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ABSTRACT

The local public service level is financed by a property tax and set by majority voting. The in-migration of low income families into a community causes a fiscal deterioration. I consider the effect of the fiscal deterioration on welfare, on the public service level and on house prices. In particular, I show that the fiscal deterioration may be beneficial for high income residents, or may cause the public service level to rise. Both cases cannot simultaneously occur.

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1. INTRODUCTION

Public programs to assist low income families with housing remain contentious. In 1988 the Yonkers City Council initially accepted a bankrupting schedule of fines rather than agree to a court-mandated housing program for families of low income; although it later reversed itself, the council behavior was certainly encouraged by local unpopularity to the program. Conventional wisdom holds that the in-migration of low income families lowers the fiscal base of the community, leading to a lowering of service levels and of the welfare of residents of high income. Within my model, I find that a decline in the public service level may be beneficial to the high income residents. I also find that the fiscal deterioration can cause public service levels to rise.

Involvement with low income housing is at all levels of government, with one of the general thrusts being to encourage the construction of housing for low income families in neighborhoods whose residents are predominantly of high income. Total 1987 expenditures by the Department of Housing and Urban Development for subsidized housing, low income housing assistance and public housing were $19 billion (1988 U.S. Budget, Washington). Until 1983, approximately 63% of Section 8 New Construction Projects had been located in low minority suburban areas (The Report of the President's Commission on Housing, Washington, 1982); in 1983 the program was terminated and replaced by a housing voucher scheme. Many states follow a policy of withholding state development assistance to communities where land use regulations do not provide for a fair share of housing growth for all income levels. Many cities provide tax incentives to encourage the construction of low income housing.

What are the consequences of in-migration of the poor? In my model, the local public service level is financed by a property tax and set by majority voting. Building land is elastically supplied within a community, so that the net of tax price of housing is fixed. There are no capital gains. The property tax introduces a distortion into the model; a family chooses "too little" housing and votes "too much" public service relative to the allocation achieved with a benefit tax. In consequence, a fall in the public service level as low income families in-migrate may be associated with falling gross house prices and larger house sizes -- the overall effect being to reduce both distortions and possibly to raise the utility of the high income residents. If housing demand is price inelastic, the public service level must fall as low income families in-migrate. However, if housing demand is price elastic, the in-migration of low income families can raise the gross house price, lowering housing expenditure and releasing income available to be spent on the public service; if this income effect is sufficiently large, fiscal deterioration can cause the public service level to rise. Examples are given.

Most discussions of local public finance start with Tiebout (1956). He argued that, in the presence of some quite restrictive assumptions, the ability of households to "vote with the feet" or "shop over communities" would force communities to provide efficient public service levels, and that communities would be segregated by taste. This paper continues the tradition of focusing upon normative issues and community composition. Tiebout implicitly assumed that the public service level is financed by a benefit tax, that the level of public service is set by profit-maximizing bureaucrats, that public service production shows congestion, and that new building land is available at some ("agricultural") reservation price. In contrast, my model follows the tradition of Rose-Ackerman (1979) and Epple et al (1984) by assuming that the public service is financed by a property tax, that community expenditures are set by voting, and that public service production shows constant returns to community size. Although this could easily be relaxed, for convenience I continue to assume that new building land within the community is elastically supplied at a reservation price.

Several studies support my assumptions. 48% of revenue raised locally is collected through the property tax.[1] Pommerehne and Frey (1976) and Inman (1978) accept the hypothesis that local public service levels are "as if" voted by the median voter. Borcherding and Deacon (1972) and Bergstrom and Goodman (1973) establish that most public service production shows constant returns to community size. Henderson (1985) argues that community boundaries outside the northeastern United States have been relatively flexible, suggesting that building land is relatively freely available.

In addition to Rose-Ackerman and Epple et al., many applied microeconomic models have relaxed one or all of Tiebout's assumptions. Hamilton (1975) shows that zoning can convert property taxes into benefit taxes. Epple and Zelenitz (1981) establish that, when community expenditures are financed by a property tax, competition between communities does not bid away profits as the number of communities becomes large. Voting to set service levels is used in the models of Westerhoff (1977) and Bewley (1981); in contrast, Wheaton (1975) assumes that the level of the local public good is set by a planner using the Samuelson (1954) condition.

An important parameter in the analysis on the public service level is the price elasticity of housing demand, ϵ. Almost all studies find that housing demand is price inelastic, with the range of most estimates for owned housing being between 0.5 and 1.0. It seems empirically likely, therefore, that fiscal deterioration will cause public service levels to fall, with the possibility of a welfare improvement for the high income residents. Muth (1971) finds $\epsilon = 0.76$, Maisel et al. (1971) find $\epsilon = 0.89$, Straszheim (1973) finds $\epsilon = 0.53$, Lee and Kong (1977) find $\epsilon = 0.57$, Rosen (1979) finds $\epsilon = 0.97$, and King (1980) finds $\epsilon = 0.52$. Barton and Olsen (1976) and other authors find that housing elasticities rise with income. Estimates of elasticities for rental housing are usually lower than for owned housing, an observation which Mayo (1981) attributes to the price elasticity rising with income and renters being predominantly of low income.

The paper is organized as follows. The formal model is developed in Section 2. Section 3 shows that a lowering of the public service level, consequent on the in-migration of low income families, may raise the utility level of high income residents. Section 4 establishes that, if housing demand were price elastic, the "fiscally-unfavorable" in-migration can raise the public service level. The intuition for each result is provided at the end of each section. Section 5 discusses the existence and stability of the internal equilibrium. Section 6 concludes.

2. THE MODEL

This paper is concerned with the effect of composition on the internal equilibrium of a community. Families have identical utility functions, but different incomes. Within the community, a fraction θ of families have low endowed income y_1 and a fraction $1-\theta$ of families have high endowed income y_2, $y_1 < y_2$. I will be considering the in-migration of low income families into a community containing predominantly high income residents, or $\theta < .5$. The utility U of a family i depends on family consumption of goods c_i, of housing services h_i, and of the level of the local public service z. In particular, I assume U is additively separable: $U(c_i, h_i, z) \equiv V(c_i) + W(h_i) + G(z)$.

Consumption goods are the numeraire. One unit of housing is competitively produced from materials m and land ℓ; the production function shows constant returns to scale and may be represented as $f(m,\ell) = 1$. Materials are competitively supplied and units are chosen so that one unit of material costs one unit of numeraire. One unit of land has price r. Competition in the construction of housing implies that the producer price of housing services is

$$p = \min_{(m,\ell)} m + r\ell \quad \text{subject to} \quad f(m,\ell) = 1.$$

The community is assumed to include some land which is unused for housing, so that the price r is the ("agricultural") reservation value, fixed outside the model. The producer price of housing is therefore fixed and there can be no capital gains.

If the property tax rate is t (and in the absence of any Federal subsidy), the gross price of housing services is

$$q = (1+t)p. \tag{1}$$

Families are assumed to take decisions sequentially. When choosing its house size, a family treats q as given. A family of income y_i chooses house size

$$h_i = \underset{h}{\operatorname{argmax}} V(y_i - qh) + W(h) + G(z),$$

or

$$qV'(y_1 - qh_1) = W'(h_1), \tag{2}$$

$$qV'(y_2 - qh_2) = W'(h_2). \tag{3}$$

Local public service production is assumed to show constant returns to community size. The unit of public service output is chosen so that one unit of output costs one unit of consumption. The service level is set by voting. When voting, a family ignores any general equilibrium effects of its decision: it treats its house size as given, and assumes any change in the tax burden will be shared as the existing tax burden is shared (or as the existing shares of the total property value in the community). The voter also ignores that the public service level within the community will affect migration into the community from other communities. If the high income families form the majority in the community, $\theta < .5$, they vote

$$(z,t) = \underset{(z,t)}{\operatorname{argmax}} \; V(y_2 - p(1+t)h_2) + W(h_2) + G(z) \quad \text{s.t. } tp(\theta h_1 + (1-\theta)h_2) = z,$$

or

$$\frac{h_2}{\theta h_1 + (1-\theta)h_2} V'(y_2 - qh_2) = G'(z) \tag{4}$$

$$z = (q-p)(\theta h_1 + (1-\theta)h_2) \tag{5}$$

Equations (1)-(5) fix the internal equilibrium values of the five community variables q, h_1, h_2, z and t as functions of θ and other exogenous variables. In a full model, θ would be determined by migration between communities (e.g., as in Rose-Ackerman (1979), Epple et al. (1984) and de Bartolome (1987)): here it is considered as an exogenous variable.

3. THE EFFECT OF COMPOSITION ON WELFARE

For this section, I assume the existence of internal equilibrium (this is discussed in Section 5) and consider the effect on the utility of high income residents as low income families migrate into the community. In particular, can the associated fiscal deterioration be beneficial to the high income resident? The utility achieved by a high income resident is $U_2 = V(y_2 - qh_2) + W(h_2) + G(z)$. From Equations (2) and (3), housing sizes are functions of the gross price (and income) only. Totally differentiating, and using Equations (1)-(5), the change in the utility of a high income resident as the community composition changes is

$$\frac{dU_2}{d\theta} = \frac{h_2(h_2-h_1)(q-p)}{(\theta h_1+(1-\theta)h_2)^2 K}V'\{\frac{h_2\epsilon_2}{q}V' - h_2^2(1-\epsilon_2)(-V'') - (\theta h_1+(1-\theta)h_2)^2(-G'')\}, \quad (6)$$

where

$$K = \{\theta h_1(1-\frac{q-p}{q}\epsilon_1)+(1-\theta)h_2(1-\frac{q-p}{q}\epsilon_2)\}(-G'') + \frac{h_2^2(1-\epsilon_2)}{\theta h_1+(1-\theta)h_2}(-V'') + \frac{\theta h_1 h_2(\epsilon_1-\epsilon_2)}{q(\theta h_1+(1-\theta)h_2)^2}V',$$

and $\epsilon_i \equiv -(q/h_i)\partial h_i/\partial q$, the price elasticity of housing demand at income y_i. It is shown in Section 5 that, at a stable equilibrium, $0 < K$.

The possibility that the utility of a high income resident might rise as low income families in-migrate is illustrated in Example 1.

EXAMPLE 1: The utility function is

$$U = c^{0.55} + 0.5(h+10)^{0.55} + 0.1z^{0.6}.$$

With $\theta = 0$, $p = 1$, and $y_2 = 100$, solving by computer establishes that the stable equilibrium has $1.1101 < q < 1.1102$. Evaluation of Equation (6) over this range shows that $0 < dU_2/d\theta$.

PROPOSITION 1: *$0 < dU_2/d\theta$ implies $dz/d\theta < 0$ and $dq/d\theta < 0$, provided $0 < K$ and $0 < \theta h_1(1 - ((q-p)/q)\epsilon_1) + (1-\theta)h_2(1 - ((q-p)/q)\epsilon_2)$.*

PROOF: See Appendix.

Proposition 1 states that the lowering of the public service level caused by an in-migration of low income families may raise the utility of high income residents, provided two weak conditions are satisfied. The first condition is satisfied with stability; the second condition is satisfied with ineleastic housing demand (as indicated in the Introduction, this is the empirically likely case) or with a homogeneous and stable community ($\theta = 0$, $0 < K$). To establish the intuition for the utility improvement, I now consider a homogeneous community of high income residents (θ=0) and compare the efficient allocation of consumption, housing and public services, (c^*, h_2^*, z^*), with the allocation achieved at the internal equilibrium, $(\tilde{c}, \tilde{h}_2, \tilde{z})$.

PROPOSITION 2: *$c^* < \tilde{c}$, $\tilde{h}_2 < h_2^*$ and $z^* < \tilde{z}$.*

PROOF: The efficient allocation is achieved with benefit taxes,

$$(h_2^*, z^*) = \underset{h_2, z}{\operatorname{argmax}}\ V(y_2 - ph_2 - z) + W(h_2) + G(z).$$

The associated first-order conditions are

between public service and housing: $G'(z^*) = W'(h_2^*)/p.$

between consumption and public service: $V'(y_2-ph_2^*-z^*) = G'(z^*).$

From Equations (4) and (5), the equivalent equations for the internal equilibrium $(\tilde{h},\tilde{z})$ are

$$G'(\tilde{z}) = W'(\tilde{h}_2)/q,$$

$$V'(y_2-p\tilde{h}_2-\tilde{z}) = G'(\tilde{z}).$$

(FIGURE 1 HERE)

Combinations (h_2,z) which satisfy $G'(z) = W'(h_2)/p$ are plotted in Figure 1: by normality, rising house sizes are associated with rising public service level. As the perceived cost of housing rises from p to q, the curve shifts down as drawn. Combinations (h_2,z) which satisfy $V'(y_2-ph_2-z) = G'(z)$ are also plotted in Figure 1: the curve is downward sloping. The public service level in both allocations are chosen "as if" the resources to be divided between consumption and the public service are net of housing, (y_2-ph_2): as h_2 increases, the "as if" net resources fall and, by normality, z falls. The efficient allocation is at intersection E^* and the internal equilibrium (if it exists) is at $\tilde{E}$. By inspection, $\tilde{h} < h^*$ and $z^* < \tilde{z}$.

Finally, $V'(\tilde{c}) = G'(\tilde{z}) < G'(z^*) = V'(c^*), \Rightarrow c^* < \tilde{c}.$

Descriptively, the property tax distorts the housing choice, leading to "too little" housing (in the positive outcome as measured against the normative outcome). The family choice of public service level is made taking as given its resource expenditures on housing, or "as if" its budget is $(y_2 - ph_2)$. With "too little" resource expenditure on housing, there is "too much" expenditure on consumption and public services.

The deterioration in the fiscal base as low income families in-migrate may lead to a lowering of the service level. This could be advantageous for the high income resident if the overall effect is to move them towards the first-best allocation, with the lower gross housing price leading to larger houses. This explains Proposition 1.

4. THE EFFECT OF COMPOSITION ON THE PUBLIC SERVICE LEVEL

Must the public service level fall as low income families in-migrate into the community? Totally differentiating Equations (4) and (5),

$$\frac{dz}{d\theta} = -\frac{h_2(h_2-h_1)}{(\theta h_1+(1-\theta)h_2)K}\{(1-\frac{q-p}{q}\epsilon_2)V' + h_2(q-p)(-V'')-\epsilon_2 h_2(q-p)(-V'')\}. \quad (7)$$

If housing demand is inelastic, $\epsilon_2 < 1$, and $dz/d\theta = (-)$: in-migration by low income families lowers the public service level. However, if housing demand is elastic, $1 < \epsilon_2$, it is possible that the service level *rises* as the low income families in-migrate. This possibility is confirmed by Example 2.

EXAMPLE 2: The utility function is

$$U = c^{0.55} + 0.5h^{0.55} + 0.1(z - 3.5907)^{0.6}.$$

With $\theta = 0$, $p = 1$ and $y_2 = 100$, solving with the computer shows that the stable equilibrium has $1.87 < q < 1.871$. Evaluation of Equation (7) over this range shows that $0 < dz/d\theta$.

PROPOSITION 3: *(a) $0 < dz/d\theta$ implies $1 < \epsilon_2$, provided $0 < K$. (b) $0 < dz/d\theta$ implies $0 < dq/d\theta$, provided $0 < K$ and either $\epsilon_1 \le \epsilon_2$ or $\theta = 0$.*

PROOF: (a) Direct inspection of Equation (7). (b) See Appendix.

As indicated in the Introduction, empirical estimates of the price elasticity of demand suggest $0.5 < \epsilon < 1.0$, and hence the necessary condition for the fiscal deterioration to cause a rise in the public expenditure level is unlikely to be met empirically. (Recent empirical estimates also suggest that price elasticities rise with income, or $\epsilon_1 \le \epsilon_2$.) I now provide the intuition for the restriction on inelastic housing demand, using the case of $\theta = 0$. Services are voted "as if" housing sizes are fixed:

$$\max_z V(y_2 - p\, h_2 - \frac{h_2}{\theta h_1 + (1-\theta) h_2} z) + G(z).$$

$h_2/(\theta h_1+(1-\theta)h_2)$ is the "price" of the public service perceived by the high income voter. Holding the public service level constant, the in-migration of low income families raises the "price" of the public service, and, if this were the only effect, would lower the voted service level. The first term of Equation (7) is the substitution term and the second term is the conventional income term associated with this price change. There is, however, an additional income term associated with ϵ_2: the voter is behaving "as if" his "disposable income," to be divided between consumption and the public service, is y_2-ph_2. The rise in the service "price" is reflected in a rise in tax rates or gross house prices, so that housing sizes fall. Net housing expenditures fall, increasing "disposable income" and tending to raise the voted service level. For the additional term to dominate, housing demand must be very price sensitive or elastic: in the first-order condition of Equation (4), with elastic housing demand, the rise in the tax-rate would lead gross housing expenditure to fall, lowering the marginal utility of consumption and tending to raise voted service levels.

4. EXISTENCE AND STABILITY OF THE INTERNAL EQUILIBRIUM

(FIGURE 2 HERE)

For convenience, I consider first the case of θ=0. From Equations (2) and (3), h_1 and h_2 are functions of q (and y) only, $h_1(q)$ and $h_2(q)$. Using Equations (4) and (5), equilibrium occurs at

$$\begin{aligned} V'(y_2 - qh_2(q)) &\geq G'((q-p)h_2(q)), \quad q = p, \\ V'(y_2 - qh_2(q)) &= G'((q-p)h_2(q)), \quad q > p. \end{aligned} \tag{8}$$

I consider first existence. Internal equilibrium occurs in Figure 2 at the intersection of the $V'(\cdot)$ and $G'(\cdot)$ curves, drawn as functions of q. As Epple et al. (1984) have noted, equilibrium may not exist. Differentiating the left-hand side of Equation (8),

$$\frac{\partial}{\partial q} V'(y-qh(q)) = (-q \frac{dh_2}{\partial q} -h_2)V'' = h_2(1-\epsilon_2)(-V'').$$

$V'(\cdot)$ is upward (downward) sloping as housing demand is inelastic (elastic): increasing the gross housing price is associated with less (more) consumption. Differentiating the right-hand side of Equation (8),

$$\frac{\partial}{\partial q} G'((q-p)h_2(q)) = -h_2(1- \frac{q-p}{q} \epsilon_2)(-G'').$$

If housing demand is inelastic (Figure 2a), $G'(\cdot)$ is downward sloping: increasing the tax rate is associated with rising revenue. For elastic demand (Figure (2b)), $G'(\cdot)$ is downward sloping at low tax-rates (the price term dominates) but the deterioration in the tax base leads $G'(\cdot)$ to be upward sloping at high tax-rates.

Internal equilibrium exists provided $V'(\cdot)$ is equal to or greater than $G'(\cdot)$ at some q, $q \geq p$. With housing demand always inelastic (the empirically likely case), a necessary and sufficient condition for existence is $V'(y_2 - \lim_{q\to\infty} qh_2(q)) > G'(\lim_{q\to\infty} (q-p)h_2(q))$, and equilibrium is unique. This condition seems relatively weak. With housing demand always elastic, equilibrium is more problematic: it seems reasonable that $V'(y_2 - \lim_{q\to\infty} qh_2(q)) < G'(\lim_{q\to\infty} (q-p)h_2(q))$, and multiple equilibria are likely (see Figure 2b). With elastic demand, the possible failure to get existence, (i.e., $G'(\cdot)$ always lies above $V'(\cdot)$) is associated with the rapid deterioration in the fiscal base as the tax-rate rises.

In Rose-Ackerman (1979), the total supply of housing is fixed, so that the tax-base is unaffected by the tax-rate; with constant returns to scale, internal equilibrium exists. Epple et al. (1984) impose conditions on the marginal rate of substitution and require inelastic housing demand. It is easy to find examples of non-existence. For example, there is no internal equilibrium if utility is Cobb-Douglas,

$V(c) + W(h) + G(z) = \alpha_1 \log c + \alpha_2 \log h + (1-\alpha_1-\alpha_2)\log z$, and if $2\alpha_2 < 1-\alpha_1$. With logarithmic utility, $\epsilon = 1$ and the $V'(\cdot)$ curve is horizontal. With $2\alpha_2 < 1-\alpha_1$, utility is always sufficiently service-sensitive that $G'(\cdot)$ is above $V'(\cdot)$.

(FIGURE 3 HERE)

Stability is associated with some description of "out-of-equilibrium" behavior. The following iterative process is postulated, with superscripts being used to indicate the period of iteration. Initially, the housing price is q^0 (by historical chance or whatever). In the first period, (a) each family chooses its house size taking the housing price q^0 as given, $h^1 = h(q^0)$. Using Figure 3, the marginal utility of consumption is at A^1, and the marginal utility of services is at B^1. (b) Families vote service levels holding house sizes fixed at h^1, and are levied their share of the associated taxes, $V'((y-q^1h^1) = G'((q^1-p)h^1)$, or move to the intersection E^1 of their marginal utility of consumption and service curves. In the second period, (a) each family chooses its house size taking the house price q^1 as given, $h^2 = h(q^1)$, and the marginal utilities of consumption and services move to A^2 and B^2 respectively. (b) Families vote service levels, holding housing sizes at h^2, and are levied their share of the associated taxes. The process continues until the allocations repeat themselves at $\tilde{E}$.

The solid lines in Figure 3 correspond to the "long-run" marginal utility of consumption and the public service, with housing sizes being allowed to adjust, and the dashed lines correspond to the "short-run" marginal utility curves with the housing sizes being fixed. The iterative process corresponds to moving to the "long-run" curves, and then along the "short-run" curves. With $V'(y-qh(q)) < G'((q-p)h(q))$ as drawn, the movement is from left to right, or with rising tax rates. Non-existence arises when house sizes are sufficiently sensitive that ever-larger tax-rates are voted.

An equilibrium is stable if it would be achieved as the limit of the iterative process starting from some q^0, or if $G'(\cdot)$ crosses $V'(\cdot)$ from above. Equilibrium with inelastic housing demand is always stable and, as discussed earlier, this is the empirically likely case. In Figure 2(b), equilibrium E_1 is stable and E_2 is unstable.

Repeating the discussion but for a mixed community with the majority having income y_2, an equilibrium is stable if

$$\frac{d}{dq}G'((q-p)(\theta h_1(q)+(1-\theta)h_2(q))) < \frac{d}{dq}\frac{h_2(q)}{\theta h_1(q)+(1-\theta)h_2(q)}V'(y_2-qh_2(q)),$$

or if

$$0 < \{\theta h_1(1-\frac{q-p}{q}\epsilon_1) + (1-\theta)h_2(1-\frac{q-p}{q}\epsilon_2)\}(-G'') + \frac{h_2^2(1-\epsilon_2)}{\theta h_1+(1-\theta)h_2}(-V'') + \frac{\theta h_1\, h_2(\epsilon_1-\epsilon_2)}{q(\theta h_1+(1-\theta)h_2)^2}V' \equiv K_2$$

5. CONCLUSION

The in-migration of low income families into a community composed primarily of high income residents causes a fiscal deterioration. I have shown that it can also be associated with an increase in the utility of the existing residents or a rise in the public service level. The latter case requires elastic housing demand. Both cases cannot simultaneously occur.

The model is concerned with the internal equilibrium of a community. Future research will need to establish the effects when the community is considered part of a larger metropolitan area, with free migration between communities.

APPENDIX: PROOF OF PROPOSITIONS 1 AND 3(b).

PROPOSITION 1: *$0 < dU_2/d\theta$ implies $dz/d\theta < 0$ and $dq/d\theta < 0$, provided $0 < K$ and $0 < \theta h_1(1 -((q-p)/q)\epsilon_1) + (1-\theta)h_2(1 -((q-p)/q)\epsilon_2)$.*

PROOF: (A) From the definition of K,

$0<K$ and $0 < \theta h_1(1 -((q-p)/q)\epsilon_1) + (1-\theta)h_2(1 -((q-p)/q)\epsilon_2)$ imply

$$- \frac{\dfrac{h_2^2(1-\epsilon_2)}{\theta h_1+(1-\theta)h_2}(-V'') + \dfrac{\theta h_1 h_2(\epsilon_1-\epsilon_2)}{q(\theta h_1+(1-\theta)h_2)^2}V'}{\theta h_1(1-\dfrac{q-p}{q}\epsilon_1)+(1-\theta)h_2(1-\dfrac{q-p}{q}\epsilon_2)} < (-G'') . \qquad \text{(A)}$$

From Equation (6),

$$0 < dU_2/d\theta \Rightarrow 0 < h_2\epsilon_2 V'/q - h_2^2(1-\epsilon_2)(-V'') - (\theta h_1+(1-\theta)h_2)^2(-G'').$$

Using Equation (A), this implies,

$$0 < \frac{h_2\epsilon_2 V'}{q} - h_2^2(1-\epsilon_2)(-V'') + \frac{h_2^2(1-\epsilon_2)(\theta h_1+(1-\theta)h_2)(-V'') + \theta h_1 h_2(\epsilon_1-\epsilon_2)V'/q}{\theta h_1(1-\dfrac{q-p}{q}\epsilon_1) + (1-\theta)h_2(1-\dfrac{q-p}{q}\epsilon_2)} ,$$

or $\qquad 0 < (1-((q-p)/)\epsilon_2)V' + h_2(1-\epsilon_2)(q-p)(-V'').$

From Equation (7), this last inequality implies $dz/d\theta < 0$.

(B) $U_2 = V(y_2 - qh_2(q)) + W(h_2) + G(z)$. Totally differentiating, and using Equation (3), $dU_2/d\theta = -h_2V'dq/d\theta + G'dz/d\theta$. If $0 < dU_2/d\theta$, then either $dq/d\theta < 0$ or $0 < dz/d\theta$ (or both). But, from (A), $0 < dU_2/d\theta$ implies $dz/d\theta < 0$. Therefore $dq/d\theta < 0$.

PROPOSITION 3(b): *$0 < dz/d\theta$ implies $0 < dq/d\theta$, provided $0 < K$ and either $\epsilon_1 \le \epsilon_2$ or $\theta = 0$.*

PROOF: Differentiating Equation (4), and rearranging,

$$\frac{dq}{d\theta} = - \frac{(\theta h_1 + (1-\theta)h_2)^2(dz/d\theta)(-G'') + h_2(h_2 - h_1)V'}{h^2(\theta h_1 + (1-\theta)h_2)(1-\epsilon_2)(-V'') + \theta h_1 h_2(\epsilon_1 - \epsilon_2)V'/q} .$$

With $0 < dz/d\theta$, the numerator is positive. With $1 < \epsilon_2$, and either $\epsilon_1 \le \epsilon_2$ or $\theta = 0$, the numerator is negative or $0 < dq/d\theta$.

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LIST OF FIGURES

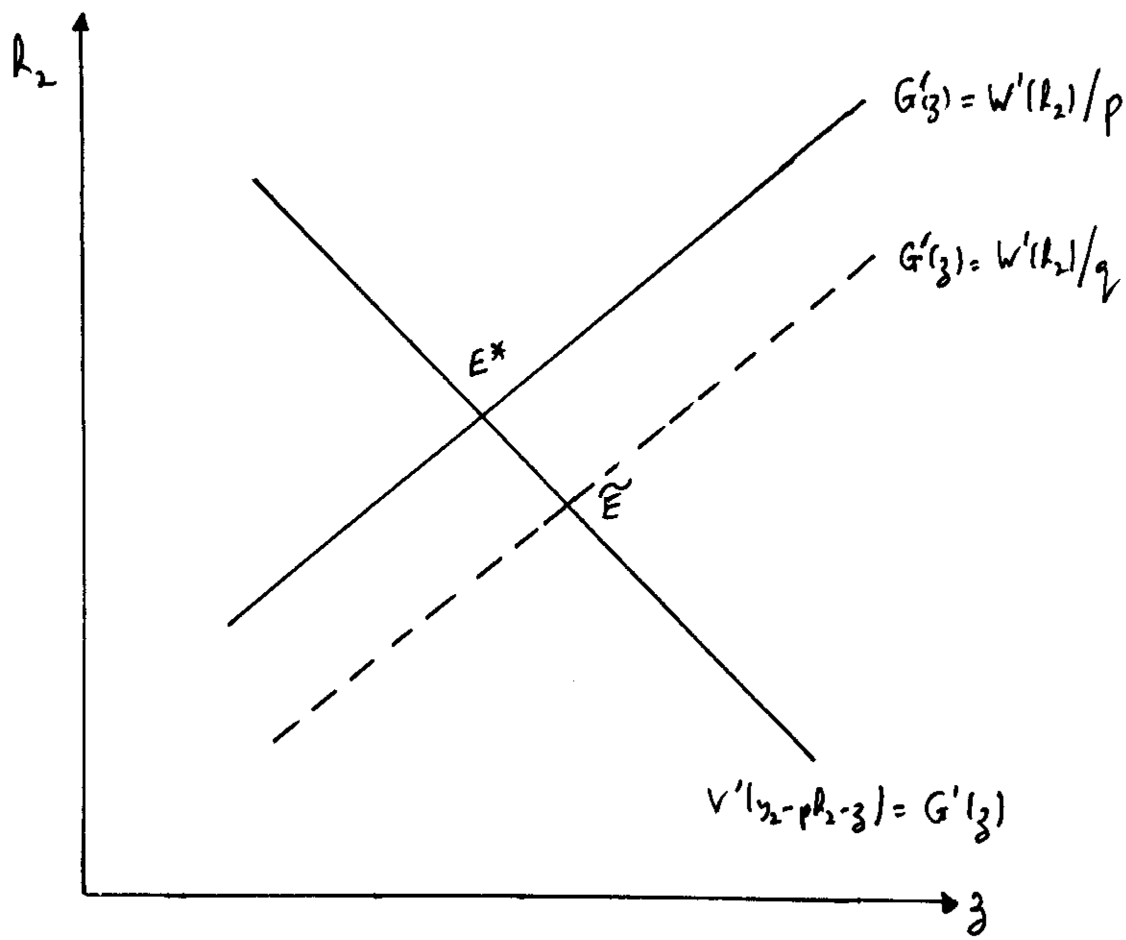

Figure 1: Normative and positive outcomes.

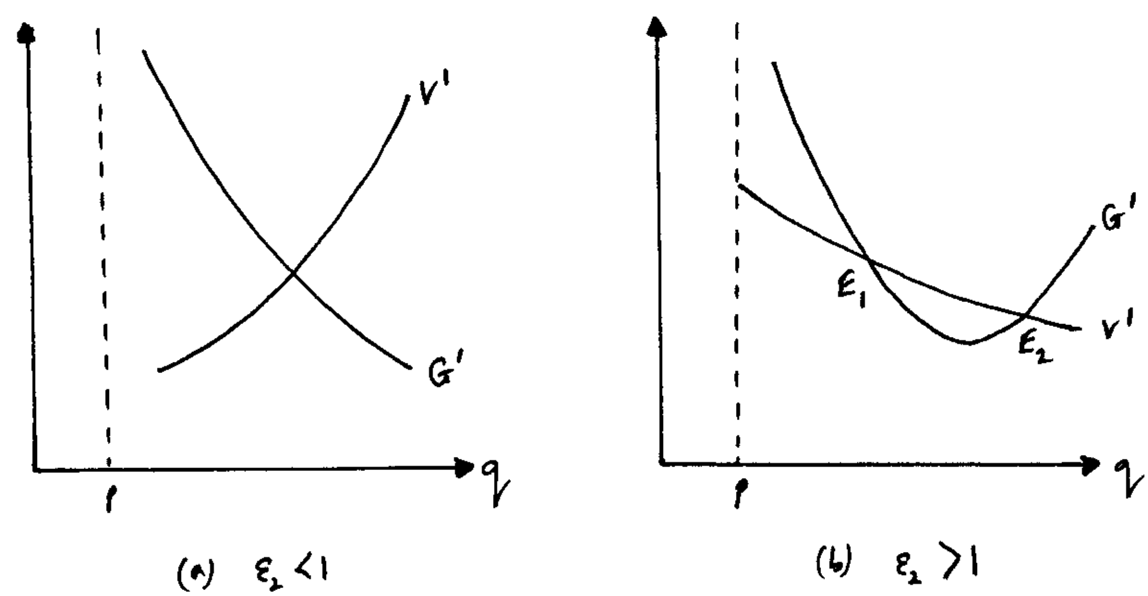

Figure 2: Existence of internal equilibrium.

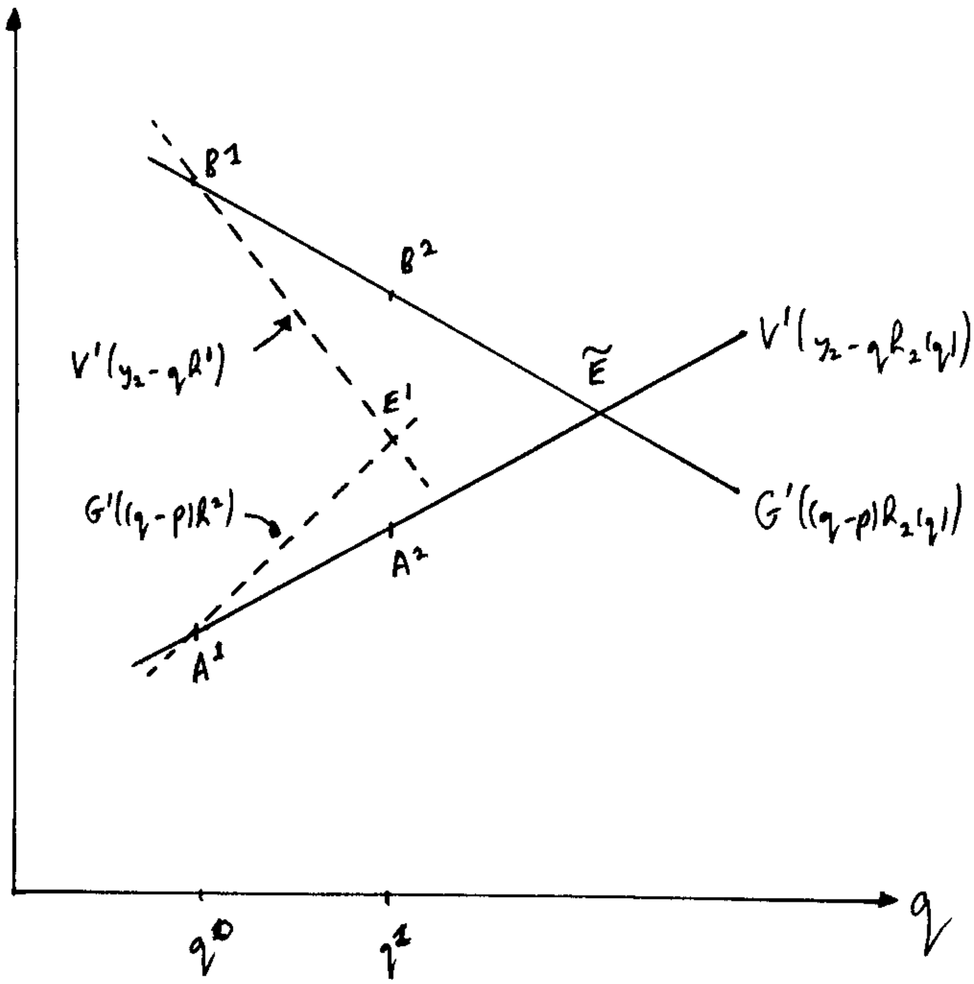

Figure 3: Stability of internal equilibrium.

FOOTNOTES

[1] In 1981/82, total tax revenue of local government was $104 billion, of which $79 billion was collected through the property tax. Other sources of revenue raised locally (including charges) were $61 billion. (Table 2 in *1982 Census of Government, Vol. 4, Number 5*. Washington: Bureau of the Census).