Migration and the Tiebout-Tullock Hypothesis Revisited

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Abstract: This empirical study investigates the Tiebout-Tullock hypothesis as it might have applied to net domestic state in-migration rates over the period 1990 through 1999. It appears that the net state in-migration rate has been directly related to the ratio of the total state plus local government outlays per capita on public education in a state to that state's total state plus local government tax burden per capita. Other variables included in the study, including the previous-period median single-family housing price inflation rate, a measure of previous-period growth in real income per capita, and quality-of-life variables reflecting violent crime rates and sunnier climates, also seem to be significant determinants of the net state in-migration rate. Thus, for the study period, it appears that the Tiebout-Tullock hypothesis played a significant role in determining internal migration patterns.

I. INTRODUCTION

There exists an extensive body of literature dealing with the determinants of internal migration. Greenwood (1975) and Cebula (1979) provide surveys of earlier-period studies. Some of the more recent or more frequently cited contributions relevant to the present study would include Cebula (1974), Cebula and Belton (1994), Clark and Hunter (1992), Conway and Houtenville (1998, 2001), Gale and Heath (2000), Glantz (1973), Herzog and Schlottman (1986), Lybbert and Thimany (2000), Pack (1973), Renas (1980, 1983), Saltz (1998), and Vedder (1976). There are a number of these studies that have yielded potentially profound public policy implications, namely, those studies that investigate the so-called Tiebout or Tiebout-Tullock hypothesis. In general terms, the empirical findings regarding the Tiebout-Tullock hypothesis for the pre-1990 period are that: poor migrants have tended to be attracted to areas offering higher levels of public assistance; most migrant groups have been attracted to areas with higher per capita outlays on public education; and most migrant groups, especially the elderly and higher-income migrants, prefer areas with lower tax (especially property tax and income tax) burdens.

The so-called Tiebout (1956, p. 418) hypothesis can be stated, as follows: "The consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods." Tullock (1971) effectively restates the hypothesis in a way that emphasizes that the choice consumer-voters make is one of assessing *bundles* of local public goods and services *and* tax liabilities. In any event, to the extent that the excess of the perceived net value of local public goods

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and services over associated tax liabilities is not capitalized into property values in a given area, in-migration to that area should increase as consumer-voters attempt to reap the benefits of any perceived "fiscal surplus."

Although the Tiebout-Tullock hypothesis was empirically investigated at length for the 1950s, 1960s, 1970s, and 1980s, inquiries into the hypothesis have been relatively small in number for the period of the 1990s. Accordingly, for the 1990 through 1999 period, this exploratory study seeks to investigate the Tiebout-Tullock hypothesis empirically, thereby integrating 2000 census information and providing updated and current analysis. The model deals with net domestic in-migration rates at the state level and includes fiscal as well as purely economic and quality-of-life factors.

This study differs from other related studies in one or more ways. First, this study deals with net domestic state in-migration rate determinants for the period 1990 through 1999, a period that to date has not received extensive attention in terms of the Tiebout-Tullock hypothesis. Second, unlike most related studies, geographically comparable living cost levels are included, although not as a separate variable, but rather in such a way as to create a geographically comparable *expected real future income* proxy. The focus on state-level migration parallels numerous earlier studies, including Cebula (1974), Cebula and Belton (1994), Conway and Houtenville (1998, 2001), Davies, Greenwood, and Li (2001), Gale and Heath (2000), Gallaway and Cebula (1973), and Saltz (1998). Third, the *previous-period* median single-family housing price inflation rate in each state is included in the model as a separate explanatory variable. This variable is intended to reflect the potential negative in-migration impact that might result as higher *previous-period*, median single-family housing price inflation led to higher *current levels* of housing prices. Fourth, the Tiebout-Tullock fiscal variable for each of the 50 states is expressed as the *ratio* of total state plus local government outlays per capita on public education in any state to that state's per capita total level of state plus local government taxes. This specification is effectively unique within this *migration* literature for the study period.

It is hoped that the differentiating traits listed above will enable the present study to provide useful updated insights into the migration impact of the Tiebout-Tullock hypothesis. In any case, section 2 of this study provides a simple model of migration as an investment. Sections 3 and 4 provide four alternative empirical estimates. Finally, section 5 provides concluding observations. Clearly, focusing on state net domestic in-migration differs sharply from focusing on state net population growth rates since the latter involves births, deaths, net federal movement, international migration, *and net domestic in-migration*. Arguably, the last is the most reflective of the Tiebout-Tullock framework.

II. A SIMPLE MODEL

This study follows the models in Riew (1973) and Cebula (1979, Chapter 4). In particular, the consumer-voter is treated as regarding the migration decision

as an investment decision. Consequently, the decision to migrate from area i to area j requires that the net discounted present value of the move from area i to area j, DPVij, be both (a) positive and (b) the maximum perceived net discounted present value that can be expected by moving out of area i into *any* other known alternative.

As suggested by the models in Riew (1973) and Cebula (1979, Chapter 4), the net discounted present value of migration from area i to area j, DPVij, consists of the following three major components:

1. expected real income or income growth (I) in the areas and housing price inflation (HINF) and related housing price changes in the areas;
2. expected benefits from publicly provided goods and services, such as public education (PE), and expected costs from tax liabilities (T) in the areas; and
3. expected quality-of-life (QOL) characteristics in the areas.

Accordingly, it follows, based on Riew (1973) and Cebula (1979, Chapter 4), that migration will flow from area i to area j only if:

$$(1) \qquad DPVij > 0; DPVij = MAX \text{ for } j,\ j = 1,\ldots,n\ ,$$

where n represents all of the feasible and known alternative locations to area i. The decision to migrate from state i to state j implies that for some persons, DPVij > 0 and also that their DPV is expected to be maximized in state j.

From this framework, it follows that for state j:

$$(2) \qquad MIGj = f(Ij, HINFj, PEj, Tj, QOLj)\ ,$$

where MIGj is in-migration to state j. Expressed in linear terms, the model in Equation 2 becomes the following:

$$(3) \qquad MIGj = a + bIj + cHINFj + dPEj + eTj + fQOLj\ .$$

Based on conventional migration modeling and the Tiebout-Tullock hypothesis, it is expected here that:

$$(4) \qquad b > 0,\ d > 0,\ e < 0,\ f > 0\ .$$

It is also hypothesized in the present study that $c < 0$. This is because to the extent that greater *previous-period* median single-family housing price inflation in a state led to subsequently higher *current levels of housing prices* and thus to a higher overall cost of living in the state, that state will be less attractive to in-migration (Cebula 1978; Renas 1980). Thus, ceteris paribus, net in-migration to a state is expected to be inversely related to its previous-period median single-family housing price inflation rate.

III. THE INITIAL REGRESSION ESTIMATES

Predicated on the framework summarized in Equations 3 and 4, the following two reduced-form regressions are initially estimated:

$$(5)\quad MIGj = a0 + a1PGPCRIj + a2SUNSHINEj + a3VCRIMEj + a4HPIj + a5PETj + u'$$

$$(6)\quad LOGMIGj = b0 + b1PGPCRIj + b2SUNSHINEj + b3VCRIMEj + b4HPIj + b5PETj + u'',$$

where:

MIGj = the net domestic in-migration to state j between 1990 and 1999, expressed as a percentage of state j's 1990 total population;

LOGMIGj = log of the net domestic in-migration rate to state j between 1990 and 1999;

a0, b0 = constants;

PGPCRIj = the percentage growth rate of per capita real income in state j, 1981-1990, as a proxy for *expected* future income opportunities in state j;

SUNSHINEj = the average annual percentage of possible sunshine in state j (i.e., the average annual percentage of daylight in state j that sunshine is experienced);

VCRIMEj = the number of violent crimes in state j per 100,000 population, 1992;

HPIj = the average annual median single-family housing price inflation rate in state j, 1980-1990, as a percentage;

PETj = ratio of total state plus local government outlays per capita on public education in state j (PEj) to total state plus local government taxes per capita in state j (Tj), 1992, expressed as a percentage; and

u', u" = stochastic error terms.

The data source for variable MIGj is the U.S. Census Bureau (2000, Tables 20, 22). For the quality-of-life variables SUNSHINEj and VCRIMEj, the source is the U.S. Census Bureau (2000, Table 414; 1994, Table 303). The data for variable HPIj are obtained from Chao and Cebula (1996, Table 1). The cost-of-living index (COLj) for deflating nominal per capita income into real per capita income is obtained from McMahon (1991, Table 3). McMahon (1991) formulates reduced-form estimations for computing a geographically comparable state-level living-cost index for each of the years from 1981 through 1990. The variable PGPCRIj is computed as follows:

$$(7)\quad PGPCRIj = 100*\left[(PIPCj, 1990/COLj, 1990) - (PIPCj, 1981/COLj, 1981)\right] / (PIPCj, 1981/COLj, 1981),$$

where:

PIPCj, 1990; PIPCj,1981 = the nominal per capita income in state j in 1990 and 1981, respectively (U.S. Census Bureau 2001, Table 727; 1985, Table 731); and

COLj, 1990; COLj, 1981 = the cost of living for the average four-person family unit in state j in 1990 and in 1981, respectively, expressed as an index (average = 100.00) (McMahon 1991, Table 3).

The PGPCRIj ratio, expressed as a percentage, is treated as the measure of the *expected future growth rate in real income per capita in state j*, i.e., as a measure of expected economic opportunity in state j. In principle, this specification parallels that in Cebula and Belton (1994), Gale and Heath (2000), and Saltz (1998).The variables SUNSHINEj and VCRIMEj are intended to reflect elements of the quality of life that have previously been found to affect migration patterns (Milligan 2000; Conway and Houtenville 1998, 2001; Gallaway and Cebula 1973; Cebula 1979, 1990; Gale and Heath 2000; Renas 1978, 1980; and Saltz 1998). The PEj and Tj variables (U.S. Census Bureau 1994, Tables 476, 479) from the previous section have been combined here into a single variable, PETj, as suggested in the different (although somewhat parallel) analysis in Cebula (2002) of *net population growth* rather than net domestic in-migration. This specification addresses the fact that PEj and Tj are likely to be highly correlated, especially since state budgets are generally required to be balanced. In any event, the ratio PETj (=PEj/Tj) is expressed as a percentage. Relatively long time lags for explanatory variables reflect an effort to allow sufficient time for full or nearly full information to flow to households; however, shortening the time lags does not materially alter the conclusions.

Estimating regression Equations 5 and 6 by OLS, while adopting the White (1980) procedure to correct for heteroskedasticity, yields Equations 8 and 9, respectively:

$$\begin{aligned}(8)\quad MIGj = {} & -0.54 + 0.029\,PGPCRIj + 0.0049\,SUNSHINEj - 0.008\,VCRIMEj \\ & \quad\ (+4.23) \qquad\quad (+3.61) \qquad\quad (-2.62) \\ & - 0.00064\,HPIj + 0.0003\,PETj \\ & \ (-2.67) \qquad (+4.23)\end{aligned}$$

$$RSQ = 0.54,\ adjRSQ = 0.49,\ F(5,44) = 10.27$$

$$\begin{aligned}(9)\quad LOGMIGj = {} & -2.34 + 0.102\,PGPCRIj + 0.016\,SUNSHINEj - 0.036\,VCRIMEj \\ & \quad\ (+4.49) \qquad\quad (+3.67) \qquad\quad (-3.01) \\ & - 0.002\,HPIj + 0.00008\,PETj \\ & \ (-2.52) \qquad (+3.98)\end{aligned}$$

$$RSQ = 0.51,\ adjRSQ = 0.46,\ F(5,44) = 9.25\ ,$$

where the terms in parentheses beneath the coefficients are t-values. All ten of the estimated coefficients in Equations 8 and 9 have the hypothesized signs and are statistically significant at the 5% level or beyond. Indeed, nine of the ten coefficients are statistically significant at the 1% level.

The estimated coefficients on the *expected real* income variable in these two estimates are both positive and significant at the 1% level. Hence, it appears that the *previous-period* percentage growth rate of real income per capita, as defined above, as a proxy for *expected* future real income growth and/or employment opportunities, acts to significantly and positively influence net domestic state in-migration. This finding is consistent with the recent finding on state migration by Davies, Greenwood, and Li (2001, p. 349) that "...people move to places of greater perceived economic...opportunity." Next, the estimated coefficients on the SUNSHINEj and VCRIMEj variables are positive and negative, respectively, and statistically significant at the 1% level. Thus, the net state in-migration rate tends to be higher in states having a higher percentage of sunshine and lower in states having a higher rate of violent crimes. This finding that quality-of-life considerations affect migration is consistent with numerous studies, including the recent contributions by Conway and Houtenville (1998, 2001), Gale and Heath (2000), Milligan (2000), Saltz (1998), and Clark and Hunter (1992). In Equations 8 and 9, the estimated coefficients on the *previous-period* median single-family housing price inflation rate variable are negative and significant at the 1% level. Thus, the net state in-migration rate tends to be lower to those states where the previous-period median single-family housing price inflation rate has been higher. These results are consistent with Cebula (1978) and Renas (1980). Presumably, this finding may be because to the extent that higher previous-period median single-family housing price inflation in a state led to higher *current* housing price *levels* in the state, a significant disincentive for in-migration to the state may have been created.

Finally, in Equations 8 and 9, the estimated coefficients on variable PETj are both positive and statistically significant at the 1% level. Hence, the evidence implies that states with higher ratios of state plus local government public education outlays per capita to state plus local government tax burdens per capita experience greater net domestic in-migration rates. These results provide strong empirical support for the Tiebout-Tullock hypothesis for the study period. This finding is in principle consistent with the recent related studies of somewhat earlier migration by Conway and Houtenville (1998, 2001), Clark and Hunter (1992), Saltz (1998), and Gale and Heath (2000).

IV. AN ALTERNATIVE SPECIFICATION

It is suggested in Cebula (1990) for elderly migrants and in Saltz (1998) for younger migrants age 20-40 years that the mere existence of a state income tax system, of and in itself, may act as a deterrent to in-migration. Accordingly, following both of these studies, regression Equations 5 and 6 are so amended as to include an additional variable, TDj, which is a dummy (binary) variable indicating whether or not state j has a state income tax system (U.S. Census Bureau 1994, Table 479). Specifically, TDj = 1 for those states having a state income tax system, TDj = 0 otherwise. State income tax systems exist in 43 of the 50 states. These OLS estimates, again using the White (1980) correction for heteroskedasticity, are provided in Equations 10 and 11:

(10) $$MIGj = +0.02 + 0.027\,PGPCRIj + 0.0047\,SUNSHINEj - 0.008\,VCRIMEj$$
$$(+4.21) \qquad (+3.99) \qquad (-2.82)$$
$$-0.0005\,HPIj + 0.0002\,PETj - 0.056\,TDj$$
$$(-2.27) \qquad (+3.81) \qquad (-1.66)$$

$$RSQ = 0.57, \quad adjRSQ = 0.51, \quad F(6,43) = 9.49$$

(11) $$LOGMIGj = -2.12 + 0.0959\,PGPCRIj + 0.015\,SUNSHINEj - 0.0004\,VCRIMEj$$
$$(+3.45) \qquad (+3.86) \qquad (-3.18)$$
$$-0.002\,HPIj + 0.00007\,PETj - 0.16\,TDj$$
$$(-2.22) \qquad (+3.45) \qquad (-1.62)$$

$$RSQ = 0.53, \quad adjRSQ = 0.47, \quad F(6,43) = 8.2$$

In Equations 10 and 11, the estimated coefficients on the variables PGPCRIj, SUNSHINEj, and VCRIMEj are significant at the 1% level or beyond with the expected signs. In addition, the estimated coefficients in Equations 10 and 11 on variable HPIj are negative and significant at the 5% level. Clearly, these results are entirely consistent with the corresponding results in Equations 8 and 9. In Equations 10 and 11, although the estimated coefficients on the income tax dummy variable both have the expected negative signs, they are not quite statistically significant at even the 10% level. Thus, the evidence regarding the significance of the *existence* of a state income tax system for net state in-migration over the 1990s is very weak. It should be observed that in two separate estimates, in place of variable TDj, the maximum marginal state personal income tax rate in each state (TMAXj) was used, with those seven states having no state income tax system at all simply assigned a value of zero (i.e., TMAXj=0). In both of these estimates, the overall results were entirely consistent with those in Equations 10 and 11 above. In any event, it is of course noteworthy that the estimated coefficients on the PETj variable in Equations 10 and 11 both are positive and significant at the 1% level, once again providing strong empirical support for the Tiebout-Tullock hypothesis.

Thus, the net state in-migration rate for the study period appears to be positively related to the previous-period real income per capita growth rate and the quality of life as reflected in the variable SUNSHINEj, while being inversely related to the state previous-period median single-family housing price inflation rate and the violent crime rate. Furthermore, the net state in-migration rate *does* appear to follow a Tiebout-Tullock pattern insofar as it is positively related to the ratio of state plus local government outlays per capita on public education to state plus local government tax burdens per capita. On the other hand, the evidence appears to indicate that the existence of a state income tax system per se may not have significantly affected the net state in-migration rate during the study period.

Finally, it is observed that alternative versions of the model yield further support for the Tiebout-Tullock hypothesis. For example, consider the following model:

$$(12) \quad MIGj = c0 + c1PAGSPj + c2HAZj + c3HPIj + c4PETj + u''',$$

where:

PAGSPj = the average annual growth in gross state product in state j, 1979-1988, as a percentage (Chao and Cebula 1996, Table 1); and

HAZj = the number of hazardous waste sites in state j, 1993 (U.S. Census Bureau 1994, Table 372).

This model adopts a different measure of expected economic opportunity (PAGSP) and uses a different measure of the quality of life (HAZ) than the estimations above. Nevertheless, the OLS estimation, after using the White (1980) correction, lends strong support to the Tiebout-Tullock hypothesis:

$$(13) \quad MIGj = \underset{}{-0.139} + \underset{(+3.59)}{0.026}\,PAGSPj - \underset{(-2.05)}{0.005}\,HAZj - \underset{(-2.34)}{0.00063}\,HPIj + \underset{(+2.13)}{0.0004}\,PETj$$

$$RSQ = 0.51, \text{ adjRSQ} = 0.47, F(4,45) = 11.87.$$

In this estimate, the estimated coefficient on the PET variable is positive and significant at beyond the 5% level. Indeed, substitution of the cost-of-living index for 1990 from McMahon (1991) for the HPI variable yields results nearly identical to those in Equation 13.

V. CONCLUSION

This empirical study has examined the impact on the net domestic state in-migration rate over the 1990 through 1999 period of a variable reflecting the Tiebout-Tullock hypothesis. This study controls for the impacts of interstate previous-period real income per capita growth rate differentials, previous-period median single-family housing price inflation rate differentials, and quality-of-life factors such as sunshine and violent crime rates. The results strongly suggest that the Tiebout-Tullock framework is alive and well. Indeed, the evidence consistently indicates that the net state in-migration rate has been an increasing function of the ratio of state plus local government outlays per capita on public education to the state plus local government tax burden per capita over the study period.

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