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Determinants of Net Interstate Migration, 2000-2004

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Abstract. The present study investigates the impact on net state in-migration over the 2000-2004 period of a variety of economic and non-economic factors. The empirical estimates indicate that the net state in-migration rate was an increasing function of median family income and the previous-period employment growth rate on the one hand and a decreasing function of the 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 and pollution in the form of toxic chemical releases. Finally, net state in-migration was an increasing function of state plus local government spending per pupil on primary and secondary education and a decreasing function of the state individual income tax burden.

1. Introduction

Numerous studies have empirically addressed the determinants of internal migration [as illustrated in part in the surveys by Greenwood (1975) and Cebula (1979)]. A number 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 (1979; 1993; 2005), Cebula and Belton (1994), Cebula and Payne (2005), Clark and Hunter (1992), Conway and Houtenville (1998; 2001), Cushing (1987), Davies, Greenwood, and Li (2001), Gale and Heath (2000), Gallaway and Cebula (1973), 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), Renas (1978; 1983), and Charney (1993), among others, omission of non-economic factors from an empirical migration analysis constitutes an omitted-variable problem that generally compromises the integrity of that analysis.

The present study seeks to identify net state in-migration rate determinants for the period 2000-2004, a period that to date understandably has not as yet received any significant attention in the published empirical migration literature. Thus, the study deals with very current/recent information on U.S. internal migration and its determinants. In addition, this study considers not only the migration impacts of economic factors and positive quality-of-life considerations (amenities) but also the migration impacts of certain negative quality-of-life factors ("disamenities") as well as state plus local government primary and secondary education outlays per pupil, per capita state death and gift taxes, and state income tax burdens, first measured on a per capita basis and then measured as a percent of personal income. The majority of empirical migration studies do not consider the latter two sets of factors insofar as they may influence the migration decision calculus. Moreover, this study considers the often-ignored impact of geographic living-cost differentials. Furthermore, not only is a measure of income included in the analysis but so also is a measure of previous-period employment growth (as an indicator of expected employment opportunities).

2. A Model of Net In-Migration

To a large degree, this study parallels the migration-investment models developed in Sjaastad (1962), Gatons and Cebula (1972), Riew (1973), and Cebula (1979, Ch. 4), although, along with the inclusion of the employment growth rate, it extends this framework by including disamenities and additional factors reflecting certain often ignored state and local government policies. 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 and acceptable alternative area/location. Extending the scope of the aforementioned models, in this study the *DPVij* consists of five major sets of considerations, namely:

1. expected income (I) in the areas, as well as the cost of living (COL) in those areas;
2. employment prospects in the areas, as reflected in the recent previous growth rate of employment (EMPLGR) in the areas;
3. positive quality-of-life (POSQOL) characteristics of the areas (amenities);
4. negative quality-of-life (NEGQOL) characteristics of the areas (disamenities); and
5. per pupil state plus local government education outlays at the primary and secondary levels (EDPUP), per capita death and gift taxes (D&G), and state income tax burdens (SIT), measured either on a per capita basis or as a percentage of personal income, in those areas.

Some measure of income or "expected income" (the first category above) is considered in nearly all migration studies [Greenwood (1975), Cebula (1979)]. Moreover, in more recent studies, the linkage between employment/job growth and human migration (the second category listed above) is becoming better established [Charney (1993, p. 314), Partridge and Rickman (2006, p. 970)]. Furthermore, positive quality-of-life factors (the third category above) have assumed a growing importance in migration studies [e.g., Cushing (1987), Clark and Hunter (1992), Cebula (1993), Charney (1993), Conway and Houtenville (1998), Cebula (2005), and Cebula and Payne (2005)]. By contrast, factors included under the fourth category listed above are routinely overlooked in a majority of empirical migration studies [cf. the recent earlier-period migration study by Cebula (2005)]. Indeed, even geographic cost-of-living differentials (listed under the first category) are very frequently ignored in empirical migration studies [Clark and Hunter (1992), Davies, Greenwood, and Li (2001), Conway and Houtenville (1998; 2001), Milligan (2000)], although there certainly are exceptions [Cebula (1993), Cebula and Belton (1994), Renas (1978; 1980; 1983), Saltz (1998)]. Finally, Charney (1993) observes that there are in fact relatively few studies that explicitly and effectively investigate the relationships between migration flows and public policies such as those included within category five above. Thus, the present study differentiates itself from related studies not only in its dealing with very recent net in-migration (2000-2004) but also in its simultaneous inclusion of factors reflecting COL, NEGQOL, EDPUP, D&G, and SIT. Furthermore, unlike many previous migration studies, this study considers not merely the impact of income-level measures *or* the employment growth rate but the impacts of *both simultaneously*. Naturally, given the focus here on *net* in-migration, considerations of space/distance [Cushing (1986)] are beyond the scope of this study.

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

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

where *z* represents all of the known plausible and acceptable alternative locations to area *i*. Obviously, if *DPVij*<0, the consumer-voter resident of area *i* will remain in area *i*, and a flow of migrants from area *j* to area *i* may even occur [Gatons and Cebula (1972)]. 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.

In this context, it logically follows that for state j:

$$\text{MIGj} = f(\text{Ij, COLj, EMPLGRj, POSQOLj, NEGQOLj, EDPUPj, D\&Gj, SITj}) \qquad (2)$$

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

$$\text{MIGj} = a + b\text{Ij} + c\text{COLj} + d\text{EMPLGRj}, + e\text{POSQOLj} + f\text{NEGQOLj} + g\text{EDPUPj} + h\text{D\&Gj} + i\text{SITj} \quad (3)$$

Following the conventional wisdom, the expected signs on b, c, and e are obviously positive, negative, and positive, respectively. Based on logical extensions of the conventional wisdom [see, especially, Riew (1973) and Cebula (1979, Ch. 4), as well as Charney (1993)], it is further hypothesized that (a) negative amenities in area j (NEGCOLj) should act to discourage in-migration, *ceteris paribus*; (b) a greater previous-period employment growth rate in area j (EMPLGRj) should act to encourage in-migration, *ceteris paribus*;

(c) higher per pupil state plus local government outlays for primary and secondary public education in area j (EDPUPj) should act to encourage in-migration, *ceteris paribus*; and (d) a higher income tax burden in area j (SITj) should act to discourage in-migration, *ceteris paribus*. Accordingly, it is expected in equation (3) that:

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

3. The Empirical Model and Results

Given the framework provided in (1), (2), (3), and (4) above, initially the following reduced-form equation is to be estimated:

$$MIGj = a_0 + a_1MFIj + a_2COLj + a_3EMPLGRj + a_4JANTEMPj + a_5COASTDUMj + a_6HAZARDj + a_7TOXICj + a_8EDPUPj + a_9D\&GTAXj + a_{10}STINCTAXj + u \quad (5)$$

Definitions of each of these variables and their respective data sources are found in Table 1. The term a_0 is the constant/intercept, and u is the stochastic error term. The study includes all 50 states but excludes Washington, D.C. To assist the reader in interpreting the results, Table 2 provides the means and standard deviations for each of the variables considered in this study.

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. Naturally, it is expected---per the conventional wisdom---that net in-migration should be an increasing function of MFIj, *ceteris paribus*. Assuming that migrants are not subject to "money illusion," net in-migration should be a decreasing function of the cost of living in state j (COLj), *ceteris paribus*, as argued at length in Cebula (1979, Chapter 4) and Cebula (1993). The variable EMPLGRj is adopted as an indicator of expected employment opportunities; *ceteris paribus*, the net in-migration rate is expected to be an increasing function of EMPLGRj [Charney (1993, p.314)]. The variables JANTEMPj and COASTDUMj are intended to be measures of POSQOLj. It is hypothesized that net in-migration is an increasing function of warmer mean January temperatures, *ceteris paribus*; in addition, it is hypothesized that net in-migration is an increasing function of closer proximity to either the Atlantic Ocean, Pacific Ocean, or the Gulf of Mexico, *ceteris paribus*. These two hypotheses are in principle compatible with Cushing (1987), Milligan (2000), Conway and Houtenville (1998; 2001), Hinze (1977), Gallaway and Cebula (1973), Cebula (1979), Clark and Hunter (1992), and Gale and Heath (2000). The reader should be made aware that, in an alternative estimation provided in this study, the binary coastal dummy COASTDUMj is replaced with a variable measuring the actual number of statute miles of coastline in each state (COASTMILESj). The variables HAZARDj and TOXICj are intended to reflect NEGQOLj variables, i.e., disamenities. Accordingly, it is hypothesized that the net in-migration rate is a decreasing function of HAZARDj, *ceteris paribus*, since HAZARDj reflects the presence of hazardous waste sites. In addition, it is expected that net in-migration is a decreasing function of TOXICj, *ceteris paribus*, since TOXICj reflects pollution in the form of toxic chemical releases. As suggested in Tiebout (1956), Tullock (1971), and Riew (1973), and observed in Cebula (1990), Clark and Hunter (1992), Charney (1993), and Conway and Houtenville (1998; 2001), net state in-migration should be a decreasing function of state tax burdens in the state, *ceteris paribus*, and an increasing function of public elementary plus secondary school outlays per pupil in the state (EDPUPj), *ceteris paribus*. It should be observed that in the initial model shown in equation (5), two tax variables are introduced, STINCTAXj and D&GTAXj. Naturally, it is expected that, *ceteris paribus*, net in-migration is a decreasing function of both STINCTACj and D&GTAXj. It is further noted, however, that in an alternative estimation provided in this study, the state income tax burden measured as a percent of personal income (STINCTAXPIj) replaces variable STINCTAXj.

The results from estimating equation (5) by OLS, adopting the White (1980) correction for heteroskedasticity, are provided in column (a) of Table 3. In this estimation, eight of the ten estimated coefficients exhibit their expected signs and are statistically significant at the five percent level or beyond. Only two of the explanatory variables (COASTDUMj and D&GTAXj) fail to be statistically significant. The coefficient of determination is 0.62, so that the model explains more than three-fifths of the variation in the net state in-migration rate. The F-statistic is significant at beyond the one percent level, attesting to the overall strength of the model.

The three purely economic variables all behave as expected. The estimated coefficient on the MFI variable is positive and significant at the one percent level, implying that net in-migration is an increasing function of median family income. This finding is consistent with the conventional wisdom [Sjasstad (1962), Riew (1973), Cebula (1979)]. The coefficient on the often-neglected cost-of-living variable (COL) variable is negative and statistically significant at the one percent

Table 1. Variable Definitions and Data Sources

Variable	Definition; Data Source
MIGj	Net in-migration rate to state j between 2000 and 2004, expressed as a percentage of state j's 2000 total population; Sources: U.S. Census Bureau (2006, Table 20; 2005, Table 17)
MFIj	Median family income in state j, 2000; Source: U.S. Census Bureau (2002, Table 656)
COLj	Cost of living in state j for average four-person family; Source: ACCRA (2001)
EMPLGRj	Percent employment growth rate in state j between 1996 and 2000; Sources: U.S. Census Bureau (1998, Table 649; 2001, Table 572)
JANTEMPj	Normal daily maximum temperature (degrees Fahrenheit) in state j in January; Source: U.S. Census Bureau (2005, Table 376)
COASTDUMj	A binary variable indicating whether state j has coastline bordering on either the Atlantic Ocean, the Pacific Ocean, and/or the Gulf of Mexico: COASTDUMj=1 if state j borders on any of these bodies of water and COASTDUMj=0 otherwise
COASTMILESj	Number of miles of coastline in state j along the Pacific Ocean, Atlantic Ocean, and/or the Gulf of Mexico; Source: U.S. Census Bureau (2001, Table 345)
HAZARDj	Percent distribution of hazardous waste sites in state j on the National Priority List; Source: U.S. Census Bureau (2005, Table 369)
TOXICj	Toxic chemical releases in state j, 2000, expressed in pounds per person; Source: U.S. Census Bureau (2005, Tables 17, 368)
EDPUPj	State plus local government elementary and secondary school expenditures in state j per pupil, 2000; Source: U.S. Census Bureau (2001, Table 242)
D&GTAXj	Per capita death and gift taxes paid in state j in 2000; Sources: U.S. Census Bureau (2003, Table 455; 2005, Table 17)
STINCTAXj	Per capita state income tax burden in state j, 2000: Sources: U.S. Census Bureau (2003, Table 455; 2005, Table 17)
STINCTAXPIj	State income tax burden in state j as a percent of personal income: Sources: U.S. Census Bureau (2003, Table 455; 2002, Table 642)

Table 2. Descriptive Statistics

Variable	Mean	Standard Deviation
MIGj	4.43	23.83
MFIj	40,400	5,899
COLj	97.49	10.4
EMPLGRj	4.29	3.6
JANTEMPj	32.71	12.65
COASTDUMj	0.4	0.49
HAZARDj	2.0	2.07
TOXICj	5.63	6.02
EDPUPj	7,111	1,591
D&GTAXj	26.89	19.1
STINCTAXj	623.92	373.02
STINCTAXPIj	2.64	2.15
COASTMILESj	165.5	460.1

Table 3. OLS Estimations for 2000-2004 Net State In-Migration Rate Determinants

Variable/Column[1]	(a)	(b)	(c)
Intercept	+11.67	+15.29	+29.63
	(+0.40)	(+0.47)	(+1.11)
MFIj	+0.00167**	+0.0015*	+0.0014*
	(+2.89)	(+2.45)	(+2.19)
COLj	-1.36**	-1.25**	-1.29**
	(-3.25)	(-2.63)	(-2.77)
EMPLGRj	+3.24*	+3.06*	+3.13*
	(+2.52)	(+2.38)	(+2.30)
JANTEMPj	+1.052**	+0.86**	+0.78**
	(+4.24)	(+3.70)	(+3.19)
COASTDUMj	-10.26		
	(-1.51)		
HAZARDj	-2.96*	-2.84*	-2.31*
	(-2.06)	(-2.04)	(-2.17)
TOXICj	-1.09*	-1.02*	-1.12*
	(-2.23)	(-2.06)	(-2.32)
EDPUPj	+0.0048**	+0.0046*	+0.0039**
	(+2.65)	(+2.29)	(+2.59)
D&GTAXj	+0.155	+0.091	
	(+0.86)	(+0.48)	
STINCTAXj	-0.019**		-0.02**
	(-3.24)		(-3.11)
STINCTAXPIj		-2.29*	
		(-2.51)	
COASTLINEj		-0.0007	
		(-1.11)	
R^2	0.62	0.60	0.58
AdjR^2	0.52	0.50	0.49
F	6.26**	5.82**	6.96**

[1.] Terms in parentheses are t-values.
**Statistically significant at the 1.0 percent level.
*Statistically significant at the 5.0 percent level.

level as well, implying that migrants are not subject to "money illusion." This finding is consistent with the conventional wisdom [Sjaastad (1962), Riew (1973), Cebula (1979)] , as well as certain other empirical studies [Cebula (1978; 1979; 1993), Cebula and Belton (1994), Renas (1978; 1983), Saltz (1998)]. Next, the estimated coefficient on the employment growth variable (EMPLGR) is positive and statistically significant at the two percent level, implying that migrants tend to seek destinations with better employment prospects, *ceteris paribus*. This finding is consistent with the very recent study by Partridge and Rickman (2006, p. 970) and consistent with the observation by Charney (1993, p. 314) that "…the link between jobs growth and human migration is well documented."

The estimated coefficient on the quality-of-life variable JANTEMP is positive and significant at the one percent level, confirming the finding in so many other studies that migrants prefer warmer climates to colder ones [Cebula (2005), Clark and Hunter (1992), Conway and Houtenville (1998), Cushing (1987), Gale and Heath (2000)]. On the other hand, the coefficient on the coastal dummy (COASTDUM) is negative although not significant at even the ten percent level. As will be shown elsewhere in Table 3, use of a variable measuring the number of miles of shoreline per state also fails to be statistically significant. This finding notwithstanding, it still can be inferred that amenities such as warm climate act to attract in-migration.

There are two disamenity variables in the model, TOXIC and HAZARD. Most empirical migration studies fail to include these variables in analyzing migration determinants. As the results in column (a) for these two variables illustrate, however, their omission may be of importance. In particular, the estimated coefficient on TOXIC is negative and significant at the three percent level, implying that state net in-migration is a decreasing function of toxic chemical emissions (expressed in pounds per person). Furthermore, the coefficient on HAZARD is negative as well while being statistically significant at beyond the five percent level, as in Cebula (2005). This result implies that the greater the prevalence of hazardous waste sites in a state, the less the net in-migration rate. Interestingly, a similar (although slightly less statistically significant) conclusion is obtained when hazardous waste sites are expressed in per capita terms.

Finally there are the three fiscal variables. On the expenditure side, the estimated coefficient on the EDPUP variable is positive and significant at the one percent level, implying strongly that greater state plus local government outlays per pupil on public elementary and secondary education act to increase net in-migration. This finding is consistent with the assessment in Charney (1993, p. 318) that "Higher … spending on … [public] education induces in-migration." The estimated coefficient on the D&GTAX variable is actually positive, but it is not statistically significant at even the ten percent level. Thus, this variable does not appear to significantly influence state migration patterns. On the other hand, the coefficient on the per capita state income tax burden is negative and significant at the one percent level, strongly implying that state net in-migration is a decreasing function of per capita state income tax levels. This result is in principle consistent with Cebula (1990) and Saltz (1998), although the state income tax is measured by a dummy variable in the latter two studies.

Alternative versions of equation (5) were estimated and found to yield very similar conclusions. For instance, consider column (b) of Table 3. This reduced-form specification differs in two ways from that in column (a). First, the binary (dummy) variable COASTDUMj is replaced by the variable COASTMILESj, the actual number of miles of coastline in state j. Second, the variable STINCTAXj, which measures the state income tax burden in state j in per capita terms, is replaced by the variable STINCTAXPIj, which measures the state income tax burden in state j as a percent of personal income in state j.

The OLS estimation of this modified version of equation (5), with the White (1980) heteroskedasticity correction adopted, is provided in column (b). Overall, the results in column (b) parallel those in column (a), despite the fact that two of the explanatory variables in column (b) are somewhat different from their counterparts in column (a). In column (b), eight of the ten estimated coefficients exhibit the expected signs and are significant at the five percent level or beyond. The R^2 is 0.60, so that this version of the basic model explains three-fifths of the variation in the migration rate. Finally, the F-statistic is again significant at the one percent level.

As in the initial estimation, the three purely economic variables, MFI, COL, and EMPLGR, all exhibit the expected signs and are significant at beyond the five percent level. Thus, net in-migration appears to be an increasing function of median family income and the previous-period employment growth rate and a decreasing function of the cost of living. Although the coefficient on the variable measuring miles of coastline (COASTMILES) fails to be statistically significant, the coefficient on JANTEMP is positive and significant at the one percent level, implying once again that state net in-migration is an increasing function of warmer climate. The coefficients on both of the disamenity variables are negative and significant at the five percent level, implying that state net in-migration is a decreasing function of both the presence of hazardous waste sites and toxic chemical releases. As for the fiscal variables, the coefficient on the D&GTAX variable remains insignificant, whereas the coefficients on the EDPUP and STINCTAXPI variables are statistically significant at the three percent level and two percent level, respectively, with the expected signs. Thus, it appears that state net in-migration is an increasing function of state plus local government elementary plus secondary school outlays per pupil and a decreasing function of the state income tax burden expressed as a percent of personal income. The latter of these results is consistent with the alternative representation of the state income tax burden considered in column (a), STINCTAX, which was expressed in per capita terms.

Column (c) of Table 3 provides yet another version of the basic model in equation (5), In this case, the two consistently insignificant variables, COASTj /COASTMILESj and D&GTAXj, are deleted from the model. The OLS estimate in column (c), where the White (1980) heteroskedasticity correction is again adopted, yields results that reinforce the other findings in Table 3. To begin with, all eight of the estimated coefficients are statistically significant with the hypothesized signs at the five percent level or beyond. Indeed, four of the eight are actually significant at the one percent level. The R^2 is 0.58, so that this version of the model explains nearly three-fifths of the variation in the dependent variable. Finally, the F-statistic is again significant at the one percent level. Clearly, these findings imply that the 2000-2004 state net in-migration was positively influenced by MFI, EMPLGR, JANTEMP, and EDPUP, while negatively influenced by COL, HAZARD, TOXIC, and STINCTAX. Interestingly, these very same conclusions are also obtained if the model is estimated with the migration variable expressed in log form.

4. Conclusions

This empirical study has investigated determinants of the state net in-migration rate over the 2000-2004 period. This paper appears to be the first published study to examine migration determinants for this period. This study examines the effects of purely economic variables, positive quality-of-life variables (amenities), negative quality-of-life variables (disamenities), and various state and local fiscal variables. As observed in the Introduction, certain of these variables (including the variables HAZARD, TOXIC, COL, STINCTAX, STINCTAXPI, EDPUP, and D&GTAX) have frequently been overlooked in the empirical migration literature.

The net in-migration rate is positively impacted by median family income (MFI). This result is consistent with the conventional wisdom which views migration as a form of investment [Sjaastad (1962), Riew (1973), Cebula (1979)]. The net in-migration rate is also negatively influenced by the cost of living (COL), a variable overlooked in most empirical migration studies. This negative impact of living-cost levels on net in-migration is consistent with a number of prior studies [Cebula (1978; 1979; 1993), Cebula and Belton (1994), Renas (1978; 1980; 1983), Saltz (1998)]. The previous-period employment growth rate (EMPLGR) is found to positively impact state net in-migration, a finding which would, according to Charney (1993, p. 314), provide further evidence of "…the link between jobs growth and human migration…"

As for the amenity variables, there is consistent evidence that state net in-migration is positively influenced by warmer climates, a finding consistent with a large number of previous studies, including Cebula (2005), Clark and Hunter (1992), and Conway and Houtenville (1998). By contrast, however, neither a coastal dummy (COAST) or a variable measuring the number of miles of coastline in a state (COASTMILES), as measures of proximity to an ocean or the Gulf of Mexico, was found to significantly influence state net in-migration.

On the other hand, both disamenity variables, one reflecting the presence of hazardous waste sites in a state and the other reflecting emissions of toxic chemical in a state, were consistently found to negatively impact on net in-migration over the study period. Most empirical migration studies fail to include these disamenity measures. Interestingly, Charney (1993, p. 318) suggests that, if disamenities such as pollution are found to negatively impact in-migration, then a good means of attracting migrants would be to promote an environment of "…clean air and water…"

Finally, there are the fiscal variables. On the one hand, state death and gift taxes appear to exercise no significant influence over state migration patterns. On the other hand, higher per pupil state plus local government expenditures on primary and secondary public education appear to exercise a significant positive influence on net state in-migration. This finding is consistent with the finding described in Charney (1993, pp. 318) that higher per capita spending on public education can act as an inducement to in-migration. Furthermore, state income tax burdens, whether expressed in per capita terms or as a percent of personal income, are shown in this study to consistently act as a deterrent to net in-migration. This finding is consistent with a modest number of previous studies, including Cebula (1990), Charney (1993), and Saltz (1998). Clearly, in terms of growth and economic development strategies, states with higher state income taxes may have an incentive over the long run to at least investigate alternative revenue sources, sources which might be less likely to create adverse migration effects.

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