < 0, \quad \frac{\partial b_{i2}^{*}}{\partial \tau_i} > 0$$

$$\frac{\partial b_{i2}^{*}}{\partial \gamma_j} = \frac{\partial b_{i2}^{*}}{\partial I_j} = \frac{\partial b_{i2}^{*}}{\partial s_j} = \frac{\partial b_{i2}^{*}}{\partial P_j} = \frac{\partial b_{i2}^{*}}{\partial \tau_j} = \frac{\partial b_{i2}^{*}}{\partial c} = \frac{\partial b_{i2}^{*}}{\partial d} = \frac{\partial b_{i2}^{*}}{\partial K_i} = \frac{\partial b_{i2}^{*}}{\partial K_j} = 0$$

The higher the Cobb-Douglas utility weighting on other consumption the lower will be the equilibrium benefit level. This may be interpreted as indicating that states with lower preferences for poverty relief will offer lower average AFDC benefits. The higher the state's income the higher the benefit it will offer. This is simply the income effect for a normal good. The higher is the federal matching share, and therefore the lower the marginal dollar price of b_i, the higher will be the benefit level offered. This result is the standard price response. The greater the state's stock of poor, and thus the higher the marginal caseload price of b_i, the lower will be the equilibrium benefit. Again, this is the standard price response. Finally, the higher the probability of employment, the higher will be the benefit level because in-migration poses less of a financial threat.

Because G_i and $\dfrac{\partial G_i}{\partial b_i}$ are, by definition, zero in this area, the benefit-setting game is in a sense "suspended." State j's employment will not affect state i's choice. The costs of migration and the distance to the rival state also will have no impact on the state's benefit level.

In Region 4, where all of state j's poor migrate to i, $G_i > 0$ and $\frac{\partial G_i}{\partial b_i} = 0$. In this region the first order condition is:

$$(25'')\quad (1-s_i)(1-\tau_i)(P_i+P_j) - (1-\gamma_i)I_i = 0,$$

and the optimal benefit level is $b^*_{i4} = \frac{(1-\gamma_i)I_i}{(1-s_i)(1-\tau_i)(P_i+P_j)}$. The same comparative static results as in Region 2 hold with the addition that $\frac{\partial b_{i4}}{\partial P_j} < 0$. The larger the stock of poor in the rival state, the lower the equilibrium benefit level in this region.

In Regions 1 and 3, where migration and $\frac{\partial G_i}{\partial b_i}$ are both nonzero, the generalized game takes place and the rival's characteristics and migration costs will influence a state's AFDC benefit choice. Substituting (5) into (29) produces state i's best Region 1 (out-migration) response :

$$(31)\qquad b_i^1 = \frac{-P_i\left(1 - \frac{1}{K_i}\left(\rho(\tau_j\varepsilon_j - \tau_i\varepsilon_i + (1-\tau_j)b_j) - cd_{ij}\right)\right)}{2\frac{P_i}{K_i}\rho(1-\tau_i)(1+\gamma_i)} +$$

$$\frac{\sqrt{P_i^2\left(1-\frac{1}{K_i}\left(\rho(\tau_j\varepsilon_j-\tau_i\varepsilon_i+(1-\tau_j)b_j)-cd_{ij}\right)\right)^2 - 4\frac{P_i}{K_i}\frac{\rho(\gamma_i+1)(\gamma_i-1)I_i}{(1-s_i)}}}{2\frac{P_i}{K_i}\rho(1-\tau_i)(1+\gamma_i)}$$

Substituting (6) into (29) produces state i's best Region 3 (in-migration) response:

$$b_i^3 = \frac{-(P_i + \frac{P_j}{K_j}(\rho(\tau_i\varepsilon_i - \tau_j\varepsilon_j - (1-\tau_j)b_j) - cd_{ij}))}{2\frac{P_j}{K_j}\rho(1-\tau_i)(1+\gamma_i)} + \tag{32}$$

$$\frac{\sqrt{(P_i + \frac{P_j}{K_j}(\rho(\tau_i\varepsilon_i - \tau_j\varepsilon_j - (1-\tau_j)b_j) - cd_{ij}))^2 - 4\frac{P_j}{K_j}\frac{\rho(\gamma_i+1)(\gamma_i-1)I_i}{(1-s_i)}}}{2\frac{P_j}{K_j}\rho(1-\tau_i)(1+\gamma_i)}$$

The rival's best reponse functions for Region 1 and 3 can be similarly derived:

$$b_j^1 = \frac{-P_j(1 - \frac{1}{K_j}(\rho(\tau_i\varepsilon_i - \tau_j\varepsilon_j + (1-\tau_i)b_i) - cd_{ij}))}{2\frac{P_j}{K_j}\rho(1-\tau_j)(1+\gamma_j)} + \tag{33}$$

$$\frac{\sqrt{P_j^2(1 - \frac{1}{K_j}\quad(\rho(\tau_i\varepsilon_i - \tau_j\varepsilon_j + (1-\tau_i)b_i) - cd_{ij}))^2 - 4\frac{P_j}{K_j}\frac{\rho(\gamma_j+1)(\gamma_j-1)I_j}{(1-s_j)}}}{2\frac{P_j}{K_j}\rho(1-\tau_j)(1+\gamma_j)}$$

$$(34)\qquad b_j^3 = \frac{-\left(P_j + \frac{P_i}{K_i}\left(\rho(\tau_j\varepsilon_j - \tau_i\varepsilon_i - (1-\tau_i)b_i) - cd_{ij}\right)\right)}{2\,\frac{P_i}{K_i}\,\rho(1-\tau_j)(1+\gamma_j)} + \frac{\sqrt{\left(P_j + \frac{P_i}{K_i}\left(\rho(\tau_j\varepsilon_j - \tau_i\varepsilon_i - (1-\tau_j)b_i) - cd_{ij}\right)\right)^2 - 4\,\frac{P_i}{K_i}\,\frac{\rho(\gamma_j+1)(\gamma-1)I_j}{(1-s_j)}}}{2\,\frac{P_i}{K_i}\,\rho(1-\tau_j)(1+\gamma_j)}$$

To solve for state i's equilibrium benefit level, assuming it exports its poor to state j for example, one would substitute (34) into (31) and solve for b_i. Conversely, substituting (31) into (34) produces state j's equilibrium benefit level, given it imports state i's poor. Because each state's regional best response function is quite complex, these substitutions produce very lengthy and complicated expressions which cannot be solved explicitly.

The equilibrium can, however, be characterized by an implicit function. Let A equal the expression which results from substituting (29) into (28). Then this particular equilibrium is the solution of the following implicit function:

$$(35)\qquad b_i^1 - A = 0.$$

In principle, comparative statics of the state i export-state j import equilibrium can now be obtained by applying the implicit function rule. In the Cobb-Douglas case the resulting expressions can be signed only by making numerous restrictions on the ranges of the parameters.

Fortunately, the comparative static properties of the import-export equilibria benefits can be determined through numeric simulation. A SAS program has been written which simulates the generalized game assuming Cobb-Douglas preferences. The program uses an iterative search routine to determine the equilibrium pair of benefit levels for a given set of parameter values within the observed ranges.[8] The value of one parameter is allowed to vary and the equilibrium benefit levels are then plotted against this variable. The slopes of the resulting graphs suggest the direction of the impact of a change in the parameter on the equilibrium.

The results of these simulations will be presented in detail for three parameters of particular interest: the initial (pre-migration) stock of poor, state income, and the federal matching share. The results for the remaining parameters will, for the sake of brevity, be reported in less detail.

E.1 The Initial Stock of Poor

Previous studies; e.g., Orr (1976), generally find that the greater the state's poor population the lower, on average, are the state's per recipient benefit levels. The game theoretic model simulations also indicate an inverse relationship between the number of poor in the state and the average benefit level (Figure 3.4). This result obtains because the greater the number of poor in the state, the greater is the caseload price (and hence the marginal cost) of increasing the benefit level.

The game theoretic model further implies an additional response to the poor population in the rival state: the larger the stock of poor in the rival state the lower will be the state's own equilibrium benefit level (Figure 3.5). Intuitively, this relationship makes sense. Suppose state j has a substantial number of poor residents. State i will recognize that offering a benefit level which induces the in-migration of even a small fraction of j's poor can mean a large absolute increase in its own AFDC caseload. Thus, state i will set a lower benefit level than would be the case if state j's poor population were relatively smaller, ceteris paribus.

E.2 State Income

Simulations of the impact of changes in state income indicate that the higher the state's income the higher, on average, is its equilibrium benefit level (Figure 3.6). This result simply reflects the income effect for normal goods and is common in the literature. The model also predicts that higher the rival state's income the higher will be the state's own equilibrium benefit level (Figure 3.7). The intuition here is that a higher rival state income implies a higher rival state benefit level. Consequently the state can raise its own level without attracting as many the rival's poor.

E.3 The Federal Matching Share

According to the simulations, the game theoretic model predicts that the current federal matching program will have a positive effect on states' choice of benefit levels: The higher the federal share the

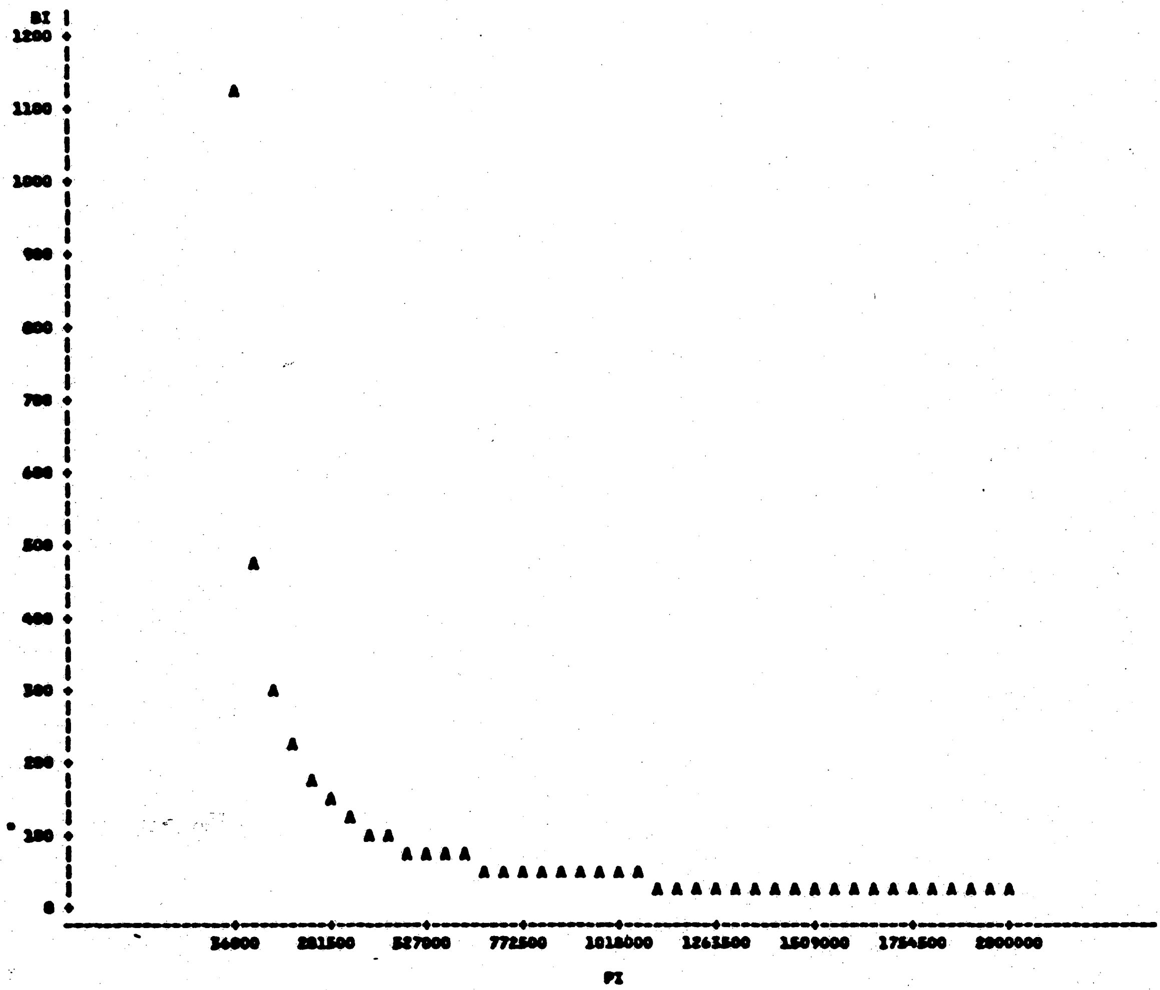

FIGURE 3.4

Impact of Own Initial Stock of Poor on State i's Equilibrium Benefit Level

(See Appendix B for parameter values)

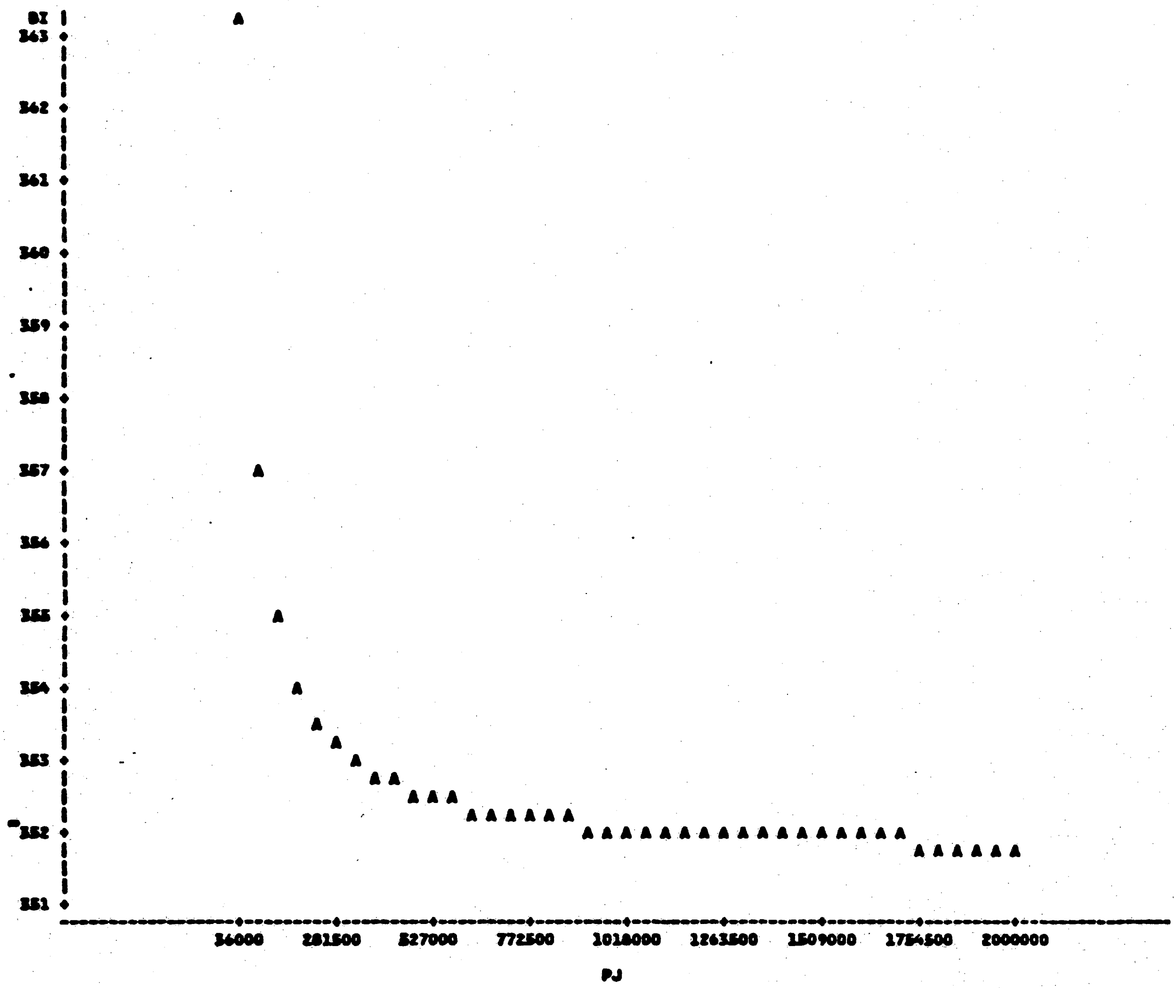

FIGURE 3.5

Impact of Rival's Initial Stock of Poor on State i's Equilibrium Benefit Level

(See Appendix B for parameter values)

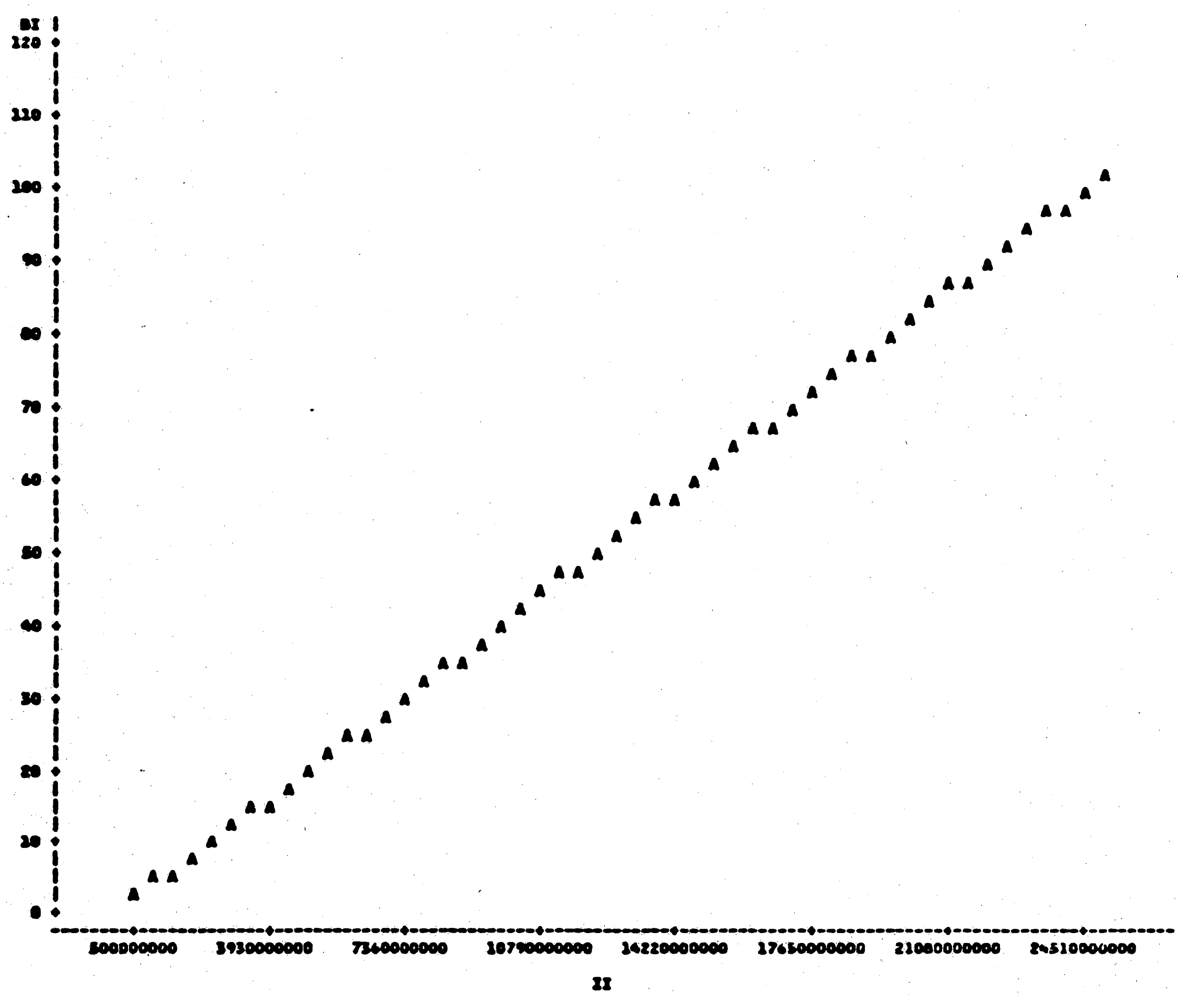

FIGURE 3.6

Impact of Own Exogenous Budget on State i's Equilibrium Benefit Level

(See Appendix B for parameter values)

higher will be the state's equilibrium benefit level (Figure 3.8). This implication is consistent with findings by Pogue and Sgontz (1968), Orr (1976), and Craig and Inman (1985).

Furthermore, the model predicts that the higher the federal share paid to the rival state, the higher will be the state's own equilibrium benefit level, ceteris paribus. The higher the federal share in the rival state the higher the rival's benefit level and the smaller the expected gain from moving from i to j. Thus, the higher is s_j the lower lower is state i's caseload price, and the higher its offered benefit (Figure 3.9).

E.4 <u>Expected Earnings, Migration Costs, and Preferences</u>

The results of the simulations for the remaining parameters are summarized in Table 3.1. The higher the average earnings of the poor in the state, the lower will be the equilibrium benefit level. Conversely, the higher the average earnings of the poor in the rival state, the higher will be the equilibrium benefit level. These comparative statics conform to the observed general pattern: Any characteristic which makes the state more attractive raises the caseload price and thus lowers the equilibrium benefit level. Also, any characteristic which makes the rival more attractive lowers the caseload price and thus raises the equilbrium benefit level.

The effect of the state's employment rate on the equilibrium benefit level cannot be signed. This indeterminancy arises because τ_i exerts two conflicting pressures on the AFDC caseload price and thus the chosen benefit level. First, a higher employment rate will attract the

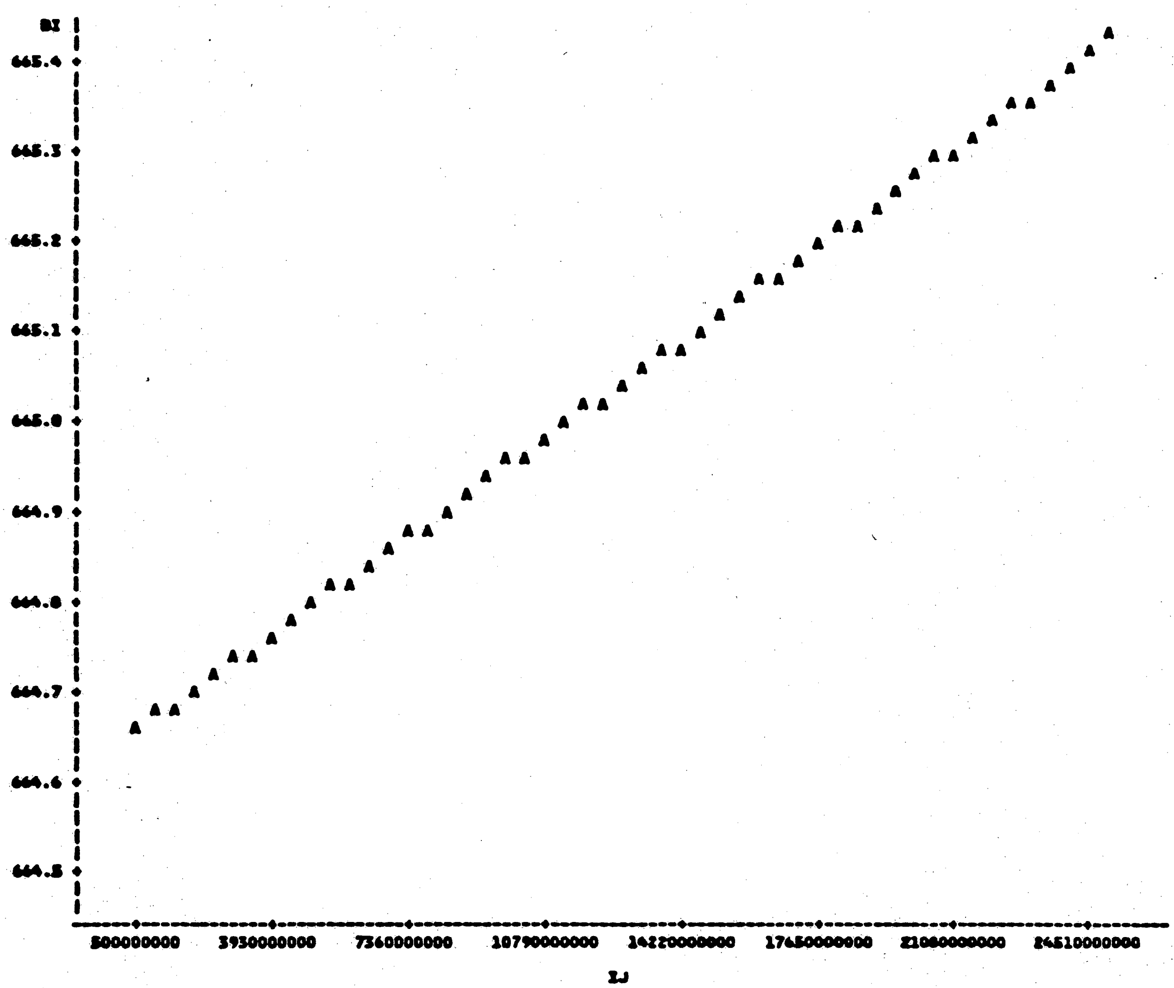

FIGURE 3.7

Impact of Rival's Exogenous Budget on State i's
Equilibrium Benefit Level

(See Appendix B for parameter values)

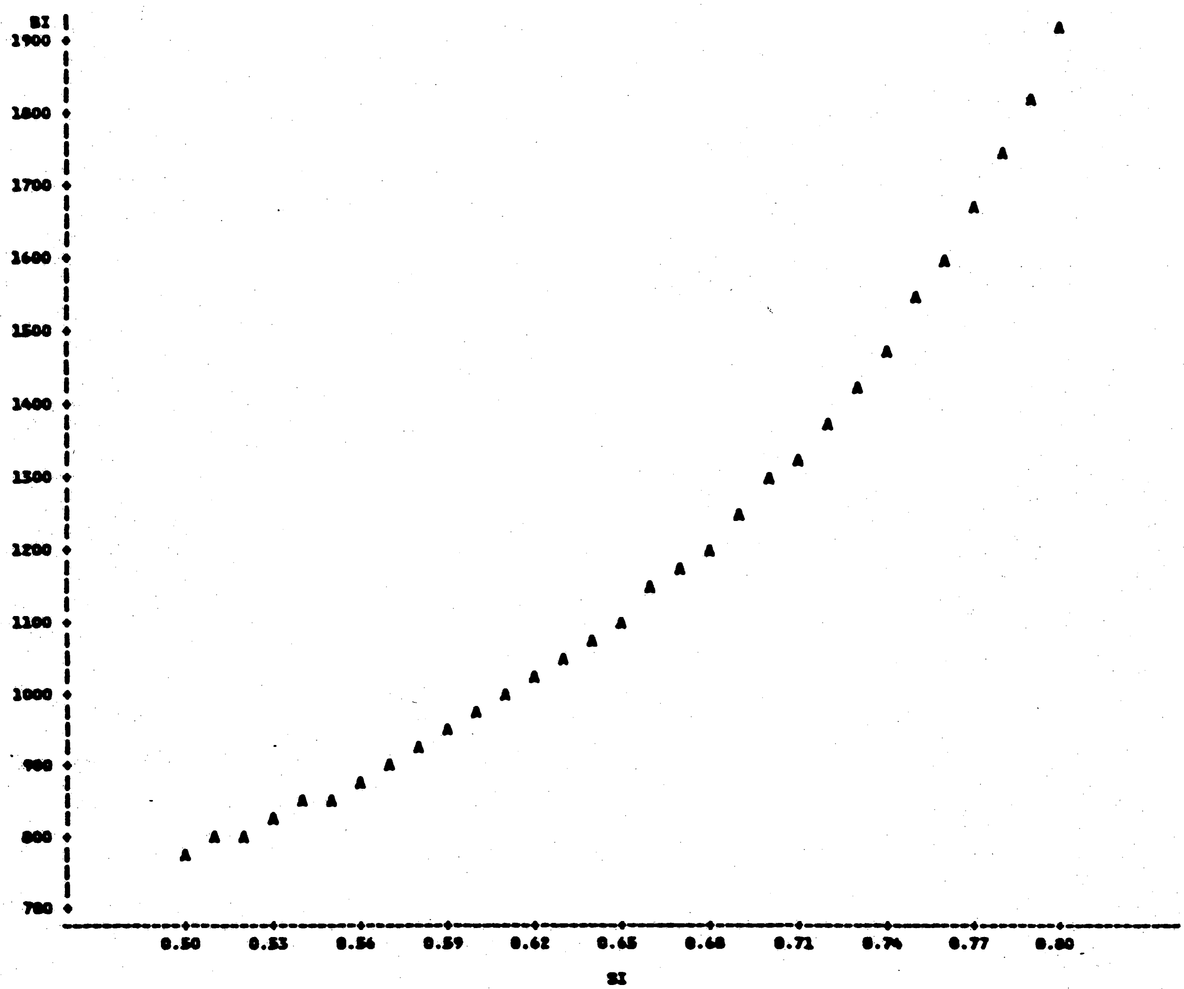

FIGURE 3.8

Impact of Own Federal Share on State i's Equilibrium Benefit Level

(See Appendix B for parameter values)

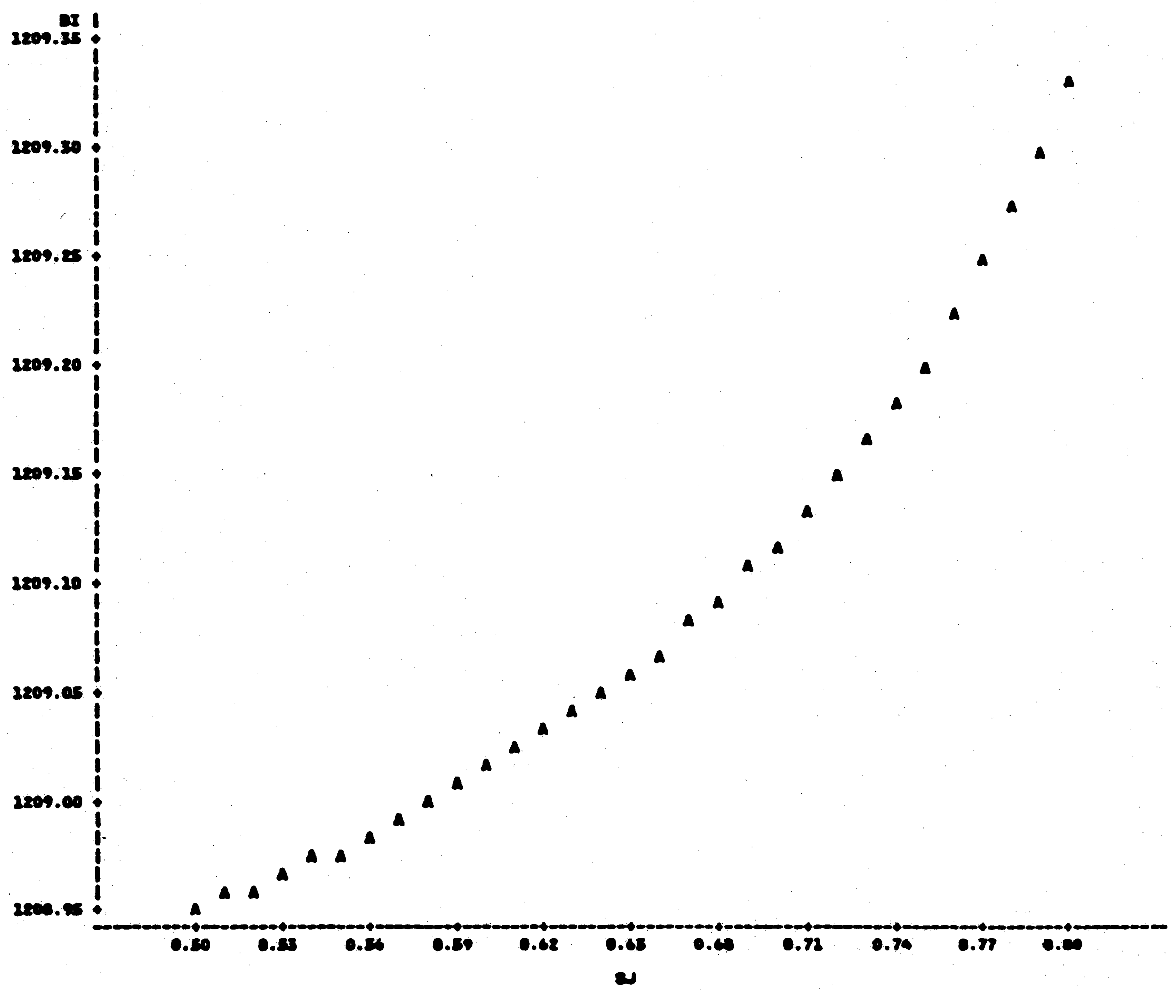

FIGURE 3.9

Impact of Rival's Federal Share on State i's Equilibrium Benefit Level

(See Appendix B for parameter values)

TABLE 3.1

Impact of Migration Parameters on Equilibrium Benefit Levels

Variable	Impact on Equilibrium Benefit Levels
average earnings	$\frac{\partial b_i^*}{\partial \varepsilon_i} < 0, \quad \frac{\partial b_i^*}{\partial \varepsilon_j} > 0$
probability of employment	$\frac{\partial b_i^*}{\partial \tau_i} \lessgtr 0, \quad \frac{\partial b_i^*}{\partial \tau_j} \lessgtr 0$
Cobb-Douglas utility weight on other consumption	$\frac{\partial b_i^*}{\partial \gamma_i} < 0, \quad \frac{\partial b_i^*}{\partial \gamma_j} < 0$
migration cost, per mile	$\frac{\partial b_i^*}{\partial c} \gtrless 0, \quad \frac{\partial b_j^*}{\partial c} \lessgtr 0$
distance	$\frac{\partial b_i^*}{\partial d_{ij}} \gtrless 0, \quad \frac{\partial b_j^*}{\partial d_{ij}} \lessgtr 0$

poor, raising the caseload price of the AFDC benefit and lowering b_i. Second, a higher employment rate will reduce the likelihood that a resident will indeed join the AFDC roles, reducing the caseload price of the benefit level and raising b_i.

The effect of the monetary costs of migration and distance are also indeterminant. Each parameter exerts both positive and negative pressures on the equilibrium benefit level. The greater the costs of migration and the greater the distance to the rival, the less likely are a state's residents to out-migrate. Thus, the higher are c and d the greater the caseload price of the benefit level. However, the higher are both these variables, the less likely are the rival's poor to in-migrate. Thus, higher costs and greater distances simultaneously act to reduce the caseload price of the benefit level.

The effect of both c and d on the size of the no-migration zone can, however, be unambiguously determined:

$$\frac{\partial b_i^{low}}{\partial c} = - \frac{\partial b_i^{up}}{\partial c} = - \frac{d}{\rho(1 - \tau_i)} \qquad (36)$$

For each unit increase in the monetary cost of migration per mile expands the range of no-migration by $\frac{2d}{\rho(1-\tau_i)}$.

Similarly,

$$\frac{\partial b_i^{low}}{\partial d} = - \frac{\partial b_i^{up}}{\partial d} = - \frac{c}{\rho(1 - \tau_i)} . \qquad (37)$$

For each one mile increase in the distance between the competing states Region 2 expands by $\frac{2c}{\rho(1-\tau_i)}$. Equations (36) and (37) show that as either c or d increases, the larger is the range of b_i over which no migration takes place. Given the comparative statics of the no-migration equilibrium one would then expect that the larger the total monetary cost of migration the less likely that the rival's characteristics will influence the state's benefit selection. Or alternatively, the larger the total monetary cost of migration the less intense will be the competition between the states.

Finally, the greater the Cobb-Douglas utility weight on other consumption (γ_i), the lower the state's equilibrium benefit level. Simply put, states which prefer other consumption to the provision of some minimum income level for the poor offer lower AFDC benefit levels. The model also implies that the lower the rival's utility weight on other consumption, the higher will be the state's own equilibrium benefit level. That is, if the state's rival AFDC program appears quite generous a state can raise its benefit level without attracting poor immigrants.

FOOTNOTES

[1]An article in the July 13, 1975 edition of the Los Angeles Times provides anecdotal evidence that states do in fact consider the impact of their welfare benefit levels on the migration behavior of of the poor. The article reports that the Michigan Manpower Council was "trying to find ways to export welfare recipients." The specific proposal under consideration was a plan to pay welfare recipients $5,000 to leave the state. The Council was seeking a method to reduce the state's growing relief roles because "Michigan was attracting too many unemployed persons from states in which welfare payments were less generous."

[2]Transfer payments were the sole source of income for 87.2% of AFDC recipient families in 1979.

[3]Other distributions, such as the Chi-square, would be more general, but would unduly increase the mathematical complexity of the problem.

[4]Uniqueness of equilibrium in the generalized game has not been formally established in the literature and such a proof is beyond the scope of this study.

[5]This form has been chosen for two reasons. First, Cobb-Douglas utility functions possess a number of well-known and desirable properties. Second, other more general forms, such as CES, greatly increase the mathematical complexity of the model.

[6]If u_i is not quasi-concave the best response function may be discontinuous and multi-valued. Thus, an equilibrium may not exist. However, simulations of this game (described in Appendix B) indicate that even when the state's choice set is not convex equilibrium usually exists.

[7]Recall that in Region 1 the state exports its poor and in Region 3 the state imports poor from its rival. See equations (5), (6) and (7) and Figure 3.2.

[8]Data for the migration parameters has been collected for 1979. See Appendix A. Appendix B explains the simulation program in detail and reports the parameter values used to generate Figures 6 through 10.

CHAPTER 4

EMPIRICAL TESTS OF THE GAME THEORETIC MODEL

The major econometric challenge is to design and conduct tests of the two state model developed in Chapter 3 using forty-eight state data.[1] To empirically test the model two general questions must be resolved: 1) How can "the rival" be defined given that each state may actually compete with up to forty-seven other states? 2) How can one specify the benefits equation given that the optimal benefit may not have a closed-form solution (see equations (31) through (34))? Section A discusses two methods for defining each state's rival through alternative data structures. Section B presents two basic model specification issues: the choice of functional form and the treatment of states' preferences. The remaining sections present the results from analyses using both single and multi-equation estimation techniques.

A. Alternative Methods for Defining the Rival

This section explores and evaluates two methods of empirically defining a state's rival. Both approaches are based on data structure rather than on any specific econometric techniques. First, the data are structured such that each observation is made up of a state's AFDC benefit level, its migration parameters, those of another state, which serves as the "rival," and the distance between the two states. For example, the average benefit level, employment rate, average earnings of the poor, et cetera, for Virginia would be paired with those variables, save the benefit level, for Maryland, along with the distance between

Virginia and Maryland.[2] Constructed in this fashion each observation will capture competition between two states. This approach is referred to as the "state pairs data structure."

The question now is which pairs of state ought to be considered as rivals. One can easily imagine contiguous neighbor states engaged an AFDC benefit-setting game. A data set composed of observations on pairs of contiguous states would then seem to be appropriate. The poor do, however, migrate between non-bordering states, indicating that the contiguity criterion may be too restrictive. As the model itself does not imply a specific definition of rivalrous state pairs a variety of pairwise data structures will be explored.

Second, the data are structured such that a state's benefit and migration parameters are paired with the migration parameters of a composite of all other states. The composite rival is constructed by distance weighting the information in all other states. As the model does not imply a specific weighting structure two weighting schemes are explored. This approach will be referred to as the "composite rival" data structure.

B. Model Specification

The model implies that a very complex nonlinear relationship exists between the AFDC benefit level and the specified parameters. In fact, each state's best response functions for Regions 1 and 3 alone are rather complicated and nonlinear (see equations (31) through (34)) . Furthermore, a closed-form solution for the "global" best response can not be analytically derived; there is no structural equation to which nonlinear estimation techniques can be applied. However, the "global" best response function can be characterized as an implicit function such as (35). Because this implicit function is locally continuous and differentiable it can be linearly approximated, locally, using a first order Taylor Series expansion. Thus, the following simple linear specification of the benefit function will be estimated and used to test the model's implications:

$$(36)\quad b_i = \alpha_0 + \alpha_1\tau_i + \alpha_2 EARN_i + \alpha_3\gamma_i + \alpha_4 I_i + \alpha_5 s_i + \alpha_6 P_i + \alpha_7\tau_j + \alpha_8 EARN_j + \alpha_9\gamma_j + \alpha_{10} I_j + \alpha_{11} s_j + \alpha_{12} P_j + \alpha_{13} DIST + \mu_i.$$

The random error, μ_i, is assumed to be normally distributed and the independent variables are as defined in Table 4.1.[3]

A number of the independent variables can be measured by a variety of statistics. Consider for example EARN. The migration function posits that migration is a direct function of expected earnings. In selecting the appropriate measure of EARN one must decide exactly whose expected earnings enters the migration decision. In 1979 females headed the majority of AFDC families. This fact suggests that the potential poor migrant is likely to be female and hence that the appropriate earnings to measure would be those of poor female-headed households ($FE_{i,j}$). Nearly twenty percent of AFDC recipient families were headed by males however. It may well be that male earnings may also influence the migration decisions of potential AFDC recipients. Accordingly, the model is also estimated using the average earnings of all poor families to measure EARN ($E_{i,j}$).

TABLE 4.1

Variable Descriptions

Variable	Definition	Minimum	Maximum	Mean
b	The average annual AFDC benefit per recipient.	\$328.32	\$1455.36	\$966.45
τ	The rate of employment in 1979.	.920	.972	.946
EARN	The average annual earnings of a poor resident. Two measures are used.			
	1. The average annual earnings of families with incomes below the 1979 poverty line ($E_{i,j}$).	\$1929.00	\$4254.00	\$3103.06
	2. Mean earnings of female-headed households with incomes below the 1979 poverty line ($FE_{i,j}$).	\$2017.00	\$3295.00	\$2525.60
P	Population below the 1979 poverty line.	36,000	2,036,000	419,520.833
I	The state budget or income, measured as total state non-debt general expenditures in 1979, in millions of dollars.	\$522.0	\$25279.00	\$4122.27
γ	The Cobb-Douglas utility weight on other consumption. Proxied by total state non-AFDC expenditure/total state non-debt expenditure.	.905	.987	.959
s	The federal matching share. 1978.	.50	.783	.608
DIST	The distance, in miles, from state i to state j (all pairs).	27	3216	1220.64

Potential poor migrants may respond to differences in the actual purchasing power of earnings rather than to nominal earnings. A state consumer price index, constructed by Robert Inman and Steven Craig, is used to convert both nominal earnings measures, E and FE, into real values, RE and RFE respectively. The mean of this index in 1979 is 2.512, where Arkansas in 1964 is the base.[4]

Three variables in the theoretic model are omitted from the general empirical specification. The cost of migration per mile, c, does not vary over the sample and so simply scales distance. The maximum values of the psychic cost distributions, K_i and K_j, are assumed to be equal and constant over all states and thus are not included. This assumption is made since estimation of psychic costs for even one group of potential migrants is quite difficult and is beyond the scope of this study.[5]

The final specification question to address is how does one model and measure a state's preferences over the provision of income assistance and the provision of other (non-AFDC) goods? Unless a specific utility function is assumed the preference parameters cannot be precisely defined and measured. If one assumes that each state maximizes a Cobb-Douglas utility function without error, then each state will set the share of its total expenditures allocated to non-AFDC goods to:

$$(37) \qquad \gamma_i = \frac{I_i - b_i(1 - s_i)(1 - \tau_i)(P_i + G_i(bi;b_j))}{I_i} .$$

Thus, one observation of this expenditure share will be an errorless measurement of the Cobb-Douglas preference parameter. The model could then be estimated using Ordinary Least Squares (OLS) and the impact of variations in states' preferences on the AFDC benefit level could be readily determined.

If, however, states preferences are not consistent with the Cobb-Douglas specification or if states optimize with error, a single observation of the non-AFDC expenditure share will measure the preference parameter with error. As a consequence, OLS estimation of the system including γ_i and γ_j will produce biased and inconsistent estimates. The degree of the bias and inconsistency will depend on the covariance between γ_i and γ_j and the "true" regression error. Conclusions regarding the role of states' preferences could still be be made, but only with caution.

In light of the potential problems associated with including γ_i and γ_j inaccurately measured one might consider making the assumption that preferences do not vary across states; i.e. every state has the same utility function. The preference parameters γ_i and γ_j would then be constants and thus would not be included as explanatory variables. If states do possess homogeneous preferences OLS estimation of (36) excluding γ_i and γ_j will produce unbiased and consistent estimates. However, if preferences do vary from state to state dropping these parameters will omit relevant variables from the regression. The OLS estimates will again be biased and inconsistent (unless γ_i and γ_j are perfectly orthogonal to the other regressors).

It is not obvious which assumption regarding the nature of the states' utility functions will result in the better estimates. Assuming Cobb-Douglas preferences and perfect optimization allows analysis of an interesting and important question: How do state's preferences affect the AFDC benefit level? If this assumption is wrong the results of the analysis will be biased and inconsistent due to errors in the measurement of γ_i and γ_j. Assuming that state preferences have no role in explaining variation in states' AFDC benefits and dropping the preference parameters precludes the difficulties associated with such errors in variables. If this assumption is wrong, however, dropping γ_i and γ_j will cause the estimated parameters to be biased and inconsistent. The results from estimations based on each assumption are reported because it is impossible to determine a priori which assumption is more realistic and thus likely to produce the better results.

C. Single Equation Estimates Using State Pairs Data Structures

C.1 Contiguous State Pairs

For each of the two model specifications four regressions, using the four possible measures of EARN (E, FE, RE, RFE) are estimated using pairs of contiguous states. Tables 4.2 and 4.3 summarize the predicted signs of each variable and the OLS estimates when γ_i and γ_j are included (Model 1) and excluded (Model 2). All eight regressions perform well in terms of $\bar{R}^2$ (Adjusted R-square). Based on this criteria the regressions in which EARN is measured as the average earnings of poor female-headed households perform best, explaining 88.38% and 86.12% of the total variation in b_i in Models 1 and 2 respectively. The regressions which omit γ_i and γ_j (Model 2) tend to explain smaller proportions of the variation in b_i relative to the regession which include them (Model 1).

TABLE 4.2

Model 1: OLS Regressions for Contiguous State Pairs
(n = 213)

Independent Variables	1	2	3	4
INT	5451.67*	3240.02*	1757.47*	397.35*
τ_i (+/-)	5951.583*	5302.499*	2461.319*	2927.989*
E_i (-)	-0.026935			
FE_i (-)		-0.472945*		
RE_i (-)			-0.084817*	
RFE_i (-)				-0.335672*
γ_i (-)	-8716.871*	-4248.082*	-3126.611*	-2099.168*
s_i (+)	-723.450*	- 642.996*	-115.704*	-71.948
I_i (+)	0.0028237	0.013088*		
RI_i (+)			0.0065054*	0.01301*
P_i (-)	-0.0002583*	-0.000229*	-0.0000892*	-0.000071*
τ_j (+/-)	876.515	-1092.380	84.56111	-80.66329
E_j (+)	0.046944			
FE_j (+)		0.029944		
RE_j (+)			0.007199	
RFE_j (+)				0.029259
γ_j (-)	-1934.391*	-589.105	-552.803*	-330.552
s_j (+)	- 481.801*	-111.521	-123.068*	-27.7085
I_j (+)	-.00535353	-0.000928		
RI_j (+)			-0.003721	-0.001404
P_j (-)	-0.0000827*	-0.0000458*	-0.000016	-0.000004
DIST (+/-)	0.200756*	0.100233*	0.055589*	0.010558
$\bar{R}2$	0.7740	.8838	.7678	.8526
Joint Sig. of Rival	99.87%	90.69%	96.50%	11.50%

*indicates significance at 90% level.

TABLE 4.3

Model 2: OLS Regressions for Contiguous State Pairs
(n = 213)

Independent Variables	1	2	3	4
INT	1216.64	595.16	244.13	-1140.27
τ_i (+/-)	1998.56*	4059.40*	1091.31	2407.36*
E_i (-)	-0.1266*			
FE_i (-)		-0.5790*		
RE_i (-)			-0.1923*	
RFE_i (-)				-0.4398*
s_i (+)	-943.83*	-763.38*	-125.13*	-108.87*
I_i (+)	0.0237*	0.0228*		
RI_i (+)			0.0264*	0.0259*
P_i (-)	-0.00031*	-0.00024*	-0.0001*	-0.00007*
τ_j (+/-)	-761.52	-1516.59*	-461.54	-232.86
E_j (+)	0.0174			
FE_j (+)		0.0069		
RE_j (+)			-0.0219	
RFE_j (+)				0.0113
s_j (+)	-697.82	-137.15	-161.29*	-39.27
I_j (+)	0.00047	0.00115		
RI_j (+)			-0.0011	0.00167
P_j (-)	-0.00013*	0.000047*	-0.00003*	0.000005
DIST (+/-)	-0.08	-0.0314	-0.0457*	-0.0646*
$\bar{R}^2$	0.6487	.8612	.6566	.8075
Joint Sig. of Rival	99.96%	89.78%	91.10%	32.00%

*indicates significance at 90% level.

Using Model 1, the state's own Cobb-Douglas utility weight on other consumption, γ_i, is consistently significant and negative, as predicted. Further, states also appear to offer lower benefit levels the greater the Cobb-Douglas utility weight the rival places on other consumption. These findings are consistent with the model implications

The state's employment rate coefficient, which is theoretically indeterminant, is consistently significant and positive. This result suggests that the savings in terms of reduced caseload of own poor due to a higher employment rate tend to outweigh any increases in caseload due to the attraction of the rival's poor to the more promising labor market.[6]

All the regressions indicate that the higher the average earnings of the poor, the lower the average benefit level. Also as predicted, the earnings of the rival's poor exhibit a significant and positive effect in all eight regressions. These results are consistent with the model's implications for an equilibrium in which there is migration between the states; i.e., state i either imports or exports poor persons. Recall that in the no-migration equilibrium the benefit level did not depend at all on earnings. Consequently, these results not only support the model's implications, but also indicate that "migration" equilibria are far from rare.

The impact of distance on the average benefit level is analytically indeterminant. Empirically it is significantly positive in three of the four regressions which include the preference parameters. The farther away is the rival state the higher tends to be the state's AFDC benefit, ceteris paribus. This result suggests that distance's discouraging effect on in-migration influences a state's choice of benefit levels more than does its discouraging effect on out-migration. When the system is estimated omitting the preference parameter (Model 2) distance is significant and negative in two of the regressions. Clearly interpretations of the effect of distance can only be made with caution as the sign of the coefficient seems to vary with the data set and model specification employed.

The state's federal matching share coefficient is negative in all eight regressions and significantly so in six. The rival state's federal matching share is also negative in all eight regressions and significantly so in three. Such "wrong" signs often indicate ill-conditioning. The Variance Inflation Factors (VIFs) do indeed indicate some ill-conditioning, but the significance of these "wrong signs" suggests that some other factor is degrading the quality of these coefficients. The likely culprit is simultaneity bias, the discussion of which is deferred to Section E.

In all eight regressions state income, measured in either nominal or real terms, exerts a significant and positive influence on the benefit level, as predicted. This result simply reflects the income effect for a normal good. The model also predicts a positive relationship between the rival state's income and the benefit level. The estimated coefficients for the rival's income exhibit positive, but statistically insignificant, coefficients in two of the regressions. The rival's income coefficient is negative, but not statistically different from zero in the remaining regressions.

The model predicts that the greater the number of poor in a state the lower will be the offered AFDC benefit level. The empirical analysis strongly supports this prediction. P_i is statistically significant and negative in all eight regressions. In addition, the number of poor persons in the rival state also tends to lower the state's AFDC benefit as predicted: The coefficient on P_j is negative in six regressions and significantly so in five. The data are consistent with the model's prediction that states will lower their benefit levels in response to increases in both the number of recipients in the state and the number of potential in-migrants, ceteris paribus.

In summary, the first set of simple tests generally support the implications of the game theoretic model. All eight regressions explain a statistically significant proportion of the variation in average annual per recipient AFDC benefits. Furthermore, t-tests indicate that many of the individual variables significantly affect the benefit level in the predicted manner. These results hold true for both model specifications. The magnitudes of many of the coefficients do vary some with the specification. Specifically, the coefficients of τ_i, s_i, P_i, and $EARN_i$, are smaller in magnitude and those of I_i and I_j larger using the Model 2 specification.

Another test of the game theoretic model can be conducted on the basis of the model's distinguishing feature. Unlike previous models of AFDC benefit determination, this model predicts that the characteristics of a rival state also influences the choice of benefit levels. The joint significance of the rival's variables will thus be a particularly critical test of this model. Based on a standard F-test the rival's characteristics are, as a group, statistically significant at the 95% level in three regressions and at the 90% in three more. Only in the two regressions using real earnings of female-headed households are the rival's characteristics not jointly significant.

C.2 <u>All Possible State Pairs</u>

Because the poor may, in reality, migrate to non-contiguous states the above regressions are run on a data set consisting of of all possible pairs of states. The resulting parameter estimates are reported in Tables 4.4 and 4.5. All eight regressions explain a significant proportion of the variation in the AFDC benefit level, with $\bar{R}^2$'s ranging from .76 to .896. The state's own variables are all significant and are of the predicted sign (except for the federal share) in all eight regressions.

Distance is significant, negatively so, in only the two regressions which use real female-headed households earnings to measure EARN. This is a somewhat curious result. It suggests that given a nationwide scope the proximity of the rival has a significant impact on states' AFDC benefit choice only when variations in cost-of-living and the earnings of poor female-headed households in particular are taken into account. Specifically, the greater the distance to the rival state the lower is the AFDC benefit level chosen, all else being equal. This result is consistent with the comparative static properties of the equilibrium b_i in which the state exports some of its poor (Region 1).

When the regressions are run using all possible state pairs the rival's characteristics are not, as a group, statistically significant. Recall however that when contiguous state pairs are used the rival's characteristics are jointly significant in six of the eight regressions. The contrast between these results suggests that states feel significant competitive pressure only from "nearby" states. That is, the benefit-setting game takes place within limited geographic subsets of

TABLE 4.4

Model 1: OLS Regressions on All Possible State Pairs
(n = 2256)

Independent Variables	1	2	3	4
INT	4838.82*	9.61	1496.03*	-242.71
τ_i (+/-)	5631.898*	4844.289*	2231.234*	2613.164*
E_i (-)	-0.077191*			
FE_i (-)		-0.50831*		
RE_i (-)			-.157688*	
RFE_i (-)				-0.333727*
γ_i (-)	-8593.202*	-4039.066*	-3047.481*	-2240.001*
s_i (+)	-990.285*	-809.964*	-135.192*	-113.829*
I_i (+)	0.00367559*	0.012906*		
RI_i (+)			.00732951*	0.011007*
P_i (-)	-0.0003039*	-0.000215*	-.0000892*	-0.000062*
τ_j (+/-)	-10.45997	-4.04563	6.240768	-20.3271*
E_j (+)	-0.0010671			
FE_j (+)		0.0004716		
RE_j (+)			.00013504	
RFE_j (+)				-0.000776
γ_j (-)	-15.33197	-29.46638	-10.67804	13.51608
s_j (+)	7.13556	2.756002	2.394856	0.308823
I_j (+)	-0.0001309	-0.0001031		
RI_j (+)			-.0001325	0.000081
P_j (-)	-.00000019	-8.6388E-07	-7.624E-07	-0.000001
DIST(+/-)	0.0062 3080	0.00228354	.001594717	-0.002458*
$\bar{R}^2$	.7641	.8963	.7886	.8700
Joint Sig, of Rival	0.02%	0.20%	1.04%	21.31%

*Indicates significance at 90% level.

TABLE 4.5

Model 2: OLS Regressions on All Possible State Pairs
(n = 2256)

Independent Variables	1	2	3	4
INT	2677.98*	528.93*	624.50*	-464.22*
τ_i (+/-)	-209.87	2814.69*	228.79*	1516.76*
E_i (-)	-0.2154*			
FE_i (-)		-0.6269*		
RE_i (-)			-0.2906*	
RFE_i (-)				-0.4551*
s_i (+)	-1241.96*	-942.85*	-148.28*	-161.26*
I_i (+)	0.0223*	0.0211*		
RI_i (+)			0.0251*	0.0232*
P_i (-)	-0.00036*	-0.0002*	-0.000099*	-0.00006*
τ_j (+/-)	-51.33	-38.14	-11.36	-28.32*
E_j (+)	-0.00195			
FE_j (+)		-0.00016		
RE_j (+)			-0.0007	
RFE_j (+)				-0.00037
s_j (+)	7.97	0.2460	2.85	0.2462
I_j (+)	-0.00001	0.00002*		
RI_j (+)			0.000013	0.000098
P_j (-)	-0.0000003	-0.000002	-0.000001	0.000002
DIST(+/-)	0.0025	-0.0019	-0.00017	-0.0055*
$\bar{R}^2$	.6297	.8718	.6645	.8074
Joint Sig, of Rival	0.11%	0.05%	0.08%	0.58%

*indicates significance at 90% level.

the nation. This result and interpretation are consistent with the model's prediction that the zone of no-migration expands as distance between rival states increases (refer to equation (37)).

To further investigate this interpretation and to perhaps ascertain the size of the area over which the competitive pressure is significant, the two nominal earnings regressions (which include γ_i and γ_j) are run on pairwise data sets created by subsetting the "all pairs" data set by distance.[7] Data made up of state pairs within 300, 400, 500, 750, 1000, 1500, and 2000 miles of each other are used and the results are summarized in Table 4.6.

Both regressions, on each of the eight data sets, explain a statistically significant proportion of the variation in average AFDC benefits. When EARN is measured as the average earnings of all poor families, distance appears "more" significant in the regressions using state pairs within 400 and 750 miles of each other. Distance is statistically significant (at the 95% level), only when the data consists of state pairs within 400 miles of each other. Using the average earnings of only poor female-headed households, distance seems "most significant" for the 750 and 2000 mile data subsets. However, in these two cases DIST is significant only at the 85% and 60% levels respectively.

The rival's variables are jointly significant at the 90% level, when EARN is measured by E, for state pairs within 400, 500, 750, and 1000 miles of each other. When EARN is measured by FE the rival's

TABLE 4.6

Summary of OLS Regressions on Distance Subsets of State Pairs (Model 1)

Data Subset	Model	$\bar{R}^2$	Level of Significance of DIST (sign)	Level of Joint Significance of Rival Variables
DIST ≤ 300	E	.8057	68.67% (+)	80.99%
n = 150	FE	.8985	2.45% (-)	76.93%
DIST ≤ 400	E	.7955	96.62% (+)	98.66%
n = 240	FE	.9003	46.36% (+)	89.94%
DIST ≤ 500	E	.7637	72.34% (+)	92.35%
n = 344	FE	.8919	21.35% (-)	97.37%
DIST ≤ 750	E	.7651	84.67% (+)	96.10%
n = 678	FE	.8911	60.38% (-)	79.73%
DIST ≤ 1000	E	.7628	38.80% (+)	92.56%
n = 1010	FE	.8931	27.99% (-)	68.87%
DIST ≤ 1500	E	.7760	67.68% (-)	73.73%
n = 1574	FE	.9024	25.81% (+)	6.12%
DIST ≤ 2000	E	.7721	63.37% (+)	15.62%
n = 1902	FE	.9015	84.94% (+)	16.87%
All pairs	E	.7641	81.82% (+)	0.02%
n = 2256	FE	.8963	54.45% (+)	0.2%

variables are jointly significant only using the 400 and 500 mile data sets. It would seem that when a state anticipates the migration of poor female-headed households only, it feels significant competitive pressure from states within a smaller proximity.

A plausible explanation of this phenomenon is that on average females may, on average have higher psychic costs of migration than do males. Or equivalently, females may value staying near friends and family more highly than do males. Evidence supporting this view is presented by Deaton, Morgan, and Anschel (1982). In their study of families who had migrated from eastern Kentucky the authors find that female-headed households would be willing to give up, on average, over \$3,000 more in income than male-headed households in order to return to eastern Kentucky.

If states anticipate the migration of female-headed households in response to the AFDC benefit level and if females do indeed have higher psychic costs, what relationship between the significance of the rival's characteristics and distance would be expected? The greater the distance to the rival state, the greater would be the psychic cost of migration for the typical potential AFDC recipient, and the less likely she would be to move. The less migration between the competing states the less significant are the rival's characteristics, as indicated by the comparative statics of the no-migration equilibrium (both states operating in Region 2 of their migration functions). Thus, the view that females tend to have higher psychic costs would be consistent with the data.

In summary, the results of the regressions using the state pairs data structure support the model. The rival state's characteristics significantly influence a state's choice of AFDC benefit level using a number of the distance subsetted data sets, indicating that states within a certain proximity do engage in an AFDC benefit-setting game. These results are, of course, subject to some qualifications. First, a linear model is used to approximate a nonlinear function. Second, in the model migration, and thus the benefit-setting game, takes place between two states only. This particular data structure incorporates migration from one state to many others. One must keep in mind that the state pairs data approach is just one way in which the notion of a rival state can be approximated.

D. Single Equation Estimates Using a Composite Rival

The second general approach to testing the competitive benefit-setting model is to collapse the information from all potential rival states into a "composite" rival. State i's composite rival is constructed by summing the distance weighted information on all other states. This approach circumvents one of the problems involved with the state pairs approach in the sense that now a state is in competition with only one rival. However, this approach diverges from the spirit of the theoretical model in that the rival is a group of states rather than a single state acting on its own behalf. The composite rival approach presumes that all other states act in a coordinated, rational fashion in the competition with state i.

Recall that the greater the distance between competing states the greater the zone of no-migration and consequently the more likely that the rival's characteristic do not influence a state's benefit level (refer to equation (36)). The regressions using various distance subsetted data sets confirm that the significance of the rival's variables indeed dissipates as the distance between the competing states increases (refer to Table 4.6). Given this information it would seem reasonable to weight the information on all other states such that the greater the distance between the states the less influential is that state's characteristics. Two such weighted average schemes are examined. First, data from each of the other states are weighted by the inverse of the distance between the state and state i. Second, the weights are defined as the inverse of the squared distance. Three regressions are run using each weighting scheme and the results are reported in Tables 4.7 and 4.8.

All the regressions perform quite well in terms of R^2. In eight of the twelve regressions the composite rival's variables are jointly significant at at least the 90% level. In the remaining four regressions the rival's variables are jointly significant at the 85% level. Further, the coefficients which are individually significant at the 90% level are of the predicted sign, except again for the federal matching share.

Collinearity diagnostics indicate that both of the weighting procedures induce substantial ill-conditioning. The condensation of the information for all other states into a single observation reduces the variation in the rival's characteristic. Furthermore, because the only difference in the composite rival for different states is the information from one out of forty-seven states the reduction in the

TABLE 4.7

Model 1: OLS Regressions Using Composite Rival
(n = 48)

Independent Variables	Inverse Distance			Inverse Distance^2		
	1	2	3	1	2	3
INT	6938.83*	2938.00*	-487.14*	7357.94*	3038.56*	239.00
τ_i (+/-)	5398.00*	5299.49*	2966.2*	3820.9*	3946.66*	2914.93*
E_i (-)	-0.0989			-0.0575		
FE_i (-)		-0.4903*			-0.49447*	
RFE_i (-)			-0.3498*			-0.37491*
γ_i (-)	-10191.8*	-5189.1*	-2423.2*	-9245.4*	-4059.5*	-2543.9*
s_i (+)	-952.30*	-931.62*	-143.59	-1258.7*	-949.34*	-172.98
I_i (+)	-0.00226	0.00991*		-0.00072	0.01071*	
RI_i (+)			0.0078			0.00563
P_i (+)	-0.00028*	-0.0002*	-0.0001*	-0.0003*	-0.0002*	-0.00006*
τ_j (-)	-2576.39	-2262.4	-1116.2	-419473*	-3249164*	84262.5
E_j (+/-)	11.6104*			1592.44*		
FE_j (+)		19.927*			1137.95*	
RFE_j (+)			0.8391*			0.32557*
γ_j (+)	-22707.59	-59061.3*	3876.3	-327346	-208271	-50471
s_j (+)	-17169.25	16882.96	-2464.6	-436643	967875	30816.4
I_j (-)	-.218064	0.19521		-16.677	4.10487	
RI_j (+)			0.00365			-0.0011
P_j (+)	-0.01388*	-0.01328*	-0.0038*	-1.8217*	-0.7956	-0.1886
$\bar{R}^2$	.7919	.9129	.8698	.7801	.8970	.8697
Joint Sig. of Rival	98.13%	99.20%	89.47%	95.98%	91.78%	89.40%

*indicates significance at 90% level.

TABLE 4.8

Model 2: OLS Regressions Using Composite Rival
(n = 48)

Independent Variables	Inverse Distance			Inverse Distance^2		
	1	2	3	1	2	3
INT	1275.70	-553.59	-2055.72*	3813.34**	666.09	-1477.18*
τ_i (+/-)	1267.27	3832.51*	2339.93*	-1258.92	2707.20*	2320.65*
E_i (-)	-0.2533*			-0.2277*		
FE_i (-)		-0.5988*			-0.6368*	
RFE_i (-)			-0.4889*			-0.5278*
s_i (+)	-780.09**	-819.38*	-109.52	-1443.7*	-1037.94*	-150.85
I_i (+)	0.0192*	0.021*		0.01899*	0.01911*	
RI_i (+)			0.0216*			0.0199*
P_i (+)	-0.0003*	-0.0002*	-0.00007*	-0.0004*	-0.0002*	-0.00005*
τ_j (-)	-7447.12*	-4493.5*	-1863.7*	-6960754*	-3989040*	-163753
E_j (+/-)	11.51*			2317.05*		
FE_j (+)		10.26*			1170.72*	
RFE_j (+)			0.7061*			0.2706*
s_j (+)	-38828	-33259**	6253.9*	-209834	1602629	284990
I_j (-)	-0.0703	0.0142		-27.42**	3.94669	
RI_j (+)			0.021			-0.0053
P_j (+)	-0.0218*	-0.0091*	-0.0037*	-1.3643**	-0.2829	0.1588
$\bar{R}^2$	.6547	.8700	.8216	.6308	.8767	.8069
Joint Sig. of Rival	96.50%	87.57%	94.78%	90.66%	94.22%	83.96%

*indicates significance at 90% level.
**indicates significance at 80% level.

rival's variables may be significant. Variance Inflations Factors indicate that the estimated coefficients of E_j, P_j, γ_j, and s_j are the most severely distorted as a result of the induced ill-conditioning. Naturally, dropping γ_i and γ_j (Model 2) tends to reduce the ill-conditioning. In spite of the collinearity the coefficients of these variables are statistically significant and, with the exception of s_i, bear the predicted sign under both specifications.

On balance, using the composite rival approach, the model performs well.[8] This evaluation holds true under either model specification. As in the state pairs analysis, only the magnitudes of the coefficients vary some with the specification.

E. Multi-equation Analyses

A problem with the single equation analyses is that the coefficient for the federal matching share (s_i) is, contrary to the model's implication, negative and significant in many of the regressions. Further, when s_j, the federal matching received by the rival, is statistically significant it is also of the "wrong" sign. As previously noted, the significance of these coefficients suggests that something other than collinearity is affecting the estimates.

The most probable explanation of these "wrong" signs lies in the structure of the AFDC matching schedule. As Orr (1976) and others have noted, the original AFDC matching schedule defines s_i as an inverse function of the benefit level. The federal government matches each of the first \$18 of a state's monthly AFDC benefit by \$0.83 (segment I_iA in Figure 4.1, Panel a). Benefit payments from \$18 to \$32 (segment AB) are matched at the federal matching rate:

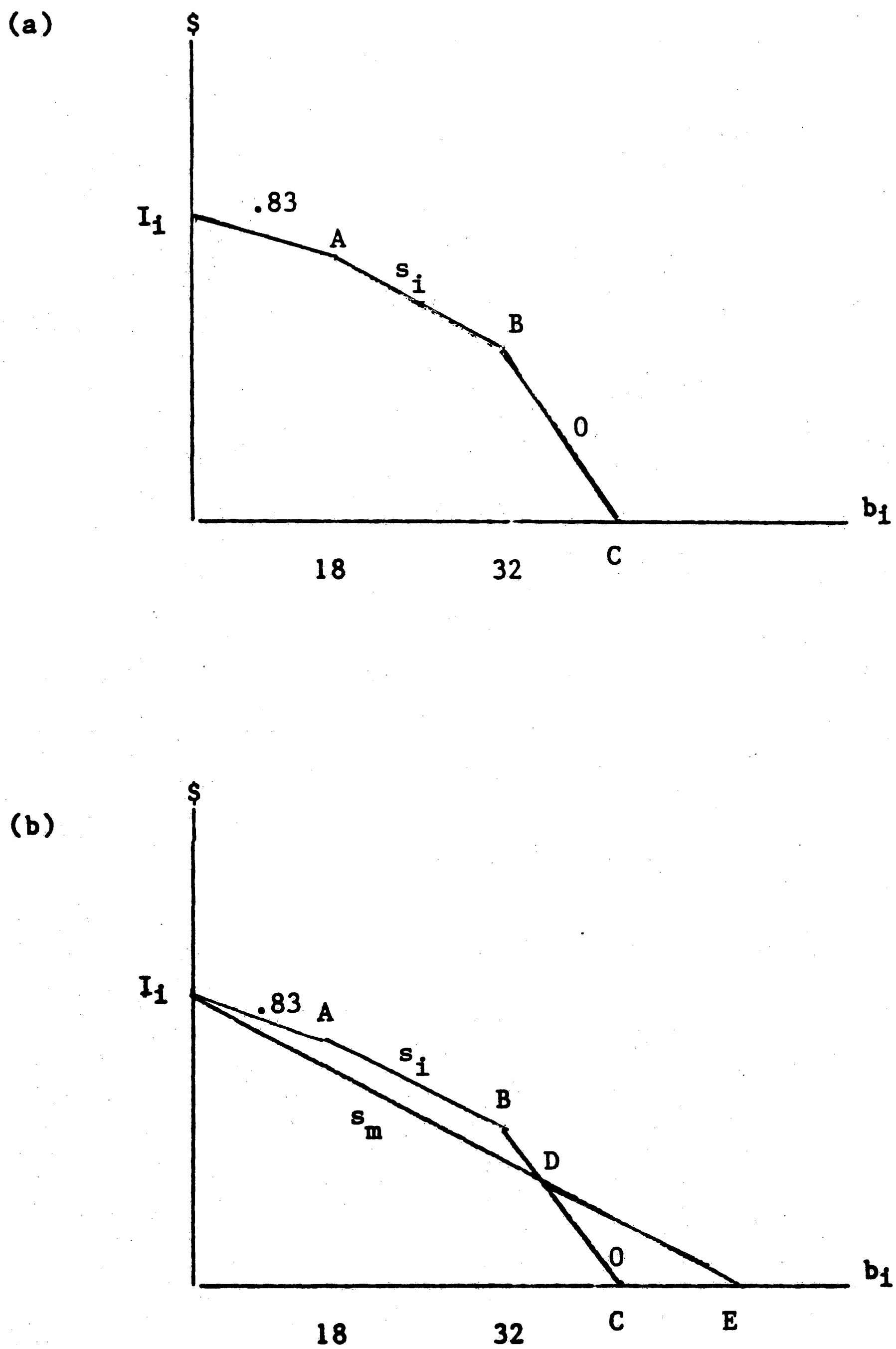

FIGURE 4.1

Federal Matching Share as a Function of the Benefit Level

$$s_i = 1 - .5 \left(\frac{\text{state per capita income}}{\text{national per capita income}} \right),$$

up to a maximum of .65. No matching aid is provided for state payments in excess of \$32 (segment BC). Thus, s_i depends inversely on the benefit level. The negative coefficents on s_i (and s_j) in the estimated benefit equations are likely the consequence of this simultaneous relationship.

This odd federal AFDC matching schedule was further complicated by 1965 legislation which allowed states to receive matching aid for AFDC benefits according to the Medicaid matching rate:

$$s_m = 1 - .45 \left(\frac{\text{state per capita income}}{\text{national per capita income}} \right)^2,$$

over all benefit levels (segment I_1E in Figure 4.1, Panel b). Because all but two of the sample states, Arizona and Texas, receive federal aid according to this schedule one might initially suspect that s_i and b_i would no longer be interdependent. Note though that in both the state pairs and composite rival data approaches, information from these two states will be in many more than just two observations. On this basis alone one might expect some simultaneity between the benefit level and the federal matching share to persist in the data.

A second consideration is that this option introduced an interesting non-convexity into the state's budget constraint (point D in Figure 4.1, Panel b). Moffitt (1984) points out that due to this non-convexity a state's utility maximizing benefit level may jump from the Medicaid segment back to the standard AFDC schedule when the federal matching share, s_i, increases. Such an increase would tilt the variable matching rate segment (AB) upward to AB' (Figure 4.2). Due to this

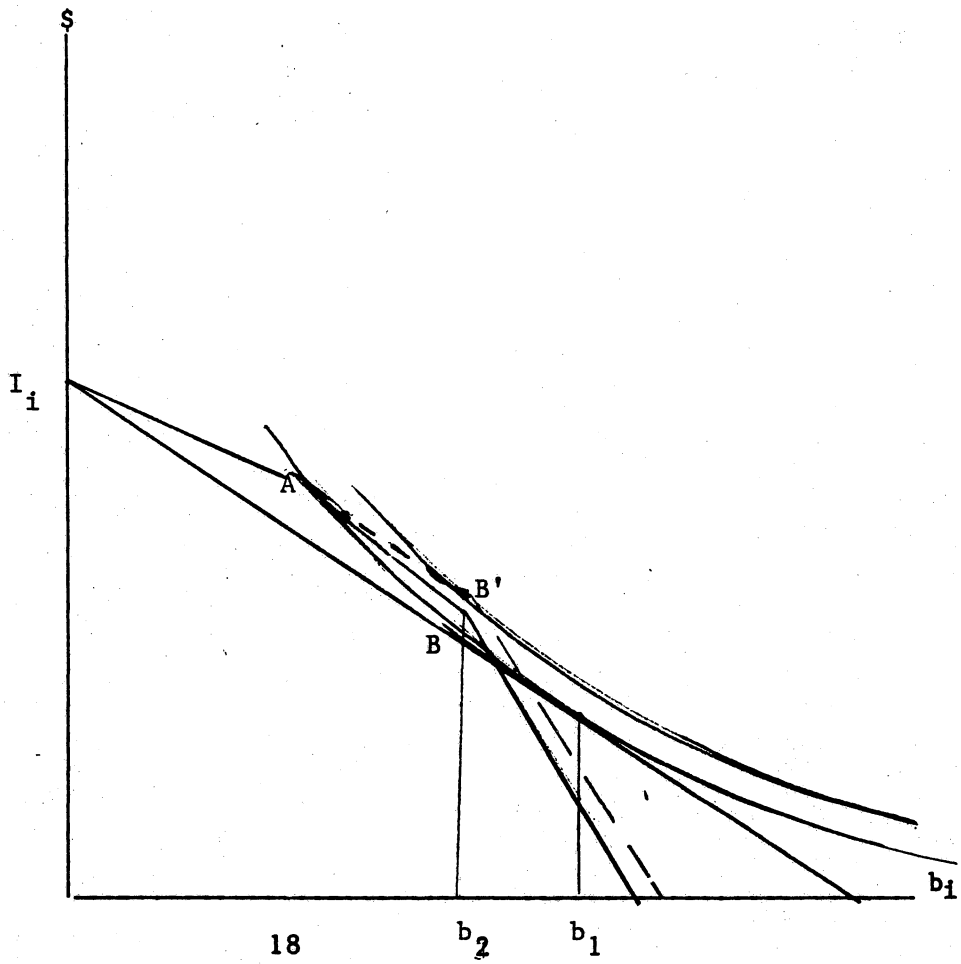

FIGURE 4.2

Impact of Changes in the Federal Matching Share change in the budget constraint the state's optimal benefit level would decrease from b_1 to b_2. Thus, even given the option of the straight Medicaid matching schedule it is possible that s_i varies inversely with the benefit level.[9]

To account for the simultaneity between the benefit level and the federal matching share the model is reformulated as a three equation simultaneous system consisting of the original benefit equation and equations expressing s_i and s_j as functions of the respective state incomes, total populations, and AFDC benefit levels:

$$(38)\quad b_i = \alpha_0 + \alpha_1\tau_i + \alpha_2 EARN_i + \alpha_3\gamma_i + \alpha_4 I_i + \alpha_5 s_i + \alpha_6 P_i + \alpha_7\tau_j + \alpha_8 EARN_j + \alpha_9\gamma_j + \alpha_{10} I_j + \alpha_{11} s_j + \alpha_{12} P_j + \alpha_{13} DIST + \mu_{i1}$$

$$(39)\quad s_i = \beta_0 + \beta_1 TOTPOP_i + \beta_2 Ii + \beta i b_i + \mu_{i2}$$

$$(40)\quad s_j = \delta_0 + \delta_1 TOTPOP_j + \delta_2 I_j + \delta_j b_j + \mu_{j2}$$

Again the linear specification can be justified as a useful and reasonable approximation of the true nonlinear relationship (refer to discussion in Section B).

Equation (38) will be overidentified if $\hat{\beta}_1$ and $\hat{\delta}_1$ are significantly different from zero. Equations (39) and (40) will be overidentified under a variety of parameter restrictions; e.g. $\hat{\alpha}_{11}$ and $\hat{\delta}_2$ not equal to zero.[10] The Two Stage Least Squares (2SLS) estimates of the system using the contiguous state pairs data set on each model specification are presented in Tables 4.9 and 4.10.[11]

All eight regressions explain a significant proportion of the variation in b_i. Most of the coefficients on state's own variables are statistically significant and of the predicted sign (according to asymptotic t-tests). In particular, s_i is now significant and positive as predicted. The s_j is also positive but is not statistically different from zero. Distance is statistically significant and negative in three of the four regressions on Model 1. It is significant, and negatively so, in only one of the regressions using Model 2.

The rival's stock of poor is consistently negative and significant, as predicted, under both model specifications. When the preference parameters are included (Model 1), γ_i and γ_j are also significantly negative. Lastly, the rival's income exhibits the anticipated significant and positive impact on the benefit level.

The principal differences between the results for Models 1 and 2 lie in the proportion of total variation explained and the magnitudes of the estimated coefficients. The regressions on Model 2 generally produce lower $\bar{R}^2$. The magnitudes of the coefficients differ as described in the single equation analyses. The signs of two coefficients vary with the model specification. When the preference parameters are included (Model 1) the intercept is positive in three of the four regressions. When these parameters are excluded (Model 2) their negative impact tends to be absorbed in the intercept, causing it to be negative, significantly so in two regressions. Distance appears to have a significant and positive impact on b_i when the γ's are included. When the γ's are excluded, the coefficient on distance tends to be negative, but not statistically different from zero.

The federal shares equations consistently explain a significant proportion of the variation in s_i and s_j respectively. In all of the regressions state income is significantly negative and total population is significantly positive, contrary to the implications of the matching

TABLE 4.9

Model 1: 2SLS Estimates Using Contiguous State Pairs

Eq.	Variable	Parameter Estimates			
b_i	INT	6470.64*	614.81	1959.86	-496.55
	τ_i (+/-)	9014.93*	9257.61*	2934.21*	3755.08*
	E_i (-)	-0.3052*			
	FE_i (-)		-0.5600*		
	RE_i (-)			-0.3557*	
	RFE_i (-)				-0.4284*
	P_i (-)	-0.0005*	-0.0003*	-.0001*	-.00008*
	γ_i (-)	-11866.1*	-6670.59*	-3181.7*	-2377.85*
	I_i (+)	0.0345*	0.02956*		
	RI_i (+)			0.0295*	0.0231*
	s_i (+)	3781.78*	1893.12*	1112.34*	469.70*
	τ_j (+/-)	398.65	-289.81	-715.75	148.61
	E_j (+)	-0.04458			
	FE_j (+)		-0.10114**		
	RE_j (+)			-0.0316	
	RFE_j (+)				-0.0430
	P_j (-)	-0.00037*	-0.00875*	-.0661*	-.00002
	γ_j (-)	-5237.06*	-1635.06	-909.39*	-481.01**
	I_j (+)	0.01094	0.00875		
	RI_j (+)			0.0024	0.0048
	s_j (+)	1380.95	664.20	90.03	207.41**
	DIST (+/-)	0.4278*	0.16616*	0.075*	0.0094
		$\bar{R}^2$=.3750	$\bar{R}^2$=.6672	$\bar{R}^2$=.5606	$\bar{R}^2$=.7137

(Continued on next page)

TABLE 4.9 (Continued)

Eq.	Variable		Parameter Estimates		
s_i	INT	0.8251*	0.8001*	0.8403*	.8140*
	$TOTPOP_i$ (+)	-2.49E-08*	-2.16E-08*	-2.98E-08*	-2.67E-08*
	I_i (-)	0.00002*	0.00002*		
	RI_i (-)			0.000072*	0.0006*
	b_i (-)	-0.0002*	-0.0002*		
	Rb_i (-)			-0.00059*	-0.00051*
		$\bar{R}^2$ =.4761	$\bar{R}^2$ =.4601	$\bar{R}^2$ =.4853	$\bar{R}^2$ =.4669
s_j	INT	0.8217*	0.7983*	.8371*	.8115*
	$TOTPOP_j$ (+)	-2.44E-08*	-2.14E-08*	-2.94E-08*	-2.63E-08*
	I_j (-)	0.00002*	0.00002*		
	RI_j (-)			0.000071*	0.00006*
	b_j (-)	-0.0002*	-0.0002*		
	Rb_j (-)			-0.00058*	-0.00051*
		$\bar{R}^2$ =.4684	$\bar{R}^2$ =.4536	$\bar{R}^2$ = .4785	$\bar{R}^2$ =.4602

*indicates significance at the 90% level.
**indicates significance at the 80% level.

TABLE 4.10

Model 2: 2SLS Estimates Using Contiguous State Pairs

Eq.	Variable	Parameter Estimates			
b_i	INT	-301.09	-3003.32**	275.57	-2177.72*
	τ_i (+/-)	3007.28	6438.58*	1368.42*	3319.48*
	E_i (-)	-0.4228*			
	FE_i (-)		-0.69869*		
	RE_i (-)			-0.4219*	
	RFE_i (-)				-0.5464*
	P_i (-)	-0.0006*	-0.00031*	-0.0001*	-0.00008*
	I_i (+)	0.0616*	0.03987*		
	RI_i (+)			0.0464*	0.0383*
	s_i (+)	3137.36*	1097.68**	899.14*	500.27*
	τ_j (+/-)	-2586.39	-1052.72	-1223.23*	-310.43
	E_j (+)	-0.13157			
	FE_j (+)		-0.12153*		
	RE_j (+)			-0.0817	
	RFE_j (+)				-0.0485
	P_j (-)	-0.00044*	-0.00015*	-0.00007*	-0.00002
	I_j (+)	0.02623*	0.01163*		
	RI_j (+)			0.009	0.0063
	s_j (+)	1285.93	558.97	92.75	36.12
	DIST (+/-)	-0.0237	-0.0540	-0.0381	-0.0777*
		$\bar{R}^2$=.3183	$\bar{R}^2$=.7230	$\bar{R}^2$=.5172	$\bar{R}^2$=.7262

(Continued on next page)

TABLE 4.10 (Continued)

Eq.	Variable		Parameter Estimates			
s_i	INT		0.8919*	0.8041*	0.8983*	0.8385*
	$TOTPOP_i$	(+)	-3.35E-08*	-2.22E-08*	-3.66E-08*	-2.96E-08*
	I_i	(-)	0.00003*	0.00002*		
	RI_i	(-)			0.000092*	0.00007*
	b_i	(-)	-0.0003	-0.00019*		
	Rb_i	(-)			-0.00074*	-0.00058*
			$\bar{R}^2$=.4793	$\bar{R}^2$=.4576	$\bar{R}^2$=.5006	$\bar{R}^2$=.4880
s_j	INT		0.8905*	0.8030*	0.8969*	0.8373*
	$TOTPOP_j$	(+)	-3.34E-08*	-2.20E-08*	-3.64E-08*	-2.94E-08*
	I_j	(-)	0.00003*	0.00002*		
	RI_j	(-)			0.000092*	0.00007*
	b_j	(-)	-0.0003*	-0.0002*		
	Rb_j	(-)			-0.00074*	-0.00058*
			$\bar{R}^2$=.4741	$\bar{R}^2$=.4517	$\bar{R}^2$=.4960	$\bar{R}^2$=.4829

*indicates significance at the 90% level.
**indicates significance at the 80% level.

formulae.[12] However, the benefit level is statistically significant and negative as would be expected if s_i and b_i are simultaneously related as conjectured.

Next these same systems of equations are estimated using the "all possible state pairs" data set (see Tables 4.11 and 4.12). All eight regressions explain significant proportions of the variation in the dependent variables. All of the state's own variables are statistically significant and of the expected sign in the benefit equation. In contrast, none of the rival's variables is significantly different from zero. Distance is significant, and negative, in only the regressions using the earnings of female-headed households. These simultaneous equations estimates suggest the same general pattern observed in the single equation analyses: The greater the distance between the competing states the less significant are the rival's characteristics.

Estimation of these systems using states pairs within 750 miles of each other indicates that at this distance the rival's characteristics are becoming somewhat significant factors in a state's benefit choice (Tables 4.13 and 4.14). In all regressions the state's own variables are all statistically significant and of the predicted sign. When E and RE are used to measure average earnings the size of the rival's poor population is also significant and negative, as predicted. Lastly, distance is significant and negative in five of the eight regressions.

F. Summary of Empirical Findings

The generalized game model performs well in terms of $\bar{R}^2$ and the joint significance of the rival's variables when tested using either the

TABLE 4.11

Model 1: 2SLS Estimates Using All Possible State Pairs

Eq.	Variable	Parameter Estimates			
b_i	INT	2795.34*	9.61	1018.44*	-242.71
	τ_i (+/-)	8772.22*	8005.47*	2506.51*	3436.36*
	E_i (-)	-0.3811*			
	FE_i (-)		-0.61436*		
	RE_i (-)			-0.3724*	
	RFE_i (-)				-0.4469*
	P_i (-)	-0.0004*	-0.00027*	-0.00009*	-0.00007*
	γ_i (-)	-11155.7*	-5858.448*	-3113.8*	-2515.59*
	I_i (+)	0.03098*	0.02426*		
	RI_i (+)			0.0232*	0.0201*
	s_i (+)	3075.14*	1041.12*	740.10*	426.92*
	τ_j (+/-)	-66.42	-49.22	5.04	-44.72
	E_j (+)	-0.001			
	FE_j (+)		-0.00223		
	RE_j (+)			0.0002	
	RFE_j (+)				-0.0027
	P_j (-)	0.000001	-0.000002	5.45E-08	-0.000001
	γ_j	45.75	35.92	-6.83	43.83
	I_j (+)	-0.00022	0.00022		
	RI_j (+)			-0.0002	0.00025
	s_j (+)	-12.84	17.21	0.105	-1.528
	DIST (+/-)	0.0086	-0.00433	0.0024	-0.00476*
		$\bar{R}^2$=.4575	$\bar{R}^2$=.7712	$\bar{R}^2$=.6709	$\bar{R}^2$=.7998

(Continued on next page)

TABLE 4.11 (Continued)

Eq.	Variable		Parameter Estimates			
s_i	INT		0.8168*	0.7871*	0.8397*	0.8179*
	$TOTPOP_i$	(+)	2.45E-08*	-2.06E-08*	-3.06E-08*	-2.80E-08*
	I_i	(-)	0.00002*	0.00002*		
	RI_i	(-)			-0.00007*	0.00007*
	b_i	(-)	-0.0002*	-0.0002*		
	Rb_i				-0.0006*	-0.00053*
			$\bar{R}^2$=.4613	$\bar{R}^2$=.4425	$\bar{R}^2$=.4964	$\bar{R}^2$=.4827
s_j	INT		0.8183*	0.7871*	0.8401*	0.8167*
	$TOTPOP_j$	(+)	-2.49E-08*	-2.08E-08*	-3.10E-08*	-2.81E-08*
	I_j	(-)	0.00002*	0.00002*		
	RI_j	(-)			0.00007*	0.00007*
	b_i	(-)	-0.0002*	-0.0002*		
	Rb_i	(-)			-0.0006*	-0.0006*
			$\bar{R}^2$=.4746	$\bar{R}^2$ =.4486	$\bar{R}^2$= .5049	$\bar{R}^2$=.4872

*indicates significance at the 90% level.
**indicates significance at the 80% level.

TABLE 4.12

Model 2: 2SLS Estimates Using All Possible State

Eq.	Variable	Parameter Estimates			
b_i	INT	-179.64	-1793.29*	143.46	-1204.85*
	τ_i (+/-)	1286.51*	4667.86*	454.10*	2126.33*
	E_i (-)	-0.5850*			
	FE_i (-)		-0.7584*		
	RE_i (-)			-0.5022*	
	RFE_i (-)				-0.5686*
	P_i (-)	-0.0005*	-0.00026*	-0.0001*	-0.00007*
	I_i (+)	0.0575*	0.0335*		
	RI_i (+)			0.0410*	0.0326*
	s_i (+)	3029.53*	534.08*	702.71*	312.36*
	τ_j (+/-)	-78.29	-41.51	-10.59	-38.802
	E_j (+)	-0.00119			
	FE_j (+)		-0.00196		
	RE_j (+)			-0.0002	
	RFE_j (+)				-0.0008
	P_j (-)	9.82E-08	-0.000003	-4.08E-07	-1.54E-06
	I_j (+)	-0.00021	0.00031		
	RI_j (+)			-0.00009	0.0001
	s_j (+)	-9.73	27.46	-0.6387	-0.2276
	DIST (+/-)	0.0039	-0.0087*	0.0006	-0.0078*
		$\bar{R}^2$=.3486	$\bar{R}^2$=.7836	$\bar{R}^2$=.5707	$\bar{R}^2$=.7546

(Continued on next page)

TABLE 4.12 (Continued)

Eq.	Variable	Parameter Estimates			
s_i	INT	0.8859*	0.7886*	0.8983*	0.8343*
	$TOTPOP_i$ (+)	-3.35E-08*	-2.08E-08*	-3.77E-08*	-2.99E-08*
	I_i (-)	0.00003*	0.00002*		
	RI_i (-)			0.000095*	0.00007*
	b_i (-)	-0.00028*	-0.00018*		
	Rb_i (-)			-0.00074*	-0.00057*
		$\bar{R}^2$=.4626	$\bar{R}^2$=.4342	$\bar{R}^2$=.5082	$\bar{R}^2$=.4891
s_j	INT	0.8855*	0.7870*	0.8965*	0.8297*
	$TOTPOP_j$ (+)	-3.37E-08*	-2.08E-08*	-3.78E-08*	-2.97E-08*
	I_j (-)	0.00003*	0.00002*		
	RI_j (-)			0.000094*	0.00007*
	b_j (-)	-0.0003*	-0.0002*		
	Rb_j (-)			-0.00073*	-0.00055*
		$\bar{R}^2$=.4706	$\bar{R}^2$=.4362	$\bar{R}^2$=.5130	$\bar{R}^2$=.4900

*indicates significance at the 90% level.
**indicates significance at the 80% level.

TABLE 4.13

Model 1: 2SLS Estimates Using State Pairs Within 750 Miles

Eq.	Variable	Parameter Estimates			
b_i	INT	6930.02*	1900.37*	1768.83*	-123.55
	τ_i (+/-)	6413.98*	6874.79*	2250.77*	3547.15*
	E_i (-)	-0.4228*			
	FE_i (-)		-0.6541*		
	RE_i (-)			-0.4373*	
	RFE_i (-)				-0.5160*
	P_i (-)	-0.0004*	-0.00026*	-0.00008*	-0.00007*
	γ_i (-)	-10488.6*	-5416.77*	-3082.47*	-2524.77*
	I_i (+)	0.0312*	0.0249*		
	RI_i (+)			0.0276*	0.0255*
	s_i (+)	2905.68*	950.13*	905.80*	611.42*
	τ_j (+/-)	-953.05	-461.53	-363.57**	16.83
	E_j (+)	-0.0376			
	FE_j (+)		-0.0081		
	RE_j (+)			0.0068	
	RFE_j (+)				0.00113
	P_j (-)	-0.0001*	-0.00001	-0.00002*	0.00001
	γ_j (-)	-1595.20	-671.49	-209.34	-316.54
	I_j (+)	-0.00215	-0.00231		
	RI_j (+)			-0.0035	-0.0022
	s_j (+)	436.67	42.95	-22.61	36.03
	DIST (+/-)	-0.0432	-0.041*	-0.0167	-0.0055
		$\bar{R}^2$=.4645	$\bar{R}^2$=.7768	$\bar{R}^2$=.6269	$\bar{R}^2$=.7423

(Continued on next page)

TABLE 4.13 (Continued)

Eq.	Variable	Parameter Estimates			
s_i	INT	0.8283*	0.7995*	0.8463*	0.8250*
	$TOTPOP_i$ (+)	-2.73E-08*	-2.29E-08*	-3.37E-08*	-3.07E-08*
	I_i (-)	0.000025*	0.00002*		
	RI_i (-)			0.000083*	0.000007*
	b_i (-)	-0.00022*	-0.00019*		
	Rb_i (-)			-0.00061*	-0.00055*
		$\bar{R}^2$=.4815	$\bar{R}^2$=.4690	$\bar{R}^2$=.5147	$\bar{R}^2$=.4994
s_j	INT	0.8348*	0.8045*	0.8536*	0.8302*
	$TOTPOP_j$ (+)	-2.49E-08*	-2.10E-08*	-2.99E-08*	-2.73E-08*
	I_j (-)	0.000022*	0.000018*		
	RI_j (-)			0.000072*	0.00006*
	b_j (-)	-0.00022*	-0.00019*		
	Rb_j (-)			-0.00062*	-0.00055*
		$\bar{R}^2$=.5514	$\bar{R}^2$=.5188	$\bar{R}^2$=.5644	$\bar{R}^2$=.5415

*indicates significance at the 90% level.
**indicates significance at the 80% level.

TABLE 4.14

Model 2: 2SLS Estimates Using State Pairs Within 750 Miles

Eq.	Variable	Parameter Estimates			
b_i	INT	3838.36*	-83.99	858.15*	-1257.66*
	τ_i (+/-)	-179.80	4131.37*	402.27**	2378.55*
	E_i (-)	-0.6111*			
	FE_i (-)		-0.78086*		
	RE_i (-)			-0.5624*	
	RFE_i (-)				-0.6374*
	P_i (-)	-0.0005*	-0.00028*	-0.0001*	-0.00008*
	I_i (+)	0.0642*	0.03254*		
	RI_i (+)			0.0510*	0.0431*
	s_i (+)	2933.80*	574.43*	891.01*	532.60*
	τ_j (+/-)	-2630.35*	-1121.10*	-688.67*	-278.62
	E_j (+)	-0.03032			
	FE_j (+)		-0.00707		
	RE_j (+)			-0.0308	
	RFE_j (+)				0.0005
	P_j (-)	-0.00013*	-9.16E-07	-2.09E-05*	5.45E-06
	I_j (+)	0.00267	-0.00109		
	RI_j (+)			-0.00260	-0.0003
	s_j (+)	164.67	-149.08	-138.93	-44.70
	DIST (+/-)	-0.1632*	-0.0889*	-0.0461*	-0.0279*
		$\bar{R}^2$=.3638	$\bar{R}^2$=.7779	$\bar{R}^2$=.5359	$\bar{R}^2$=.6986

(Continued on next page)

TABLE 4.14 (Continued)

Eq.	Variable		Parameter Estimates			
s_i	INT		0.8929*	0.8043*	0.8986*	0.8429*
	$TOTPOP_i$	(+)	-3.73E-08*	-2.36E-08*	-4.10E-08*	-3.32E-08*
	I_i	(-)	0.00004*	0.00002*		
	RI_i	(-)			0.0001*	0.00008*
	b_i	(-)	-0.00029*	-0.00019*		
	Rb_i	(-)			-0.00075*	-0.00060*
			$\bar{R}^2$=.4826	$\bar{R}^2$=.4637	$\bar{R}^2$=.5267	$\bar{R}^2$=.5084
s_j	INT		0.8751*	0.8004*	0.8888*	0.8368*
	$TOTPOP_j$	(+)	-3.73E-08*	-2.04E-08*	-3.38E-08*	-2.80E-08*
	I_j	(-)	0.00004*	0.00002*		
	RI_j	(-)			0.0001*	0.00007*
	b_j	(-)	-0.0003*	-0.0002*		
	Rb_j	(-)			-0.00071*	-0.00057*
			$\bar{R}^2$=.4826	$\bar{R}^2$=.4934	$\bar{R}^2$= .5652	$\bar{R}^2$=.5337

*indicates significance at the 90% level.
**indicates significance at the 80% level.

contiguous state pairs data or the composite rival approach. In the single equation analyses the state's own variables are individually significant and, but for the federal matching share, of the predicted sign in all specifications. Using the contiguous pairs data, the rival's variables are jointly significant at the 90% level in six of the eight regressions. Under the composite rival approach these variables are jointly significant at the 90% level in four of the six regressions run using each weighting scheme. They are jointly significant at the 85% level in the remaining regressions.

When the state pairs data is expanded to account for migration between non-contiguous states the model continues to explain a significant proportion of the variation in the benefit level and the state's own characteristics are significant and of the predicted sign. The impact of the rival's variables, however, tends to dissipate as distance increases. When all possible pairs of states are considered the joint significance of the rival's characteristics fairly disappears.

The simultaneous systems analyses produce similar results. As the model predicts, the state's rival's characteristics, in addition to its own characteristics, significantly influence the AFDC benefit level when contiguous state pairs are considered. When states within 750 miles of each other are considered as rivals fewer of the rival's characteristic are statistically signifcant. Finally, when all state pairs are considered a state's benefit level does not appear to depend on the rival's characteristics. This lack of significance when the distance between state pairs increases is consistent with the model's prediction that the benefit-setting game tends to be suspended as the monetary migration costs rise. The major difference between the single and multi-equation analyses is that the latter produces correct signs on the federal matching shares coefficients.

FOOTNOTES

[1]Hawaii and Alaska omitted.

[2]Distance is measured between the states' largest SMSAs. If a state has two SMSAs, neither being twice as large as the other, the average of the distances from both is used. In this example DIST is the average of the number of miles between Baltimore and Richmond and Baltimore and Norfolk.

[3]Data sources reported in Appendix A.

[4]Construction of this index described in Appendix A.

[5]For examples of such estimations see Morgan and Deaton (1975) and Deaton, Morgan, and Anschel (1982).

[6]This result might also result from an indirect positive relationship between the employment rate and state income. The higher the employment rate, the higher is the tax base and thus the higher may be state income (and consequently b_i).

[7]Regressions using the other measures of EARN and the Model 2 specification produce similar results.

[8]The composite rival was also constructed by distance weighting the information from only states within 750 miles. This reduction of the number of states in the compostite did not markedly increase the variation in the rival's characteristics.

[9]OLS regressions of (36) when observations using Texas or Arizona are dropped still produce a significantly negative coefficient for s_i. This suggests that, as hypothesized, b_i and s_i are simultaneously related even when all states operate on the Medicaid schedule.

[10]Using the Model 2 specification of the system (which omits γ_i and γ_j) the order conditions are met and all three equations will be overidentified given similar nonzero restrictions.

[11]Because the results from estimation using the composite differs very little from those obtained using the contiguous pairs data set, estimation of the simultaneous system using the composite rival is not reported. Also, Three Stage Least Squares estimation of the systems produces very similar results.

[12]The "wrong" signs on I_i and I_j in the federal shares equations may simply indicate that these variables are poor proxies for states' total personal income.

CHAPTER 5

THE "NEW FEDERALISM" AND THE AFDC BENEFIT-SETTING GAME

In 1982 the Reagan administration proposed a package of significant changes in the nation's federalist structure known as the "New Federalism". The principal goal of this chapter is to analyze the impact of this proposal on the average annual AFDC benefit level, assuming it wins Congressional approval without substantial alteration. Section A reviews the evolution of American federalism up to the early 1980's. Section B discusses in detail the goals and mechanics of the "New Federalism." The findings of two studies which simulate the impact of the proposed changes on state welfare expenditures and the AFDC benefit level are reported in Section C. Simulations using the estimated models and the game simulation program described in Chapter 4 are presented and evaluated in Sections D and E respectively.

A. The Evolution of American Federalism

The philosophy of "Dual Federalism" dominated the first century of American intergovernmental relations. State governments and the federal government were regarded as equal in power and authority. Each level of government had clearly defined, distinct responsibilities. During the New Deal era federal and state governments began to cooperate in the development and implementation of various projects. The use of federal grants-in-aid (predominantly matching categorical grants) was greatly expanded during this period of "cooperative federalism" and a new trend in intergovernmental relations was established: The federal government began to assume greater financial responsiblities while the state governments became the primary provider of non-defense public goods.

This trend continued, and indeed intensified, throughout the Johnson administration. The Federal government began to use its power of the purse string to encourage and coerce states into providing programs consistent with national goals; e.g., the War of Poverty and the Civil Rights movement. State governments soon came to resent such federal intervention and complained about the wasteful red tape associated with meeting the plethora of federal regulations and guidelines.

The Nixon administration initiated the use of General Revenue Sharing grants in response to the states' objections. Nixon sought to return decision-making power to the state level by reducing the number of federal restrictions on attached to federal grants. The use of block grants expanded, allowing states greater discretion in the use of federal aid dollars.[1] This program enjoyed a limited and short-lived success however. During the late 1970's federal grants again came with many federal strings attached. Categorical grants replaced block grants as the preferred mode of federal assistance. This reversal may be attributed to both reports of local abuse of federal funds and the Federal government's desire to regain some leverage when encouraging states to pursue specific national goals.

Reagan's proposed "New Federalism," like the federalism of the Nixon era, reflects a return to the philosophy of dual federalism. Under this proposal numerous categorical grants would be combined into a few large block grants. This change in grant format would give states greater flexibility in the administration of federal funds. The proposal also specifies separate and distinct responsibilities for the state and federal governments. Both of these measures would help bring to fruition the announced goals of the "New Federalism" legislation: The return of power to the states and the reduction of the size and influence of the Federal government.

B. <u>The "New Federalism" Proposal</u>

Proponents of the "New Federalism" package assert that the changes proposed will achieve two policy goals. First, by restructuring the format of federal grants and delineating distinct responsibilities for each level of government, states' power and authority will be restored. Second, the gradual elimination of all forms of federal aid will shrink the size of the federal government. Some opponents claim that the "New Federalism" legislation also contains a hidden agenda to reduce domestic spending in particular.

The detailed mechanics of this somewhat controversial proposal are as follows. First, financial and administrative responsibility for sixty-one federal programs will be turned over to the states. To help state governments absorb the costs of these programs the federal government will provide temporary assistance in the form of a trust fund supported by federal excise taxes. This trust will be fully funded until 1988 and will then be gradually eliminated by 1992. At this time the federal excise taxes will be discontinued, increasing the states' tax base.

The second component of the "New Federalism" consists of swapping financial and administrative responsibilities for the AFDC and Medicaid programs. The states will assume full responsibility for the AFDC program while the federal government will take over the states' Medicaid programs. The cost to the states of the AFDC plus the sixty-one other federal programs will be initially completely offset by the federal trust fund aid and the release of the Medicaid programs. In the long run the trust fund will be phased out and caps on the federal Medicaid spending will be established.

These two major components of the "New Federalism", particularly the second, will reduce the size and influence of the federal government. Further, the induced competition among states in the provision of public goods and favorable tax climates will probably act to reduce the size of the state and local sectors as well.

C. Previous Studies of the Impact of the "New Federalism"

Two major studies of the impact of the proposed "New Federalism" package on state budgeting behavior have been completed and both conclude that the announced goals of this legislation will likely be achieved. Both also find that, regardless of the question of purposeful intent, the proposed changes will achieve these goals at the expense of income assistance programs.

Craig and Inman (1985) simulate the impact of the "New Federalism" by first assuming that each component of the package is made separately, and then considering the effects of the total package before and after 1992. They base their simulation on an estimated model in which state education, welfare and other expenditures and state revenues are simultaneously determined. Craig and Inman find that the "New Federalism" legislation will indeed reduce the size of the federal government, but in the process will reduce the provision of income assistance (Table 5.1).

Gramlich (1982) makes a detailed analysis of states' AFDC benefit choice and concludes that the elimination of federal matching aid will significantly lower the average AFDC benefit level.[2] He incorporates a proposal to turn the Food Stamp program over to the states as well and finds that such a measure will reduce the combined AFDC and Food Stamp benefits, assuming states decide the level of provision for each program separately.

Gramlich also examines the impact of the "New Federalism" legislation on overall state budgeting behavior. Like Craig and Inman, he finds that this legislation will reduce the level of state and federal expenditures. His analysis further suggests that these reductions will result mainly from the elimination of federal matching aid rather than from the conversion of categorical grants into block grants.

D. Simulated Impact of the "New Federalism" Using Model's Estimated Parameters

In this section the estimated models presented in Chapter 4 are used to simulate the impact of each stage of the "New Federalism" proposal on the average AFDC benefit level. Recall that the game theoretic model predicts that the lower the federal matching rate a state receives, the lower is its offered benefit, ceteris paribus.

TABLE 5.1

Fiscal Effects of the "New Federalism" on State Welfare Expenditures as Simulated by Craig and Inman**

	Level of State Welfare Expenditure*
Pre-Reform (1980)	$60.59
Stage 1: Welfare Exchange and Trust Fund	$ 1.39
Stage 2: Elimination of Trust Fund	$23.32

*In real 1966 dollars per capita.

**Taken from Craig and Inman (1985), Table 3.

The model also predicts that the lower the federal matching rate received by a state's rival, the lower will be the state's benefit level (refer to Figures 3.10 and 3.11).

D.1 Stage 1: Elimination of Federal Matching Aid and the Creation of Federal Trust Fund Aid

The first stage of the "New Federalism" proposal would eliminate all federal matching aid for AFDC and create a temporary federal aid trust fund. This trust fund would be used to help states meet the costs of accepting full financial responsibility for their AFDC programs. As initially calculated, the trust fund aid and the release of state Medicaid programs would exactly offset the costs of assuming responsibility for AFDC and the sixty-one other federal programs.

The elimination of the federal matching program is equivalent to lowering the federal matching share of both the state and its rival to zero. Thus, the model would predict that this change will exert two negative pressures on a state's benefit level. The federal aid paid out of the trust fund will be administered as a lump sum grant and thus can be treated as an increment to the states' income (I_i and I_j). The model predicts that such increases in income will raise a state's benefit level. The model does not, however, predict that the effects of the federal matching share and income on the benefit level will necessarily be equal in magnitude.

To simulate the benefit level given the net impact of the Stage 1 changes, the benefit level is calculated as:

$$(41) \quad b_i = \hat{\alpha}_0 + \hat{\alpha}_1\tau_i + \hat{\alpha}_2 EARN_i + \hat{\alpha}_3\gamma_i + \hat{\alpha}_4 FI_i + \hat{\alpha}_5(0) + \hat{\alpha}_6 P_i + \hat{\alpha}_7\tau_j$$

$$+ \hat{\alpha}_8 EARN_j + \hat{\alpha}_9\gamma_j + \hat{\alpha}_{10} FI_j + \hat{\alpha}_{11}(0) + \hat{\alpha}_{12} P_j + \hat{\alpha}_{13} DIST \quad .$$

Where FI_i and FI_j are the states' respective full (after lump sum grant) incomes:

$$(42) \quad FI_{i,j} = I_{i,j} + s_{i,j} b_{i,j}(1 - \tau_{i,j})(P_{i,j} + G_{i,j})$$

and the $\hat{\alpha}_i$ are the estimated coefficients reported in Chapter 4.[3] All the variables, except s_i and s_j in equation (41) , are evaluated at their means. Thus the simulated benefit level will be that of the mean state rather than the mean of all states' simulated benefit levels.

The presence of the migration function in the full income calculation poses some difficulty. The discount factor, ρ, the monetary cost of migration per mile, and the maximum psychic cost of migration must be known to calculate the level of expected migration. Because these parameters are difficult to know with certainty the simulated benefit for Stage 1 is calculated using a variety of possible values. Three values for each of the unknown parameters are hypothesized and full income is calculated according to (42) for all possible combinations of these parameter values.[4] Table 5.2 summarizes the results of these simulations.

These model simulations clearly indicate that the net impact of the Stage 1 changes will lower the average AFDC benefit level: The federal trust fund aid will not fully offset the negative impact of the elimination of the matching aid program. This result obtains because the

TABLE 5.2

Simulated Benefit Levels when Matching Aid is Eliminated and Trust Fund Created (Stage 1)

Data	EARN	Mean benefit level	Simulated benefit* level	95% prediction interval
All pairs	E	$970.00	-$848.31	∓ 170078.31
	FE	970.00	334.25	∓ 49294.55
Pairs within 750 miles	E	$971.79	-1021.38	∓ 172908.38
	FE	971.79	-3554.42	∓ 49910.80
Contiguous Pairs	E	$948.46	-2163.79	∓ 292555.79
	FE	948.46	-4178.69	∓ 102403.69

*Based on Model 1 coefficients (γ's included) lump sum grant is not tied to the AFDC program. Thus states can, and will, use some of these funds on other expenditures or tax relief.

These simulations also indicate the benefit depressing effects of the Stage 1 changes are greater the more narrow the range of competition considered. This suggests that the effects of the cut in federal matching aid will vary with the degree of the interstate benefit-setting competition; the greater the degree of competition, the larger the reduction in the benefit level induced by the "New Federalism."

D.2 Stage 2: Elimination of the Federal Trust Fund

In the second stage of the proposed "New Federalism" the federal trust fund aid will be phased out, thus eliminating all forms of federal aid to states' AFDC programs. The game theoretic model would predict that the average benefit level will fall even further as a consequence. The benefit level in this stage is simulated as:

$$(43)\quad b_i = \hat{\alpha}_0 + \hat{\alpha}_1\tau_i + \hat{\alpha}_2 EARN_i + \hat{\alpha}_3\gamma_i + \hat{\alpha}_4 I_i + \hat{\alpha}_5(0) + \hat{\alpha}_6 P_i + \hat{\alpha}_7\tau_j + \hat{\alpha}_8 EARN_j + \hat{\alpha}_9\gamma_j + \hat{\alpha}_{10} I_j + \hat{\alpha}_{11}(0) + \hat{\alpha}_{12} P_j + \hat{\alpha}_{13} DIST \, .$$

Again, all variables except s_i and s_j are evaluated at their means. Table 5.3 presents the results of these simulations.

The simulated benefit levels are indeed lower than the original means, but are only slightly lower than the simulated Stage 1 levels. The impact of the Stage 1 trust fund aid is postive, but rather small. Again the impact of the "New Federalism" is greater in magnitude the greater the degree of competition in the data set.

TABLE 5.3

Simulated Benefit Levels when All Federal Aid is Eliminated (Stage 2)

Data	EARN	Mean benefit level	Simulated benefit level	95% Prediction interval
All pairs	E	$970.00	-$848.71	∓170079.71
	FE	970.00	333.93	∓ 49294.77
Pairs within 750 miles	E	$971.79	-$1021.70	∓172914.70
	FE	971.79	-3554.73	∓ 49912.03
Contiguous Pairs	E	$948.46	-2164.39	∓2925780.40
	FE	948.46	-4179.00	∓ 102966.99

D.3 Evaluation of the Simulation

The magnitudes and signs of the simulated benefit levels seem rather unrealistic. Negative AFDC benefits would indeed be "highly unexpected." Further, the 95% prediction intervals are quite large. These shortcomings arise because the estimated coefficients are derived from a linear approximation of a nonlinear relationship. Linear approximations do, in general, provide good tests of nonlinear models, but do not produce good predictions. This poor predicitve ability is exacerbated when the new observation is very far out of the sample, as is the case with s_i and s_j set to zero. In particular, Figures 3.10 and 3.11 suggest that the true relationship between the equilibrium benefit level and either matching share is nonlinear. Thus, the linear estimation of these relationships will thus tend to underestimate the benefit level when s_i or s_j is zero, holding all else constant (Figure 5.1).

Nevertheless, the direction of change the simulations predict is consistent with the model's implications: The "New Federalism" proposal will lower the average AFDC benefit. The results further indicate the magnitude of the impact of the proposal will be greater in areas of greater benefit-setting competition. The degree of success of the proposal to shrink the size of the state government as well as federal government sector will depend on the intensity of the competition of the benefit-setting game. Finally, the reduction in the size of both government sectors will clearly be achieved the cost of a lower guaranteed living standard for the poor.

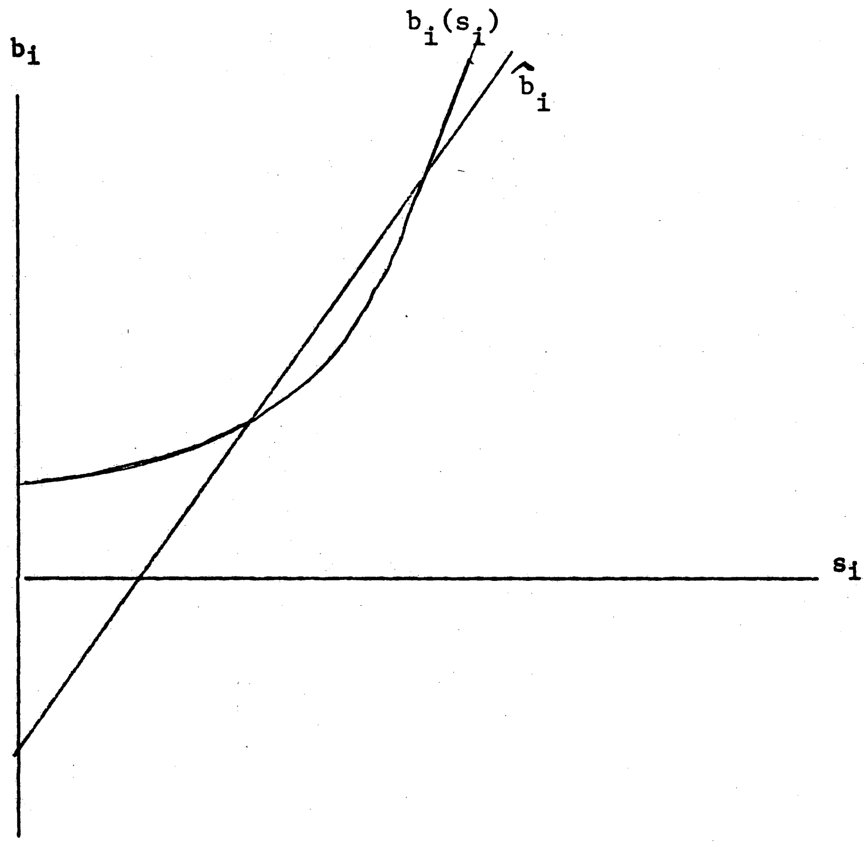

FIGURE 5.1

Error in Linear Approximation of the Nonlinear Relationship between b_i and s_i

E. Simulated Impact of the "New Federalism" Using the Generalized Game Simulation Program

The computer program used to simulate the comparative static properties of the game theoretic model in Chapter 3 can also be used to simulate the changes in the benefit level that would be caused by the "New Federalism" proposal. The analysis will again consider the separate impact of each of the two stages of implementation of the proposal.

To provide a frame of reference for the simulations, the program is first run using the current AFDC financial structure. The simulations are run using five sets of parameter values. First, all parameters are set to their means. This set of parameter values is denoted as MEANS. Second, each of state i's parameters are set to be its mean minus one standard deviation while state j's parameters are set to their means. This set of parameters in denoted as IMINUS. Third, each of state i's parameters is set to be its mean plus one standard deviation and each of state j's parameters are again set to their means. This set of parameter values is denoted as IPLUS. Analogous parameter sets are created by alterning state j's parameters, holding state i's at their means (JMINUS and JPLUS). The means and variance of each of the parameters are determined from each of the state pairs data sets used in the 2SLS estimations.

Table 5.4 presents the simulated "pre-New Federalism" benefit levels and the actual 1979 mean benefit levels. The simulated benefits are generally lower than the actual means. Simulations using the IMINUS set of parameters produces benefit levels fairly close to the actual mean values. The simulations using the other four sets of

TABLE 5.4

Base Benefit Levels as Simulated by the Generalized Game Program

Data	EARN	Mean benefit level	Simulated benefit level: MEANS	IMINUS	IPLUS	JMINUS	JPLUS
All pairs	E	$970.00	$81.92	$934.92	$43.51	$81.20	85.70
	FE	970.00	81.92	915.50	43.81	81.42	85.16
Pairs within 750 miles	E	971.79	72.24	761.05	35.62	71.08	76.02
	FE	971.79	72.06	746.92	35.81	71.31	74.97
Contiguous pairs	E	948.46	78.61	673.66	43.31	77.76	83.44
	FE	948.46	78.61	656.30	43.69	78.06	81.63

parameter values produces benefit levels significantly lower than the means.

E.1 Stage 1: Elimination of the Federal Matching Aid and the Creation of Federal Trust Fund Aid

To simulate the impact of the elimination of federal matching aid and the creation of the federal trust fund, the simulation program is run using the set of parameter values as previously described with two exceptions. First, both s_i and s_j are set to zero. Second, the state's income now incorporates the receipt of the federal trust fund aid:

$$(44) \qquad FI_{i,j} = I_{i,j} + s_{i,j}b_{i,j}(1 - \tau_{i,j})(P_{i,j} + G_{i,j})$$

Where $s_{i,j}$ is the matching rate that was effective before the "New Federalism" changes.[5]

Table 5.5 presents simulated benefit levels given the Stage 1 changes in the AFDC financial structure. When the parameters are set to be the observed means (MEANS) the elimination of federal matching and the institution of the trust fund aid causes the benefit level to fall by sixty percent. Simulations based on the other parameter sets also show that the Stage 1 changes will lower the benefit level by sixty percent. The consensus of these simulations clearly indicates that the elimination of the matching aid, even though alternative aid is offered, is to significantly lower the average AFDC benefit level.

E.2 Stage 2: Elimination of all Federal Aid

To simulate the benefit levels after the federal trust fund aid is eliminated, the program is run with s_i and s_j set to zero and state income unaugmented. The results of these simulations are very similar

TABLE 5.5

Stage 1 Simulated Benefit Levels

Data	EARN	MEANS	IMINUS	IPLUS	JMINUS	JPLUS
		Simulated benefit level				
		(Percent decline from base)				
All pairs	E	$32.87 (60%)	$378.43 (60%)	$17.49 (60%)	$32.61 (60%)	$34.92 (60%)
	FE	32.87 (60%)	370.37 (60%)	17.60 (60%)	32.69 (60%)	34.27 (60%)
Pairs within 750 miles	E	28.98 (60%)	307.48 (60%)	14.33 (60%)	28.57 (60%)	30.64 (60%)
	FE	28.95 (60%)	301.64 (60%)	14.40 (60%)	28.65 (60%)	30.20 (60%)
Contiguous pairs	E	31.54 (60%)	271.77 (60%)	17.41 (60%)	31.23 (60%)	33.61 (60%)
	FE	31.54 (60%)	264.63 (60%)	17.55 (60%)	31.34 (60%)	32.85 (60%)

to those of the Stage 1 simulations. Each Stage 2 simulated benefit level is only a few cents lower that its Stage 1 counterpart. As in the previous set of simulations, the federal trust fund aid offered in Stage 1 apparently does not significantly influence the state's budgeting decision.

This result is not surprising given the comparative statics derived in Chapter 3. Increases in the state's exogenous income; e.g. the receipt of lump sum aid, raises the benefit level, but not greatly (refer to Figure 3.6). This result obtains because only a small proportion of income is actually allocated to state AFDC expenditures. Further, when this total AFDC expenditure is divided among all recipients, the change in the benefit level due to a change in income is likely to be small. This result suggests that the trust fund aid will not offset states' increased AFDC costs and thus will not act to "smooth" the drop in the average benefit level.

E.3 Evaluation of the Numeric Simulation

The variations in the simulated benefit levels reported in Table 5.5 indicate that the numeric simulation is sensitive to the chosen parameter values. Further, the variations in the benefit levels are greatest between the IPLUS and IMINUS data sets. This suggests that this simulation procedure is particularly sensitive to the values chosen for state i's parameters. The advantage of these experiments is that the numeric simulation incorporates all the model's nonlinearities.

In contrast to simulations using the model's estimated coefficients, these experiments suggests that the impact of the "New

Federalism" changes does not vary with the degree of interstate benefit competition. The two sets of simulations are however similar in their general implication: The "New Federalism" will significantly lower the average annual AFDC benefit level, even during the period in which federal lump sum aid is given.

FOOTNOTES

[1]Block grants are federal lump sum grants designated for some general expenditure category; e.g. public welfare or transportation. These grants are fairly unrestrictive; recipient governments are free to spend these grants within the general category as they choose. In contrast, categorical grants are nore restrictive. The federal government places much more specific restrictions on how the recipient government may use the grant.

[2]Gramlich acknowleges that the benefit level offered in neighboring states may influence a state's choice of benefit levels. He includes as an exogenous variable the average benefit level in all other states. He finds that the lower the average benefit level in all other states, the lower the state's own benefit level.

[3]Using the estimated coefficients for I (state income) to simulate the impact of lump sum trust fund aid may overstate the impact of such aid on the benefit level. A number of studies note that empirically receipt of lump sum aid stimulates local expenditures more than does the receipt of an equivalent increment in income (Hamilton, 1978; Craig and Inman, 1985). The public finance literature has dubbed this phenomenon the "flypaper effect." If such an effect does indeed exist then the "true" coefficient on trust fund aid would be larger than that on the state income variable.

[4]The simulations are conducted using all possible combinations of $c = .2, .3, .4$, $K_i = K_j = 2000, 5000, 9000$, and $\rho = 5, 11, 17$.

[5]G_i is itself a function of the benefit level and so will be determined simultaneously with the benefit choice. For the purposes of the simulations G_i is approximated as the level of migration that would take place if the federal matching aid program were intact.

CHAPTER 6

SUMMARY AND CONCLUSIONS

The Aid to Families with Dependent Children program, created in 1935, has evolved into one of the largest income assistance programs in the United States. At present the program is jointly financed by state and federal governments, with the states being almost entirely responsible for program administration. Because state governments choose the parameters of the program and the benefit level to be paid, the average AFDC benefit level can, and does, vary from state to state.

A. The Game Theoretic Model of AFDC Benefit Determination

Migration studies have shown that differences in income assistance opportunities can significantly influence interstate migration behavior. Studies of state budgeting behavior and interstate variations the AFDC benefit levels demonstrate the importance of the size of a state's poor population in the state's welfare expenditure and benefit level decisions. These studies do not, however, explicitly incorporate changes in population due to migration by the poor. The game theoretic model presented blends these two veins of research to produce a model of rational and strategic benefit-setting behavior by the states. States act rationally in the sense that they account for, or anticipate, the effect of their benefit choice on their caseloads due to induced migration. States behave strategically in that each state's optimal benefit depends explicitly on that of its rival.

Like previous models, the game theoretic model predicts that states with higher incomes and smaller poor populations will tend to pay higher average AFDC benefits. In addition to these standard implications the model predicts that the income and the poor population (and other characteristics) of the rival state will also influence a state's choice of benefit levels. Specifically, the higher are average earnings and state income and the smaller is the poor population of the rival state, the higher will be a state's average benefit level.

Various empirical tests of the model suggest that the rival's characteristics do significantly affect a state's benefit level. However, the degree of competition among the states, as indicated by the level of joint significance of the rival's variables, seems to dissipate with distance. The model run on state pairs data performs best in terms of $\bar{R}^2$ using states within 400 miles of each other. The model also performs well using pairs of contiguous states and alternatively a composite rival.

B. Simulations of the Impact of the "New Federalism"

The proposed "New Federalism" package would greatly alter the current financial structure of the AFDC program. The game theoretic model can be used to simulate the impact of the proposed changes on the average AFDC benefit level. Simulations using the model's estimated coefficients and the generalized game simulation computer program indicate that, if enacted as proposed, the "New Federalism" will significantly reduce the average annual AFDC benefit level. The latter simulation approach indicates that the "New Federalism" package will lead to approximately a fifty percent decline in the average AFDC benefit level.

C. Model Extensions and Applications

The game theoretic model can be extended and applied in a number of interesting ways. For example, extension of the migration decision to include all residents, employed taxpayers as well as AFDC recipients, would enrich the model. States would then compete in the provision of both income assistance and favorable tax climates.

Either the basic or extended model could be used to analyze questions such as: Why is the federal government willing to accept full financial responsibility for the states' Medicaid programs in exchange for turning such responsibility for the AFDC programs over to the states? The model suggests that interstate migration drives the interstate competition which tends to dampen states' offered benefit levels. The AFDC-Medicaid swap could be based on the assumption that Medicaid recipients are generally less mobile; i.e., have higher migration costs, than potential AFDC recipients. Hence, there would be little competitive pressure to force state determined Medicaid benefits to decline.

A public choice application of the model can also be envisioned. The insight into the states' AFDC benefit choice afforded by the model may provide a basis for determining which states will favor the "New Federalism" package and which will oppose. The likelihood of entact passage of the legislation could be assessed with such insight.

REFERENCES

Arrow, K.J. (1963), Social Choice and Individual Values, 2nd edition, John Wiley, New York.

Buchanan, J.M. (1949), "The Pure Theory of Government Finance: A Suggested Approach", Journal of Political Economy, v. LVII, n. 57, pp. 496-505.

Buchanan, J.M. and C. Goetz (1972), "Efficiency Limits of Fiscal Mobility: An Assessment of the Tiebout Model", Journal Public Economics, April 1972, n.1, pp. 25-43.

Buchanan, J.M. and G. Tullock (1962), The Calculus of Consent, University of Michigan Press.

Cebula, R. (1975), "Nonwhite Migration and Welfare", Review of Business and Economic Research, Fall 1975.

__________(1979), "Living Costs, the Tiebout Hypothesis, and Welfare Policy, Public Choice, v. 34, pp. 129-30.

Chao, J. and S. Renas (1976), "More on Public Welfare and Migration", Review of Business and Economic Research, v. XII, n. 1, pp. 90-91.

Craig S. and R. Inman (1985), "Education, Welfare, and the 'New' Federalism: State Budgeting in a Federalist Economy", NBER working paper no. 1562.

Dawson, R.E. and J. Robinson (1963), "Inter-party Competition, Economic Variables, and Welfare Policies in the American States", Journal of Politics, v. 25, pp. 265-289.

Deaton, B. L. Morgan and K. Anschel (1982), "The Influence of Psychic Costs on Rural-Urban Migration," American Journal of Agricultural Economics, v. 64, n. 2, pp. 177-87.

Debreu, G. (1952), "A Social Equilibrium Existence Theorem", Proceedings of the National Academy of Science of the U.S.A., v. 38, pp. 886-93

Debreu, G. (1982), "Existence of Competetive Equilibrium," in Handbook of Mathematical Economics, edited by K. Arrow and M. Intriligator, North Holland Publishing Company, 1982.

DeJong, G. and W. Donnelly (1973), Pubilc Welfare and Migration, Social Science Quarterly, v. 54, n. 2, pp. 329-44.

Denzau, A. and R. Mackay (1983), "Gatekeeping and Monopoly Power of Committees: An Analysis of Sincere and Sophisticated Behavior", American Journal of Political Science, v. 27, n. 4, pp. 740-61.

Fisher, G. (1961), "Determinants of State and Local Government Expenditure: A Preliminary Analysis," National Tax Journal, v. 14, n. 4, pp. 349-55.

Gallaway, L., R. Gilbert and P. Smith (1967), "The Economics of Labor Mobility: An Empirical Analysis," Western Economics Journal, v. V, n. 3, pp. 211-23.

Goetz, C and C. McKnew (1972), "Some Paradoxical Results in a Public Choice Model of Alternative Grant Forms," in Theory of Public Choice, Buchanan and Tollison eds., University of Michigan Press, 1972.

Gramlich, E.M. (1969), "State and Local Governments and their Budget Constraint", International Economic Review, v. 10, n. 2, pp. 163-82.

__________, E.M. (1982), "An Econometric Examination of the New Federalism," Brookings Papers on Economic Activity, n. 2, pp. 327- 360.

Hamilton, J.A. (1978), Specification Tests in Econometrics," Econometrica, v. 46, pp. 1251-1271.

Heins,J (1971), "State and Local Response to Fiscal Decentralization," American Economic Review, v. LXI, n. 4, pp. 787-804.

Henderson, J. (1968), "Local Government Expenditure: A Social Welfare Analysis", Review of Economics and Statistics, v. L, n. 2, pp. 156-63.

Horowitz, A. (1968), "A Simultaneous-Equation Approach to the Problem of Explaining Interstate Differences in State and Local Government Expenditures," Southern Economics Journal, v. XXXIV, n. 4, pp. 459-476.

Ichiishi, T. (1983), Game Theory for Economic Analysis, Academic Press, 1983.

Kaluzny, R. (1975), "Determinants of Household Migration: A Comparative Study by Race and Poverty Level," Review of Economics and Statistics, v. LVII, n. 3, pp. 269-74.

Liu, B. (1975), "Differential Net Migration Rates and the Quality of Life," Review of Economics and Statistics, v. LVII, n. 3, pp. 329-37.

Moffitt, R. (1983), "The Effects of Grants-in-Aid on State and Local Expenditures: The Case of AFDC," Journal of Public Economics, v. 23, pp. 279-306.

Orr, L. (1976), Income Transfers as a Public Good: An Application to AFDC", American Economic Review, v. 66, n. 3, pp. 359-71.

Pauly, M. (1973), "Income Redistribution as a Local Public Good," Journal of Public Economics, v. 2, pp. 35-58.

Plott, C. (1967), "A Notion of Equilibrium and its Possibility under Majority Rule," American Economic Review, v. LVII, n. 4, pp. 787-804.

Pogue, T. and L. Sgontz (1968), "The Effect of Grants-in-Aid on State-Local Spending," National Tax Journal, v. XXI, n. 2, pp. 190-99.

Sharkansky, I. and R. Hofferbert, "Dimensions in State Politics," American Political Science Review, v. 63, pp. 867-79.

Shepsle, K. (1979a), "The Role of Institutional Structures in the Creation of Policy Equilibrium," in Public Policy and Public Output, Rae and Eismeir eds., Sage Publications, 1979.

__________ (1979b), "Institutional Arrangements and Equilibrium in Multidimensional Voting Models," American Journal of Political Science, v. 27, n. 4, pp. 740-61.

Sjaastad, L. (1962), "The Costs and Returns of Human Migration," Journal of Political Economy, v. LXX, supplement, n. 5, part 2, pp. 80-93.

Sloan, F. (1977), "A Model of State Income Maintenance Decisions," Public Finance Quarterly, v. 5, n. 2, pp. 139-73.

Spall, H. (1978), "State Tax Structure and the Supply of AFDC Assistance," Public Choice, v. 33, v. 4, pp. 115-30.

Sommers, P. and D. Suits (1973), "Analysis of Net Interstate Migration", Southern Economics Journal, v. 40, n. 2, pp. 193-201.

Tresch, R. (1975), "State Government and the Welfare System: An Econometric Analysis," Southern Economics Journal, v. 42, n. 1, pp. 33-43.

Uslaner, E. and R. Weber (1975), "The 'Politics' of Redistribution," American Politics Quarterly, v. 3, n. 2, pp. 867-79.

APPENDIX A

DATA DESCRIPTIONS AND SOURCES

B : The average annual AFDC benefit per recipient. Social Security Bulletin, Annual Statistical Supplement, 1980.

minimum $328.32 maximum $1455.36 mean $966.45

τ : The probability of employment, rate of employment in 1979. Statistical Abstract of the United States, 1981.

minimum .920 maximum .972 mean .946

EARN : The average annual earnings of a poor resident; i.e., the earnings a poor resident would expect to receive if employed. Two measures are used:

1. Mean earnings of families with incomes below the 1979 poverty line. Detailed Population Reports, 1980 Census of the Population, v. 1, Chapter D, Table 248. ($E_{i,j}$)

   minimum $1929.00 maximum $4254.00 mean $3103.06

2. Mean earnings of female headed households with incomes below the 1979 poverty line. Ibid.($FE_{i,j}$)

   miminum $2017.00 maximum $3295.00 mean $2525.60

P : Population below the 1979 poverty line. Statistical Abstract of the United States, 1981.

minimum 36,000 maximum 2,036,000 mean 419,520.833

I : The state budget, or income. Measured as total state non-debt general expenditures in 1979, in millions of dollars. Statistical Abstract of the United States, 1981.

minimum $522.0 maximum $25279.0 mean $ 4122.27

γ : Total state non-AFDC expenditure/total state non-debt expenditures, a proxy for the Cobb-Douglas utility weight on consumption. State expenditures by function data are from the Social Security Bulletin Annual Statistical Supplement, 1980.

minimum .905 maximum .987 mean .959

s : The federal matching share. Characteristics of State Plans for AFDC, 1978. In 1979 all but two states elected to use the state medical matching formula:

$$s = 1 - .45 \left(\frac{\text{state per capita income}}{\text{national per capita income}} \right)^2 .$$

The original AFDC formula is:

$$s = 1 - .5 \left(\frac{\text{state per capita income}}{\text{national per capita income}} \right) .$$

Formulae from the Social Security Act, 42USCS.

minimum .50 maximum .783 mean .608

DIST : The distance, in miles, from the state's largest SMSA to rival state's largest SMSA. If a state has more than one SMSA, neither being twice as large as the other, the average of the distances from both is used. Standard Mileage Guide, Rand McNally.

minimum 27 maximum 3216 mean 1220.64 (all pairs)

CPI : State cost of living index. Constructed by Steven G. Craig and Robert P. Inman and used in their paper "Education, Welfare, and the 'New Federalism': State Budgeting in a Federalist Economy", NBER working paper no. 1562. The BLS publishes Annual Lower Income Budgets for a family of four for forty SMSA's. A non-metropolitan budget is published for four regions. The budgets of all SMSA's in a state are averaged together. For states with no metropolitan budgets available the metropolitan budgets of the nearest "similar" state is used. The metropolitan and non-metropolitan budgets are then weighted by the proportion of the state's population living in a metropolitan area to total population and the proportion of the population living in non-metro areas respectively:

$$\left(\frac{1}{n} \sum_{i=1}^{n} \text{city budget}_i \right) \cdot \left(\frac{\text{metro pop.}}{\text{total pop.}} \right) + (\text{regional non-metro budget}) \cdot \left(\frac{\text{non-metro pop.}}{\text{total pop.}} \right) = CPI_i$$

minimum 2.26 maximum 2.77 mean 2.512 (Arkansas 1964 = 100)

APPENDIX B

NUMERIC SIMULATIONS OF THE GENERALIZED GAME

1. Description of the Simulation Program

The generalized game simulation program works as follows. The game begins with b_j=0 and state i chosing the utility maximizing response. The program determines this response by calculating state i's three regional best responses to b_j=0. The actual, or "global", best response is the regional best response which obtains the highest utility. State j's "global" best response to this b_i is calculated in like fashion. The program continues this process until the sign of the difference between consecutive b_i's reverses. Such a change in sign indicates that the search routine has gone past the point of intersection of the states' global best response functions. The program then begins a convergence routine which finds the intersection point (the equilibrium) within $0.001. The program also determines the pattern of migration and checks the convexity of state i's budget constraint at equilibrium.

The equilibrium determined by this program appears quite insenstive to the starting values, suggesting that the equilibrium is unique.
Also the existence of equilibrium and the comparative static properties indicated by the program are quite insensitive to the convexity of the budget constraint.

2. The SAS Program Used to Simulate the Generalized Game

```
  NN=0;NNN=0;BI=0;LBI=0;LLBI=0;
        LINK JREACT;
        LINK IREACT;
        FSTBJ=BJ;
        LINK JREACT;
        SNDBJ=BJ;
        DIST=SNDBJ-FSTBJ;
        IF DIST>0 THEN CASE=1;
           ELSE CASE=-1;
        BI=0;LBI=0;LLBI=0;
PART1B: LINK JREACT;
  IF BJ<0 THEN DO;BI=BI+50; LBI=BI;
  END;
 IF BJ<0 THEN GO TO PART1B;
 LINK IREACT;
 IF BI<0 THEN DO;LBI=BI;BI=BI+50;
  END;
 IF BI<0 THEN GO TO PART1B;
 LDIR=SIGN(BI-LBI);
*
*STEP A SEARCHES FOR AREA WHERE REACTION FUNCTIONS INTERSECT
*
STEPA: LLBI=LBI;LBI=BI;
  BI=BI+50*CASE*LDIR;
  LINK JREACT;
  LINK IREACT;
  LBI=LBI+50*CASE*LDIR;
  DIRECT=SIGN(BI-LBI);
  IF DIRECT = -1*LDIR THEN GO TO CONVERGE;
  LDIR=DIRECT;NN=NN+1;
  IF NN>30 THEN GO TO STOP;
  GO TO STEPA;
 *
 *WHEN THE AREA NEAR EQUILIBRIUM IS FOUND CONVERGE FINDS THE
 *POINT OF INTERSECTION WITHIN .001DOLLARS
 *
 CONVERGE: BI=(LLBI+LBI)/2;
 LINK JREACT;
   MIDBI=BI;
   LINK IREACT;
   DIFF=BI-MIDBI;
   DDIFF=ABS(DIFF);
   IF DDIFF<0.001 THEN GO TO ENDER;
   NEWDIR=SIGN(DIFF);
   IF NEWDIR=-1*DIRECT THEN DO;
     LLBI=MIDBI;
     LDIR=NEWDIR;
     END;
  IF NEWDIR=-1*LDIR THEN DO;
    LBI=MIDBI;
    DIRECT=NEWDIR;
    END;
  NNN=NNN+1;
  IF NNN>20 THEN GO TO STOP;
  GO TO CONVERGE;
```

```
*
*ONCE THE EQUILIBRIUM IS FOUND ENDER DETERMINES THE TYPE OF
*EQUILIBRIUM (IN TERMS OF MIGRATION FLOWS)
*
ENDER: LINK IREACT;
   OM=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ-(1-TI)*BI)-C*D);
   OUTMIG=MAX(0,OM);
   IM=(PJ/KJ)*(RHO*(EI*TI-EJ*TJ+(1-TI)*BI-(1-TJ)*BJ)-C*D);
   INMIG=MAX(0,IM);
   GIJ=INMIG-OUTMIG;
   OJ=(PJ/KJ)*(RHO*(TI*EI-TJ*EJ+(1-TI)*BI-(1-TJ)*BJ)-C*D);
   INJ=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ-(1-TI)*BI)-C*D);
  OUTMIGJ=MAX(0,OJ);
  INMIGJ=MAX(0,INJ);
  GJI=INMIGJ-OUTMIGJ;
   BILOW=(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ)-C*D)/(RHO*(1-TI));
   BIUP=(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ)+C*D)/(RHO*(1-TI));
   BJLOW=(RHO*(TI*EI-TJ*EJ+(1-TI)*BI)-C*D)/(RHO*(1-TJ));
   BJUP=(RHO*(TI*EI-TJ*EJ+(1-TI)*BI)+C*D)/(RHO*(1-TJ));
   STATUS='NTVLD';
  IF BJ<BJLOW AND BJ=BJ1 THEN STATUS='VALI3';
  IF BJ>BJUP AND BJ=BJ3 THEN STATUS='VALI1';
  IF BJ>=BJLOW AND BJ<=BJUP AND BJ=BJ2 THEN STATUS='VALI2';
 GO TO PRINTER;
*
*IREACT FINDS STATE I'S BEST RESPONSE FOR A GIVEN BJ
*
IREACT:
 A=12*(1-SI)*(PI/KI)*RHO*((1-TI)**2)*(1+GAMI);
 CC=(GAMI-1)*II;
 AA=12*PI*(1-SI);
 U=1-((1/KI)*(1-TI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ)-C*D));
 V=AA*U;
 BI1=(-V+(V**2-4*A*CC)**0.5)/(2*A);
 OM1=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ-(1-TI)*BI1)-C*D);
 OUTMIG1=MAX(0,OM1);
 IM1=(PJ/KJ)*(RHO*(EI*TI-EJ*TJ+(1-TI)*BI1-(1-TJ)*BJ)-C*D);
 INMIG1=MAX(0,IM1);
 GIJ1=INMIG1-OUTMIG1;
 IF GIJ1<0 THEN UI1=(II-BI1*(1-SI)*(1-TI)*(PI+GIJ1))**GAMI*BI1*(1-GAMI);
 BI2=(II*(1-GAMI))/(12*PI*(1-SI));
  BILOW=(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ)-C*D)/(RHO*(1-TI));
  BIUP=(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ)+C*D)/(RHO*(1-TI));
  OM2=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ-(1-TI)*BI2)-C*D);
  OUTMIG2=MAX(0,OM2);
    IM2=(PJ/KJ)*(RHO*(EI*TI-EJ*TJ+(1-TI)*BI2-(1-TJ)*BJ)-C*D);
 INMIG2=MAX(0,IM2);
 GIJ2=INMIG2-OUTMIG2;
IF GIJ2=0 THEN UI2=(II-BI2*(1-SI)*(1-TI)*(PI+GIJ2))**GAMI*BI2**(1-GAMI);
 E=12*(1-SI)*(PJ/KJ)*RHO*((1-TI)**2)*(1+GAMI);
 F=12*(1-SI);
 G=PI+((PJ/KJ)*(1-TI)*(RHO*(TI*EI-EJ*TJ-(1-TJ)*BJ)-C*D));
 H=F*G;
 I=(GAMI-1)*II;
 BI3=(-H+(H**2-4*E*I)**0.5)/(2*E);
  OM3=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ-(1-TI)*BI3)-C*D);
  OUTMIG3=MAX(0,OM3);
  IM3=(PJ/KJ)*(RHO*(EI*TI-EJ*TJ+(1-TI)*BI3-(1-TJ)*BJ)-C*D);
  INMIG3=MAX(0,IM3);
  GIJ3=INMIG3-OUTMIG3;
IF GIJ3>0 THEN UI3=(II-BI3*(1-SI)*(1-TI)*(PI+GIJ3))**GAMI*BI3**(1-GAMI);
   UIMAX=MAX(UI1,UI2,UI3);
   IF UIMAX=UI1 THEN BI=BI1;
   IF UIMAX=UI2 THEN BI=BI2;
   IF UIMAX=UI3 THEN BI=BI3;
  IF BI=BI1 THEN IMARK='1';
  IF BI=BI2 THEN IMARK='2';
  IF BI=BI3 THEN IMARK='3';
```

```
 RETURN;
*
*JREACT FINDS STATE J'S BEST RESPONSE FOR ANY GIVEN BI
*
JREACT:
 M=12*(1-SJ);
  Z=(GAMJ-1)*IJ;
  X=M*(PI/KI)*RHO*(1-TJ)**2*(1+GAMJ);
  L=PJ+(PI/KI)*(1-TJ)*(RHO*(TJ*EJ-TI*EI-(1-TI)*BI)-C*D);
  Q=M*L;
  BJ3=(-Q+(Q**2-4*X*Z)**0.5)/(2*X);
   OJ3=(PJ/KJ)*(RHO*(TI*EI-TJ*EJ+(1-TI)*BI-(1-TJ)*BJ3)-C*D);
  IJ3=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ3-(1-TI)*BI)-C*D);
 OUTMIGJ3=MAX(0,OJ3);
 INMIGJ3=MAX(0,IJ3);
 GJI3=INMIGJ3-OUTMIGJ3;
IF GJI3>0 THEN UJ3=((IJ-BJ3*(1-SJ)*(1-TJ)*(PJ+GJI3))**GAMJ)*
BJ3**(1-GAMJ);
  BJ2=((1-GAMJ)*IJ)/((1-SJ)*(1-TJ)*PJ);
  BJLOW=(RHO*(TI*EI-TJ*EJ+(1-TI)*BI)-C*D)/(RHO*(1-TJ));
  BJUP=(RHO*(TI*EI-TJ*EJ+(1-TI)*BI)+C*D)/(RHO*(1-TJ));
 OJ2=(PJ/KJ)*(RHO*(TI*EI-TJ*EJ+(1-TI)*BI-(1-TJ)*BJ2)-C*D);
 IJ2=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ2-(1-TI)*BI)-C*D);
 OUTMIGJ2=MAX(0,OJ2);
 INMIGJ2=MAX(0,IJ2);
 GJI2=INMIGJ2-OUTMIGJ2;
IF GJI2=0 THEN UJ2=((IJ-BJ2*(1-SJ)*(1-TJ)*(PJ+GJI2))**GAMJ)*
BJ2**(1-GAMJ);
 ZZ=12*(1-SJ)*(PJ/KJ)*RHO*((1-TJ)**2)*(1+GAMJ);
 XX=(GAMJ-1)*IJ;
 LL=12*PJ*(1-SJ);
 QQ=1-((1/KJ)*(1-TJ)*(RHO*(TI*EI-TJ*EJ+(1-TI)*BI)-C*D));
 VV=LL*QQ;
 BJ1=(-VV+(VV**2-4*ZZ*XX)**0.5)/(2*ZZ);
 OJ1=(PJ/KJ)*(RHO*(TI*EI-TJ*EJ+(1-TI)*BI-(1-TJ)*BJ1)-C*D);
 IJ1=(PI/KI)*(RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ1-(1-TI)*BI)-C*D);
 OUTMIGJ1=MAX(0,OJ1);
 INMIGJ1=MAX(0,IJ1);
 GJI1=INMIGJ1-OUTMIGJ1;
IF GJI1<0 THEN UJ1=((IJ-BJ1*(1-SJ)*(1-TJ)*(PJ+GJI1))**GAMJ)*
BJ1**(1-GAMJ);
  UJMAX=MAX(UJ1,UJ2,UJ3);
IF UJMAX=UJ1 THEN BJ=BJ1;
IF UJMAX=UJ2 THEN BJ=BJ2;
IF UJMAX = UJ3 THEN BJ=BJ3;
IF BJ=BJ1 THEN JMARK='1';
IF BJ=BJ2 THEN JMARK='2';
IF BJ=BJ3 THEN JMARK='3';
 RETURN;
 STOP: ;
 PRINTER:
  CHECK =RHO*(TJ*EJ-TI*EI+(1-TJ)*BJ-2*(1-TI)*BI1)-C*D;
  BC='NOT    ';
 IF CHECK>0 THEN BC='CONVEX';
 PROC PRINT;VAR BI BI1 BI2 BI3 BILOW BIUP
   BJ BJ1 BJ2 BJ3 BJLOW BJUP GIJ GJI STATUS BC PJ NN NNN UIMAX UJMAX;
            PROC PLOT;
            PLOT BI*PJ;
            PLOT BJ*PJ;
       *    PLOT BJ*BI=IMARK;
       *    PLOT BJ*BI=JMARK;
 PROC PRINT DATA=TWO;VAR EI EJ TI TJ PI PJ GAMI GAMJ II IJ SI SJ
 KI KJ C D;
```

Parameter Values for Simulations Presented

Parm.	Fig. 6	Fig. 7	Fig. 8	Fig. 9	Fig. 10	Fig. 11
ε_i	2700	2000	1000	1900	3000	3000
ε_j	3000	3295	1500	4250	3500	3500
τ_i	.96	.92	.91	.92	.97	.97
τ_j	.97	.97	.94	.97	.96	.97
s_i	.75	.50	.55	.50	---	.68
s_j	.62	.78	.55	.78	.61	---
γ_i	.98	.91	.94	.91	.97	.97
γ_j	.97	.99	.92	.99	.98	.98
K_i	4000	3000	5000	3000	4000	4000
K_j	4000	3000	5000	3000	4000	4000
P_i	----	36000	3000000	36000	10000	100000
P_j	770000	----	2000000	2000000	60000	600000
I_i^*	6000	522	----	522	15000	15000
I_j^*	7000	25000	3000	----	11000	11000
c	.4	.3	.2	.3	.4	.4
d	750	1200	750	1200	500	500

$$\rho = 11.2578 = \sum_{t=1}^{30} \frac{1}{(1+.08)^t}$$

* In millions of dollars.

The vita has been removed from the scanned document