Determinants of Migration, Revisited

Alexander, Gigi and Foley, Maggie

Jacksonville University, Jacksonville University

27 June 2014

Determinants of Migration, Revisited

Gigi M. Alexander & Maggie Foley

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 the study by Cebula and Alexander (2006). The empirical estimates indicate that the net state in-migration rate was an increasing function of median family income or expected median family income on the one hand and a decreasing function of the average cost of living. In addition, net state in-migration was an increasing function of the warmer temperatures, while being a decreasing function of the presence of hazardous waste sites. Finally, net state in-migration was an increasing function of fiscal surplus (measured as per capita state plus local government spending on public education minus per capita state plus local government property taxation) and a decreasing function of the presence of state individual income taxation. The results are generally supportive of those in Cebula and Alexander (2006).

JEL codes: J61, R23

Introduction

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

This focus on the Cebula and Alexander (2006) study is based in part upon observations regarding this study by Cushing (2006). In particular Cushing (2006) observes 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."

In-Migration Model

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 Gatons and Cebula (1972), Gallaway and Cebula (1973), and 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), and Cebula (1979B, Ch. 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*, *DPVij*, 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), Gatons and Cebula (1972), Riew (1973), and Cebula (1979B, Ch. 4), *DPVij*, consists of three major sets of considerations, namely:

1. expected income (I) in the areas as well as the cost of living (COL) in those areas;

2. quality-of-life (QOL) characteristics of the areas; 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) in those areas (Cebula, 1979A).

Based on Sjaastad (1962), Gatons and Cebula (1972), Riew (1973), and Cebula (1979B, Ch. 4), it further follows that migration will flow from area i to area *j* only if:

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

where *n* represents all of the plausible known alternative locations to area *i*.

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

It logically follows that for state j:

$$\text{MIGj} = f(\text{Ij, COLj, QOLj, EDj, PTj, SITj}) \quad (2)$$

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

$$\text{MIGj} = a + b\text{Ij} + c\text{COLj} + d\text{QOLj} + e\text{EDj} + f\text{PTj} + g\text{SITj} \quad (3)$$

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*.

Empirical Context

Given the framework provided in (1)-(4) above, initially the following two reduced-form equations are to be estimated:

$$\text{MIGj} = a_0 + a_1\text{MFIj} + a_2\text{COSTj} + a_3\text{JANTEMPj} + a_4\text{HAZARDj} + a_5\text{FISCSURPj} + a_6\text{STINCTAXj} + u' \quad (5)$$

$$\text{MIGj} = b_0 + b_1\text{EXPMFIj} + b_2\text{COSTj} + b_3\text{JANTEMPj} + b_4\text{HAZARDj} + b_5\text{FISCSURPj} + b_6\text{STINCTAXj} + u'' \quad (6)$$

where:

MIGj= 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;

MFIj = median family income in state j, 2000;

EXPMFIj = 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 (MFIj) and (1-UNRj), which is unity minus the year 2000 unemployment rate (as a decimal) in state j;

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

JANTEMPj = the normal daily maximum temperature (degrees Fahrenheit) in state j in January;

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

FISCSURPj= 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;

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

u', u" = stochastic error terms

The study includes all 50 states but not Washington, D.C. The data source for the variable MIGj was the U.S. Census Bureau (2005, Tables 17, 19). The sources for variables MFIj, EXPMFIj, and UNRj were the U.S. Census Bureau (2002, Table 656) and the U.S. Census Bureau (2001, Table 572). The source for variables JANTEMPj and HAZARDj were the U.S. Census Bureau (2005, Tables 376, 369). The data for the variable FISCSURPj were obtained from the U.S. Census Bureau (2003, Tables 446, 447) and the U.S. Census Bureau (2005, Table 17). The data for creating variable STINCTAX were obtained from Cebula (1990). The data for variable COST were obtained from McMahon (1991) yields nearly identical results as those obtained from the above source.

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 EXPMFIj, 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).

Tt is expected that net in-migration should be an increasing function of MFIj or EXPMFIj, *ceteris paribus*. Assuming that migrants are not subject to "money illusion," in-migration should be a deceasing function of the cost of living in state j (COSTj), *ceteris paribus*, as argued at length in Cebula (1979B, Chapter 4), Cebula (1993), and Gunderson and Sorenson (2010). The variables HAZARDj and JANTEMPj are intended to reflect non-economic factors that may influence migration patterns. Whereas variables similar to JANTEMPj 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 HAZZARDj *per se* [cf. Cebula and Payne (2005)]. In any case, it is hypothesized---per the 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. Variable FISCSURPj 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 occur 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. For example, 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 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.

Empirical Estimates

The OLS estimations of equations (5) and (6) are provided in columns (a) and (b), respectively, of Table 1. In columns (a) and (b), 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 estimations (a) and (b), 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* (i.e., unity minus the *unemployment 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)]. In columns (a) and (b) of Table 1, 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).

Paralleling Cebula and Alexander (2006), there are two quality of life factors included in estimations (a) and (b), JANTEMP and HAZARD. 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.[1] 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.

There are two separate fiscal variables in the system, FISCSURP and STINCTAX. 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). Finally, 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 (12000), Renas (1980), and Saltz (1998).

Alternative versions of the basic model were estimated, with little change in the results as summarized above. Consider, e.g., 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): POPDENj, the population in state j per square mile in the year 2000, as a measure of population density; and AVGPCTSUNj, the average percentage of possible sunshine in state j (the percent of days annually that are either clear or partly cloudy). POPDEN was obtained from the U.S. Census

Bureau (2001, Table 346; 2004, Table 17), whereas AVGPCTSUNj was obtained from the U.S. Census Bureau (2001, Table 377). It is hypothesized that greater population density should act as a migration deterrent [Renas (1978), and 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 such improves climatic attributes [Cebula (1979B) and 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 variables are significant at even the ten percent levels.

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 the following:

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).

Table 1. OLS Estimations for 2000-2003 Net State In-Migration Rate Determinants

Variable/Column[1]	(a)	(b)	(c)	(d)
Constant	+45.27	+44.15	+32.79	+45.2
MFIj	+0.0013** (+2.38)			
EXPMFIj		+0.00129** (+2.34)	+0.00127* (+2.25)	+0.0013* (+2.19)
COSTj	-0.853*** (-2.75)	-0.822*** (-2.70)	-0.736* (-2.16)	-0.783** (-2.39)
JANTEMPj	+0.59*** (+3.26)	+0.592*** (+3.25)	+0.54** (+2.41)	+0.56*** (+2.65)
HAZARDj	-0.201** (-2.41)	-0.198** (-2.36)	-0.179* (+2.06)	-0.195* (-2.10)
FISCSURPj	+0.017** (+2.35)	+0.016* (+2.24)	+0.0169* (+2.05)	+0.0167* (+2.19)
STINCTAXj	-13.78** (-2.34)	-14.09** (-2.38)	-13.36* (-2.09)	-13.6* (-2.20)
POPDENj			-6.56 (-0.46)	
AVGPCTSUNj			+0.273 (+0.38)	
VIOLENTCRj				+0.002 (+0.18)
STUNINSj				-0.021 (-0.29)
R^2	0.38	0.38	0.38	0.38
AdjR^2	0.29	0.29	0.26	0.26
F	4.39***	4.35***	3.18***	3.14***

1. 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.

Endnote

1. The finding for the hazardous waste sites are not terribly different whether measured as the number of waste sites in each state, the per capita number of waste sites in each state, or the number of waste sites per 1,000 square miles in each state.

.

References

Cebula, R.J. “A Brief Empirical Note on the Tiebout Hypothesis and State Income Tax Policies,” *Public Choice*, 67, 1, 1990, pp. 87-90.

Cebula, R.J. "A Survey of the Literature on the Migration-Impact of State and Local Government Policies," *Public Finance/Finances Publiques*, No. 1, 1979A, pp. 69-84.

Cebula, R.J. “An Empirical Note on the Tiebout-Tullock Hypothesis,” *Quarterly Journal of Economics*, 92, 4, 1978, pp. 705-11.

Cebula, R.J. *The Determinants of Human Migration*. Lexington, MA: Lexington Books, 1979B.

Cebula, R.J. “The Impact of Living Costs on Geographic Mobility,” *Quarterly Review of Economics and Finance*, 33, 1, 1993, pp. 101-5.

Cebula, R.J.; Alexander, G.M. “Determinants of Net Interstate Migration, 2000-2004,” *Journal of Regional Analysis and Policy*, 36, 2, 2006, pp. 116-123

Cebula, R.J.; Belton, W.J. “Voting with One’s Feet: An Analysis of Public Welfare and Migration of the American Indian,” *American Journal of Economics and Sociology*, 53, 3, 1994, pp. 273-80.

Cebula, R.J.; Payne, J.E. “Net Migration, Economic Opportunity and the Quality of Life, 1999-2000,” *International Review of Economics and Business*, 52, 2, 2005, pp. 245-54.

Clark, D.E.; Hunter, W.J. “The Impact of Economic Opportunity, Amenities, and Fiscal Factors in Age-Specific Migration Rates,” *Journal of Regional Science*, 32, 3, 1992, pp. 349-65.

Conway, K.S.; Houtenville, A.J. “Do the Elderly ‘Vote with Their Feet’?” *Public Choice*, 97, 1, 1998, pp. 63-85.

Conway, K.S.; Houtenville, A.J. “Elderly Migration and State Fiscal Policy: Evidence from the 1990 Census Migration Flows,” *National Tax Journal*, 54, 1, 2001, pp. 103-23.

Cushing, B. “Introduction to the Special Section on Population Migration,” *Journal of Regional Analysis and Policy*, 36, 2, 2006, p. 115.

Gale, L.R.; Heath, W.C. “Elderly Internal Migration in the United States Revisited,” *Public Finance Review*, 28, 2, 2000, pp. 153-70.

Gallaway, L.E.; Cebula, R.J. “Differentials and Indeterminacy in Wage Rate Analysis: An Empirical Note,” *Industrial and Labor Relations Review*, 26, 2, 1973, pp. 991-5.

Gatons, P.; Cebula, R.J. “Wage Rate Analysis: Differentials and Indeterminacy,” *Industrial and Labor Relations Review*, 25, 1, 1972, pp. 207-11.

Gunderson, R.J; Sorenson, D.J. “An Examination of Domestic Migration from California Counties,” *Journal of Regional Analysis and Policy*, 40, 1, pp. 34-52.

Long, L.H. "Poverty Status and Receipt of Welfare among Migrants and Non-migrants in Large Cities," *American Sociological Review*, 39, 1, 1974, pp. 46-56.

McMahon, W.W. "Geographic Cost of Living Differences: An Update, *Real Estate Journal, 19, 3, pp. 426-50.*

Milligan, J. "Migration and Age: The Effects of Age on Sensitivity to Migration Stimuli," *Regional Studies*, 34, 4, 2000, pp. 521-33.

Renas, S.M. "The Cost of Living, Labor Market Opportunities, and the Migration Decision," *Annals of Regional Science*, 15, 1, 1978, pp. 95-104.

Renas, S.M. "An Empirical Note on the Tiebout-Tullock Hypothesis: Comment," *Quarterly Journal of Economics*, 94, 3, 1980, pp. 619-23.

Renas, S.M. "The Cost of Living, Labor Market Opportunities, and the Migration Decision: More on Problems of Misspecification and Aggregation Bias," *Annals of Regional Science*, 17, 1, 1983, pp. 98-110.

Riew, J. "Migration as Investment," *Journal of Regional Science*, 12, 2, 1973, pp. 65-73.

Saltz, I.S. "State Income Taxation and Geographic Labour Force Mobility in the United States," *Applied Economics Letters*, 5, 5, 1998, pp. 599-604.

Sjaastad, L.A. "The Costs and Returns of Human Migration," *Journal of Political Economy*, 70, 1, 1962, pp. 80-93.

Tiebout, C.M. "A Pure Theory of Local Expenditures," *Journal of Political Economy*, 64, 2, 1956, 416-24.

Tullock, G. "Public Expenditures as Public Goods," *Journal of Political Economy*, 79, 5, 1971, 913-8.

U.S. Census Bureau. *Statistical Abstract of the United States, 2001*. Washington, D.C.: U.S. Government Printing Office, 2001.

U.S. Census Bureau. *Statistical Abstract of the United States, 2002*. Washington, D.C.: U.S. Government Printing Office, 2002.

U.S. Census Bureau. *Statistical Abstract of the Untied States, 2003*. Washington, D.C.: U.S. Government Printing Office, 2003.

U.S. Census Bureau. *Statistical Abstract of the United States, 2004-2005*. Washington, D.C., U.S. Government Printing Office, 2005.

Vedder, R.K. *The American Economy in Historical Perspective*. Belmont, CA: Wadsworth, 1976.

Vedder, R.K.; Cooper, D. "Nineteenth Century English and Welsh Geographic Labor Mobility: Some Further Evidence," *Annals of Regional Science*, 8, 1, 1974, pp. 131-39.

White, H. "A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test for Heteroskedasticity," *Econometrica*, 48, 4, 1980, pp. 817-38.