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Net Migration Determinants

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Abstract. This empirical study investigates the impact on net state in-migration over the 2000-2003 period of a variety of economic and non-economic factors and thereby serves as a robustness test of a study by Cebula and Alexander published in 2006. The estimates indicate that the net state in-migration rate was an increasing function of median family income or expected median family income and a decreasing function of the average cost of living. In addition, net state in-migration was an increasing function of warmer temperatures and a decreasing function of the presence of hazardous waste sites. Finally, net state in-migration was an increasing function of fiscal surplus and a decreasing function of the presence of state individual income taxation. The results are generally supportive of those in Cebula and Alexander (2006).

1. Introduction

This empirical study investigates net state in-migration rate determinants for the period 2000-2003, a period that approximates the 2000-2004 interval studied by Cebula and Alexander (2006) in a previous issue of this journal. This study approximately parallels the model and study period considered therein, although it adopts a number of somewhat different variables. Naturally, this study considers the impact of not only economic factors, but also of quality-of-life factors, certain state and local government education outlays and property tax levels, and the presence of state individual income taxation. Not surprisingly, the results are largely consistent with the Cebula and Alexander (2006) findings.

Our focus on the Cebula and Alexander (2006) study is based in part upon observations regarding that study by Cushing (2006). In particular, Cushing (2006, p. 115) observed that although Cebula and Alexander (2006) "…use a fairly conventional model, [they] incorporate some unconventional factors…hazardous waste sites, and toxic chemical releases…" being among them. In addition, Cushing (2006) observed that Cebula and Alexander (2006) were among the first to look at migration during the first part of the 21st century.

2. The in-migration context

Numerous studies have empirically addressed determinants of migration. Most of these studies emphasize the migration impact not only of economic factors but also of non-economic, i.e., so-called "quality-of-life" factors (Cebula, 1979B,1993; Cebula and Belton, 1994; Cebula and Payne, 2005; Clark and Hunter, 1992; Conway and Houtenville, 1998, 2001; Gale and Heath, 2000; Gallaway and Cebula, 1973; Gunderson and Sorenson, 2010; Hinze, 1977; Milligan, 2000; Renas, 1978, 1980, 1983; Saltz, 1998; Vedder, 1976; Vedder and Cooper, 1974). As demonstrated in Gallaway and Cebula (1973), Renas (1978, 1983), and more recent studies as well, omission of non-economic factors from an empirical migration analysis constitutes an omitted-variable problem that generally compromises the integrity of that analysis.

This study parallels the migration-investment models developed in Sjaastad (1962), Riew (1973),

Cebula (1979B, Chapter 4), and, of course, Cebula and Alexander (2006). The consumer-voter is treated as regarding the migration decision as an investment decision, such that the decision to migrate from area *i* to area *j* requires that his/her expected net discounted present value of migration from area *i* to area *j*, DPV_{ij}, be (a) positive; *and* (b) the maximum net discounted present value that can be expected from moving from area *i* to *any* other known and plausible alternative area/location.

Following in principle the models in Sjaastad (1962), Riew (1973), and Cebula (1979B, Chapter 4), DPV_{ij} consists of three major sets of considerations:

1. expected income (*I*) and cost of living (*COL*);
2. quality-of-life (*QOL*) characteristics; and
3. per capita state plus local public education outlays (*ED*), per capita property tax levels (*PT*), and the presence of state income taxation (*SIT*) (Cebula, 1979A).

Based on Sjaastad (1962), Riew (1973), and Cebula (1979B, Chapter 4), it further follows that migration will flow from area *i* to area *j* only if:

$$DPVij > 0; \text{ and } DPVij = \text{MAXIMUM} \quad (1)$$

Alternatively stated, the decision to migrate from state *i* to state *j* implies that for at least some persons, $DPV_{ij} > 0$ and that their *DPV* is maximized in state *j*. On the other hand, the decision for consumer-voter residents to remain in state *i* presumably implies that all *DPVij* are not positive.

It logically follows that for state *j*:

$$MIG_j = f(I_j, COL_j, QOL_j, ED_j, PT_j, SIT_j) \quad (2)$$

where MIG_j is in-migration to state *j*. In linear terms, equation (2) becomes:

$$MIG_j = a + bI_j + cCOL_j + dQOL_j + eED_j + fPT_j + gSIT_j \quad (3)$$

Following the conventional wisdom in a general sense, it is hypothesized in the present study that:

$$b>0,\ c<0,\ d>0,\ e>0,\ f<0,\ g<0 \quad (4)$$

The first two signs reflect migrant preferences for areas offering better expected economic benefits, ceteris paribus. The third sign reflects the notion that migrants prefer areas with a higher overall quality of life, ceteris paribus. The last three signs reflect the notion that migrants prefer areas offering a higher "fiscal surplus" and prefer the absence of state-level income taxation, ceteris paribus.

3. Empirical model

Given the framework above, the following two reduced-form equations are to be estimated:

$$MIG_j = a_0 + a_1MFI_j + a_2COST_j + a_3JANTEMP_j + a_4HAZARD_j + a_5FISCSURP_j + a_6STINCTAX_j + u_a \quad (5)$$

$$MIG_j = b_0 + b_1EXPMFI_j + b_2COST_j + b_3JANTEMP_j + b_4HAZARD_j + b_5FISCSURP_j + b_6STINCTAX_j + u_b \quad (6)$$

where:

MIG_j = the net in-migration to state *j* between the years 2000 and 2003, expressed as a percentage of state *j*'s 2000 population;

a_0, b_0 = constant terms;

MFI_j = median family income in state *j*, 2000;

$EXPMFI_j$ = the *expected* median family income in state *j* in year 2000, computed as the product for state *j* of its year 2000 median family income (MFI_j) and (1-UNR_j), where UNR_j is the year 2000 unemployment rate (as a decimal) in state *j*;

$COST_j$ = the cost of living for the average four-person family in state *j* in the year 2000, expressed as an index (100.00 average);

$JANTEMP_j$ = the normal daily maximum temperature (degrees Fahrenheit) in state *j* in January;

$HAZARD_j$ = the number of hazardous waste sites per 1,000 square miles in state *j* in year 2000;

$FISCSURP_j$ = the average fiscal surplus in state *j* in the year 2000, computed as the per capita level of state plus local government public education spending in state *j* in the year 2000 minus the per capita level of state plus local government property taxation in state *j* in the year 2000;

$STINCTAX_j$ = a binary (dummy) variable indicating whether there is a state personal income system in place in state *j* in the year 2000, such that $STINCTAX_j = 1$ for those states having a state personal income tax and $STINCTAX_j = 0$ otherwise; and

u_a and u_b are stochastic error terms.

The study includes all 50 states but not Washington, D.C. The data source for the variable *MIG* was the 2004-2005 Statistical Abstract of the United States

(U.S. Census Bureau, 2005, Tables 17 and 19). The *MFI*, *EXPMFI*, and *UNR* data were from the 2001 and 2002 Statistical Abstracts (U.S. Census Bureau, 2001, Table 572; 2002, Table 656). The source for *JANTEMP* and *HAZARD* was the 2004-2005 Statistical Abstract (U.S. Census Bureau, 2005, Tables 376 and 369). The data for the variable *FISCSURP* were obtained from the 2003 and 2004-2005 Statistical Abstracts (U.S. Census Bureau, 2003, Tables 446 and 447; 2005, Table 17). The data for creating variable $STINCTAX_j$ were from Cebula (1990). The data for variable *COST* obtained from McMahon (1995) yields nearly identical results as those obtained from Cebula and Alexander (2006).

Most studies of determinants of internal migration in the U.S. adopt either per capita income or median income as a measure of economic opportunity. In equation (5), the use of median family income (*MFI*) is parallel to such a specification. However, in estimation (6) the economic opportunity measure is the variable *EXPMFI*, which is the product of the nominal 2000 median family income in state *j* and the year 2000 employment rate, i.e., unity less the decimal value of the unemployment rate; this specification is offered as a potentially superior measure of *expected future family income* in state *j*. This particular specification is similar to Saltz (1998) and Cebula and Payne (2005), although it differs from the study of 2000-2004 by Cebula and Alexander (2006).

It is expected that net in-migration should be an increasing function of *MFI* or *EXPMFI*, ceteris paribus. Assuming that migrants are not subject to "money illusion", in-migration should be a decreasing function of the cost of living in state *j* ($COST_j$), ceteris paribus, as argued at length in Cebula (1979B, Chapter 4), Cebula (1993), and Gunderson and Sorenson (2010). The variables *HAZARD* and *JANTEMP* are intended to reflect non-economic factors that may influence migration patterns. Whereas variables similar to *JANTEMP* have been considered previously (e.g., Milligan, 2000; Conway and Houtenville, 1998, 2001; Hinze, 1977; Gallaway and Cebula, 1973; Cebula, 1979B, 1993; Clark and Hunter, 1992; Gale and Heath, 2000; Renas, 1978, 1980; Saltz, 1998), related studies have typically not considered a variable such as *HAZARD* per se (cf. Cebula and Payne, 2005). In any case, it is hypothesized per conventional wisdom that in-migration is an increasing function of warmer January temperatures, ceteris paribus, and a decreasing function of the presence of hazardous waste sites, ceteris paribus.

There are two separate fiscal variables in our models. $FISCSURP_j$ is defined as the per capita state plus local government spending in state *j* on public education minus the per capita level of state plus local property taxation in state *j*. This variable is intended to estimate the average fiscal surplus perceived by would-be migrants among the various states. As suggested in Tiebout (1956), Tullock (1971), and Riew (1973), and observed in Cebula (1978), ceteris paribus, migration will flow to those areas where there remains a positive fiscal surplus that has not been capitalized into housing prices. Cebula and Alexander (2006) measure these variables differently. They adopt *per pupil* expenditures and per capita property taxes as *separate* variables. Finally, the state income tax dummy (Cebula, 1990) represents an effort to control for the possibility that, ceteris paribus, migrants prefer to reside in states where a state income tax is not imposed. The specification for this variable is expressed in two non-dummy forms in Cebula and Alexander (2006): state per capita income taxes and state income taxes as an average percent of personal income per capita.

4. Empirical estimates

The OLS estimations of equations (5) and (6) are provided in columns (a) and (b), respectively, of Table 1. All 12 of the estimated coefficients exhibit the hypothesized signs and are statistically significant at beyond the five percent level. In addition, the coefficients of determination indicate that the models in both cases explain roughly two-fifths of the variation in the dependent variable. Finally, the F-statistics are both significant at beyond the one percent level, attesting to the strength of the models as a whole.

In these estimations, there are two different (alternative) variables to represent income opportunities, *MFI* and *EXPMFI*. The *EXPMFI* variable differs from the *MFI* variable insofar as it explicitly includes the employment rate and thereby endeavors to provide an arguably more accurate view of *expected* median family income in the various states. In estimation (a), the estimated coefficient on variable *MFI* is positive (as expected) and significant at the 2.5 percent level, whereas in estimation (b) the estimated coefficient on variable *EXPMFI* also is positive (as expected) and significant at the 2.5 percent level. Thus, it appears that expected median family income, be it reflected in *MFI* or *EXPMFI*, exercises a positive and significant impact on the net state in-migration rate, ceteris paribus. This finding is

clearly consistent with the conventional wisdom (Cebula and Alexander, 2006). The estimated coefficients on variable *COST* are both negative (as hypothesized) and statistically significant at the one percent level. This result implies that migrants do not appear to be subject to "money illusion", ceteris paribus, as found in Cebula and Alexander (2006) as well as in Renas (1978, 1980, 1983), and Saltz (1998).

In both estimations, the coefficients on the *JANTEMP* variable are positive (as hypothesized) and significant at the one percent level. The two results imply that migrants prefer to move to states with warmer January temperatures. This finding is consistent with a host of previous studies, including Cebula (1979B), Cebula and Payne (2005), Clark and Hunter (1992), Gallaway and Cebula (1973), Gale and Heath (2000), and Saltz (1998). The estimated coefficients on the *HAZARD* variable are both negative and significant at beyond the 2.5 percent level, implying that, ceteris paribus, migrants prefer locating in states with a lower incidence of hazardous waste sites. This result is consistent with those in Cebula and Payne (2005) for 1999-2000 migration patterns. Taken together, the results for *JANTEMP* and *HAZARD* imply that quality-of-life factors are important to the migration decision.

Table 1. OLS estimations for 2000-2003 net state in-migration rate determinants.

Variable/Column	(a)	(b)	(c)	(d)
Constant	45.27	44.15	32.79	45.2
MFI	0.0013**			
	-2.38			
EXPMFI		0.00129**	0.00127*	0.0013*
		(2.34)	(2.25)	(2.19)
COST	-0.853***	-0.822***	-0.736*	-0.783**
	(-2.75)	(-2.70)	(-2.16)	(-2.39)
JANTEMP	0.59***	0.592***	0.54**	0.56***
	(3.26)	(3.25)	(2.41)	(2.65)
HAZARD	-0.201**	-0.198**	-0.179*	-0.195*
	(-2.41)	(-2.36)	-2.06	(-2.10)
FISCSURP	0.017**	0.016*	0.0169*	0.0167*
	(2.35)	(2.24)	(2.05)	(2.19)
STINCTAX	-13.78**	-14.09**	-13.36*	-13.6*
	(-2.34)	(-2.38)	(-2.09)	(-2.20)
POPDEN			-6.56	
			(-0.46)	
AVGPCTSUN			0.273	
			(-0.38)	
VIOLENTCR				0.002
				(0.18)
STUNINS				-0.021
				(-0.29)
R^2	0.38	0.38	0.38	0.38
Adjusted R^2	0.29	0.29	0.26	0.26
F	4.39***	4.35***	3.18***	3.14***

Note: Terms in parentheses are t-values. ***Statistically significant at the 1.0 percent level; **statistically significant at the 2.5 percent level; *statistically significant at the 5.0 percent level.

Examining the fiscal variables in the system, we find that the estimated coefficients on the variable *FISCSURP* are positive, as hypothesized, and significant at the 2.5 percent level in estimation (a) and at the three percent level in estimation (b). These findings imply that, ceteris paribus, migrants are attracted to higher perceived levels of fiscal surplus, which is consistent with the models in Tiebout (1956),

Tullock (1971), Riew (1973), and Cebula (1979B, Chapter 4), as well as the empirical findings in Cebula (1978), Clark and Hunter (1992), Conway and Houtenville (1998, 2001), Gale and Heath (2000), Renas (1980), Saltz (1998), Vedder (1976), and Vedder and Cooper (1974). The coefficients on the *STINCTAX* dummies are both negative, as expected, and significant at beyond the 2.5 percent level, implying that *the existence* of a state individual/personal income tax system acts as a deterrent to net in-migration, ceteris paribus. In principle, this is consistent with Cebula (1990), Conway and Houtenville (2001), Gale and Heath (2000), Renas (1980), and Saltz (1998).

Alternative versions of the basic model were estimated, with little change in the results as summarized above. Consider, for example, the estimation in column (c) of Table 1, where two additional quality-of-life factors have been integrated into the model [neither of which is found in Cebula and Alexander (2006)] in equation (6): $POPDEN_j$, the population in state j per square mile in the year 2000, as a measure of population density; and $AVGPCTSUN_j$, the average percentage of possible sunshine in state j (the percent of days annually that are either clear or partly cloudy). *POPDEN* and *AVGPCTSUN* were obtained from the U.S. Census Bureau (2001, Tables 346 and 377; 2004, Table 17). It is hypothesized that greater population density should act as a migration deterrent (Renas, 1978; Saltz, 1998), ceteris paribus, because of the congestion associated with increased population density, whereas a greater amount of sunshine should act to attract migrants, ceteris paribus, because it is a desirable climatic attribute (Cebula, 1979B; Renas, 1978). As shown in column (c) of Table 1, the six variables initially included in the model from equation (6) still exhibit their expected signs and are all significant at beyond the five percent level. However, although the two additional quality-of-life variables exhibit the expected signs, they both fail to be significant at even the ten percent level.

In yet one more example of an attempted extension of the basic model, consider the results shown in column (d) of Table 1. In this case, the model expressed in equation (6) is altered to include an alternative quality of life variable, the violent crime rate [which is ignored in Cebula and Alexander (2006)] in state j per 100,000 population in 1999, VIOLENTCRj. Also added to the model is another form of fiscal variable, STUNINSj, defined as average weekly unemployment benefits in the year 1999 in state j; this variable also is not considered in Cebula and Alexander (2006). Data for the variables VIOLENTCRj and STUNINSj were obtained from the U.S. Census Bureau (2001, Tables 293 and 536). In principle, following the models in Riew (1973) and Cebula (1979B, Chapter 4), it can be argued that greater violent crime rates reduce the expected quality of life and act to deter net in-migration; in addition, higher available levels of unemployment insurance could be viewed as superior safety nets for prospective in-migrants in the event they should lose their jobs and therefore could serve to attract migrants (Long, 1974). The results shown in column (d) once again reveal that the six variables initially identified in the model all exhibit their expected signs and remain significant at beyond the five percent level. However, neither the violent crime rate nor the state unemployment insurance variable is significant at even the ten percent level.

5. Conclusions

This empirical study has investigated economic and non-economic determinants of net internal in-migration in the U.S. over the 2000-2003 period. Four reduced-form estimates are provided, based on an eclectic model including economic opportunities, quality-of-life factors, and state/local fiscal factors. The basic conclusions are that, over the 2000-2003 period, the net in-migration rate to a state was: (1) an increasing function of median family income or, alternatively, of expected median family income (which variable includes unemployment rate considerations) in the state; (2) a decreasing function of the average cost of living in the state; (3) an increasing function of the average January temperature in the state; (4) a decreasing function of the incidence of hazardous waste sites in the state; (5) an increasing function of the average fiscal surplus in the state; and (6) a decreasing function of the presence of a state income tax system in the state. In closing, it is observed that the overall findings in this study offer strong support for their counterpart variable findings in Cebula and Alexander (2006).

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