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Gross In-Migration and Public Policy in the U.S. during the Great Recession: An Exploratory Empirical Analysis, 2008-2009

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Introduction

Determinants of human migration, both internationally and within the U.S., continue to be of significant interest to researchers and policy makers.[1] The average annual migration rate within the US during the period 2001-2010 was 1.7% (of the population) for males and 1.7% for females, indicating that a large number of people migrate each year within the US.[2] The nature of issues considered within the context of the determinants *of internal* migration is extremely diverse; indeed, it has (naturally) become increasingly diverse over time. An important hypothesis in this literature about migration is the Tiebout hypothesis, also *sometimes* referred to as the Tiebout-Tullock hypothesis.[3] According to Tiebout (1956, p. 418), "…the consumer-voter may be viewed as picking that community which best satisfies his preferences for public goods…the consumer-voter moves to that community whose local government best satisfies his set of preferences." As Tullock (1971, p. 917) further observes, this hypothesis can effectively be extended such that it holds that, *ceteris paribus*, the "…individual deciding where to live will take into account the private effects upon himself of the bundle of government

[1] For example, Renas, 1983; Vedder, et al, 1986; Percy, Hawkins, & Maier, 1995; Carrington, Detragiache, and Vishwanath, 1996; Saltz, 1998; Nechyba, 2000; Conway & Houtenville, 2001, 2003; Rhode & Strumpf, 2003; Chi & Voss, 2005; Partridge & Rickman, 2006; Francis, 2007; Ashby, 2007; Landry, et al., 2007; Ashby, 2010; Molloy et al., 2011; Fu & Gabriel, 2012; Peters, 2012; Plantinga, et al., 2013;
[2] Molloy et al., 2011.
[3] For example, see Rhode & Strumpf, 2003; Cebula & Alexander, 2006; Banzhaf & Walsh, 2008

services and taxes…" Thus, Tullock (1971), more explicitly than Tiebout (1956), emphasizes that the consumer-voter evaluates *both* the government goods and services *and* the tax burden at the locations of choice.

The present study empirically investigates the validity of the Tiebout hypothesis during the "Great Recession" (from July, 2008 through July, 2009) using data on gross in-migration between the US states. It attempts to shed light on whether fiscal factors such as outlays per pupil on public primary and secondary education, parks, property tax burdens, and state income tax burdens influenced consumer-voters' mobility decisions over this study period. Of particular interest to us is whether factors influencing gross in-migration were different during the "Great Recession" as compared to studies that covered other periods.

Numerous previous studies have empirically addressed determinants of internal migration within the United States. A number of these studies emphasize the migration impact not only of economic factors but also non-economic, including "quality-of-life" factors, especially climate.[4] As demonstrated in these studies, the omission of non-economic factors, especially a climate variable, from an empirical migration analysis constitutes an omitted-variable problem that generally compromises the integrity of that analysis. As a consequence, this empirical study will include not only fiscal factors and economic factors but also purely non-economic (quality-of-life) factors.

The present study differs from most previous comparable studies of gross migration by its focus on *gross in-migration* during the "Great Recession" (from July, 2008 through July, 2009) and by the inclusion of a separate cost of living variable and a measure of effective state income tax rates. We test the hypothesis using three different specifications in linear, semi-log and log-log forms. After controlling for economic factors and quality of life/climate variables, we find that consistent with the previous literature during 2008-2009 migrants (consumer-voters) appear to prefer states with lower effective state income tax and property tax rates. Interestingly, in contrast, their evaluation of government services in determining their choice of location depends upon the type of government service. While consumer-voters appear on average to prefer states with greater public provision of state parks, they did not manifest a strong preference for states with higher per pupil outlays on primary and secondary public education.

The Basic Migration Decision Framework

The consumer-voter is treated as regarding the overall 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 both (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.

Following in principle the models in Tiebout, (1956), Tullock (1971), Riew (1973), Vedder (1976), Renas (1983), Vedder, Gallaway, Graves, & Sexton (1986), and Cebula & Alexander (2006), among others, *DPVij* consists in this study of three broad sets of considerations, namely:

1. Economic conditions in those areas;
2. Fiscal factors in those areas; and an

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[4] For example, Vedder 1976; Renas, 1978; 1980; 1983; Clark & Hunter, 1992; Cebula & Belton, 1994; Saltz, 1998; Conway & Houtenville, 1998, 2001, 2003; Gale & Heath,

3. Environmental characteristic of the areas.

According to this investment framework, it follows that migration will flow from area *i* to area *j* only if:

$$DPVij > 0; DPVij = \text{MAX for } j, \text{ where } j = 1,2,\ldots,z \qquad (1)$$

where *z* represents all of the plausible known alternative locations to area *i*. Given the focus in this study on state migration, area *j* is actually state *j*. Clearly, the explanatory variables in this model could have been introduced using an alternative framework, e.g., a cost-benefit framework, such as that adopted by Cebula (1997).

To measure the migration rate, *MIGj*, the gross number of domestic in-migrants to state *j* over the period July, 2008-July, 2009, expressed as a *percent* of the year 2008 population in state *j*, is adopted. This specification allows comparisons of any state's migration rate with those of the other states.

To measure the economic conditions in state *j*, three factors are adopted, one of which actually encompasses two economic dimensions. In particular, the first of the purely economic variables is a measure of *expected* per capita personal income in state *j*, *EXPINCj*. This variable is the product of two economic variables, namely, unity minus the unemployment rate in state *j*, where the latter is expressed in decimal form, and the year 2008 per capita personal income in state *j*:

$$EXPINCj = [(1-URj) \times PCPERSINCj\ ] + [(URj) \times 0] \qquad (2)$$

where: URj is the 2008 average unemployment rate of the civilian labor force in state *j*, *expressed as a decimal*; and *PCPERSINCj* is the observed 2008 average personal income per capita in state *j*. This variable constitutes a measure of expected income/wage prospects in state *j*. Specifying the income variable in this fashion in effect allows for the

2000; Milligan, 2000; Davies, Greenwood, & Li, 2001; Cebula & Alexander, 2006.

probability of obtaining the observed per capita personal income found in state j (Saltz, 1998; Cebula & Alexander, 2006). The second term on the right-hand-side of (2) is the expected income associated with not finding a job in state *j*. Because this is obviously zero, this term cancels out and (2) reduces to

$$EXPINCj = (1\text{-}URj) \text{ x } PCPERSINCj \qquad (2')$$

Clearly, gross in-migration is expected to be an increasing function of *EXPINCj*, *ceteris paribus*.

The second economic variable is *COSTj*, the overall cost of living in state *j* for the average four-person family in the year 2008, expressed as an index, with *COSTj* = 100.00 being the mean value of this variable; in the absence of money illusion, gross in-migration is hypothesized to be a decreasing function of *COSTj*. The adoption of a variable such as *COSTj* is becoming more common (Renas, 1978, 1980, 1983; Cebula, 1979; Conway & Houtenville, 1998, 2001, 2003; Gale & Heath 2000; Cebula & Alexander, 2006).

The third purely economic variable is *POVj*, the percent of the population in state *j* that is at 125% of the poverty level or lower. This variable is an additional reflection, i.e., representation, of economic prospects in state *j* for the would-be migrant. Accordingly, the greater the poverty rate in state *j*, *ceteris paribus*, the less attractive the state will be for would-be migrants, especially for those with lesser skills or educational achievement levels (Vedder, 1976; Cebula, 1979).

To measure fiscal factors, four variables are adopted, although arguably one of these, the number of state parks per capital (expressed as a decimal), clearly could be alternatively categorized as a quality-of-life variable. In any case, the first fiscal factor variable considered in this study is *AVSTINCTRTj*, the year 2008 average effective state personal income tax rate in state *j*, expressed as a percentage of the average family income in state *j* in 2008. Such a variable has often been overlooked in studies of a Tiebout-type framework, although it has been considered more recently (Conway & Houtenville, 2001; Cebula & Alexander, 2006). It is hypothesized here that the gross state in-migration rate is a deceasing function of *AVSTINCTRTj*, *ceteris paribus* (Tullock, 1971). Nine states did not have a state income tax, i.e., for them the value of *AVSTINCTRTj* = 0; the states in question are Alaska, Florida, Nevada, New Hampshire, South Dakota, Tennessee, Texas, Washington, and Wyoming.

The variable *PCPROPTXj* is defined as the year 2008 local (city plus county) average per capita property tax liability in state *j*. Such a variable has often been considered in studies of a Tiebout-type framework (Pack, 1973; Barsby & Cox, 1975; Greene, 1977; Liu, 1977; Renas, 1980; Conway & Houtenville, 1998, 2001; Gale & Heath, 2000; Rhode & Strumpf, 2003; Cebula & Alexander, 2006). It is expected that the gross in-migration rate to state *j* is a decreasing function of *PCPROPTXj*, *ceteris paribus*.

Continuing, the variable *PPPUBEDSPj* is the nominal outlay in state *j* per pupil on primary and secondary *public* education in the year 2007 from all sources, federal, state, and local; *PPPUBEDSPj* replaces the very commonly adopted variable *per capita* public education outlays (Pack, 1973; Greene, 1977; Hinze, 1977; Cebula, 1979; Renas, 1980; Conway & Houtenville, 1998, 2001; Gale & Heath, 2000; Rhode& Strumpf, 2003). It is expected that, *ceteris paribus*, the gross in-migration rate is an increasing function of *PPPUBEDSPj*.

Finally, the fourth fiscal variable is *STPARKSPCj*, the number of state parks per capital (expressed as a decimal) in 2007. This form of public expenditure embodies a host of potential benefits, fundamentally recreational in nature, such as camping, fishing, hiking, boating, picnicking, and the like, and possibly even benefits that are environmental in nature, e.g., providing *de facto* refuge for various forms of wildlife as well as protection of nature itself, that would-be in migrants to state *j* may find of value. Accordingly, it is hypothesized that gross in-migration to state *j* is an increasing function of *STPARKSPCj*.

Given the dual role played by *STPARKSPCj*, to measure expressly environmental conditions in state *j*, the focus is on three additional factors. The first of these is *JANTEMPj*, defined here as the mean January temperature in state *j* (1971-2000), as a measure of warmer climatic conditions. As in so many migration studies (Renas, 1978; 1980; 1983; Clark & Hunter, 1992; Cebula & Belton, 1994; Saltz, 1998; Conway & Houtenville, 1998, 2001, 2003; Gale & Heath, 2000; Milligan, 2000; Davies, Greenwood, & Li, 2001; Cebula & Alexander, 2006), this variable is treated as a quality-of-life control variable. As is typically the case in these studies, it is expected that warm climate is likely to increase the inflow of migrants as a reflection of their typical preference for warmer climate, *ceteris paribus*. As an alternative measure of climate, in a separate estimate we adopt the variable *HDDj*, the average annual number of heating degree days in state *j*. In this case, given the hypothesized typical migrant preference for warmer climate, in-migration is expected to be a deceasing function of *HDDj*, ceteris paribus, since more heating degree days implies colder climatic conditions.

The second expressly quality-of-life variable reflects the relative presence of hazardous waste sites in a state in 2008. In particular, the variable *HAZARDPCTj* indicates the percentage of all hazardous waste in the U.S. that is located in state *j*. Given the undesirability of such waste sites, it is expected that gross in-migration is a decreasing function of *HAZARDPCTj*. Finally, the variable *AIRPOLDEXj* measure the average amount of particulate matter in the air in state *j* in year 2009. Other things held the same, it is hypothesized that in-migration will be a decreasing function of the amount of air pollution, primarily because of the negative impact of air pollution of health and quality of life.

The reduced-form equations *initially* to be estimated are given by (3) and (4):

$$lnMIGj = a_0 + a_1\ EXPINCj + a_2\ COSTj + a_3\ POVj + a_4\ AVSTINCTRTj$$
$$+ a_5\ PCPROPTXj + a_6\ PPPUBEDSPj + a_7\ STPARKSPCj + a_8\ JANTEMPj$$
$$+ a_9\ HAZARDPCTj + a_{10}\ AIRPOLDEXj + u \qquad (3)$$

and

$$lnMIGj = b_0 + b_1\ EXPINCj + b_2\ COSTj + b_3\ POVj + b_4\ AVSTINCTRTj$$
$$+ b_5\ PCPROPTXj + b_6\ PPPUBEDSPj + b_7\ STPARKSPCj + b_8\ HDDj$$
$$+ b_9\ HAZARDPCTj + b_{10}\ AIRPOLDEXj + u' \qquad (4)$$

where:

lnMIGj = the natural log of *MIGj*, as explained above; a_0 , b_0 = constant terms; and u, u' = stochastic error terms.

The study includes all 50 states but excludes Washington, D.C. as an outlier; indeed, its inclusion altered the results for several variables. Moreover, it can be argued as a legitimate omission since it is technically not a state. In fact, inclusion of

Washington, D.C. could well raise the question of whether Puerto Rico should have been included in the study. Finally, omission of Washington, D.C. is consistent with most previous migration studies of the U.S.

The data source for the variable *MIGj* was the U.S. Census Bureau (2012, Tables 13, 33). The sources for computing variable *EXPINCj*, were the U.S. Census Bureau (2010, Tables 13, 616) and U.S. Census Bureau (2102, Table 680), while the data source for variable *COSTj* was ACCRA (2010). The source for variable *JANTEMPj* was the U.S. Census Bureau (2010, Table 378), whereas the data source for variable *HHDj* is the U.S. Bureau of the Census (2010, Table 384). The data for the policy variables *AVSTINCTRTj*, *PCPROPTXj*, and *PPPUBEDSPj* were obtained from the U.S. Census Bureau (2010, Table 13) and U.S. Census Bureau (2012, Table 555). Data for the variables *HAZARDPCTj* and *AIRPOLDEXj* were obtained from the U.S. Bureau of the Census (2012, Tables 384, 383), while data for *STPARKSPCj* were obtained from the U.S. Census Bureau (2101, Tables 13, 1216). Tables 1 and 2 respectively provide descriptive statistics and the correlations among the explanatory variables[5]

Based on the conventional wisdom, as expressed by Tiebout (1956), Tullock (1971), as well as Riew (1973), and more recently by Conway & Houtenville (2001) and Cebula & Alexander (2006), among others, the following coefficient signs (each case assumes *ceteris paribus*) are hypothesized:

$$a_1 > 0,\ a_2 < 0,\ a_3 < 0,\ a_4 < 0,\ a_5 < 0,\ a_6 > 0,\ a_7 > 0,\ a_8 > 0,\ a_9 < 0,\ a_{10} < 0 \qquad (5)$$

[5] Only those coefficients for *POVj* and *JANTEMPj* (0.497), *POVj* and *EXPINCj* (-0.650), and *HAZARDj* and *PCPROPTXj* (0.757) were of concern. Thus, there arguably are only three cases of problematic multicollinearity; however, the variables involved in all three cases all exhibit statistically significant coefficients, so that multicollinearity does not appear to be a serious issue. Also, for example, when we estimated the model without

$$b_1 > 0, b_2 < 0, b_3 < 0. b_4 < 0, b_5 < 0, b_6 > 0, b_7 > 0, b_8 < 0, b_9 < 0, b_{10} < 0 \qquad (6)$$

POVj the results were qualitatively similar and *EXPINCj* remained statistically significant.

Empirical Results

Initial Estimates

Table 3 columns (a) and (b) presents results of the semi-log estimations of equations (3) and (4) using OLS, with the White heteroskedasticity (1980) correction. Consider first the results in column (a). Of the ten estimated coefficients, nine exhibit the expected signs, with five statistically significant at the 1% level and three statistically significant at the 5% level. Only the coefficients on variables *AIRPOLDEXj* and *PPPUBEDSPj* fails to exhibit the hypothesized sign or statistical significance at the 10% level of better. The coefficient of determination (R^2) is 0.78, whereas the adjusted coefficient of determination (adjR^2) is 0.73, so that the model explains approximately three-fourths of the variation in the dependent variable, *lnMIG*j. Finally, the *F*-statistic is statistically significant at the 1% level, attesting to the overall strength of the model.

Among the economic variables of interest, *expected* per capita personal income exhibits a coefficient that is positive and statistically significant at the 2.5% level. Hence, during the Great Recession, gross state in-migration was positively attracted to states with higher levels of *expected* per capita personal income. Recall that this expected income measure was generated by combining considerations of both the prevailing per capita personal income in state *j* and the unemployment rate in state *j*.

Next, the cost-of-living variable exhibits a negative coefficient that is statistically at the 1% level. Not surprisingly, during the Great Recession, a higher cost of living negatively impacted the gross state in-migration rate. The poverty variable is negative and statistically significant at the 5% level. Thus, a higher value for the *POVj* variable could be expected to have reduced the state gross in-migration rate to state *j* during the Great Recession.

Among the (purely) quality-of-life variables, we first consider the warm weather control variable, *JANTEMPj*. The coefficient on this variable is positive and statistically significant at the 1% level; thus, as anticipated, a higher average January temperature in state *j*, i.e., states with warmer climates elicited higher gross in-migration rates (Renas, 1983; Clark & Hunter, 1992; Saltz, 1998; Conway & Houtenville, 1998, 2001; Gale & Heath, 2000). The coefficient on the hazardous waste variable, *HAZARDPCTj*, is negative and statistically significant at the 2.5% level. In this case, a higher value in state *j* for this variable elicited a lower gross in-migration rate. In contrast to the statistically significant effects of *JANTEMPj* and *HAZARDPCTj*, the coefficient on the air pollution variable, *AIRPOLDEXj*, was statistically insignificant at even the 10% level and hence did not exercise a perceptible impact on the state gross in-migration rate over the study period; this result differs from results for the same variable found in Cebula & Alexander (2006).

Finally, we focus on the public policy variables, including the hybrid variable *STPARKSPCj*, which is partly a quality of life variable. The results in column (a) indicate that the coefficient on this variable was positive and statistically significant at the 1% level, implying that the greater the number of state parks per capita in state *j*, the greater the gross in-migration rate to state *j*. Presumably, this attraction of migrants reflects the recreational dimension of this form of state government outlays. The average effective state income tax rate in state *j*, *AVSTINCTRTj*, has a negative and significant coefficient (at the 1% level), indicating that higher average effective income tax rate in state *j* would result in lower gross in-migration rate to state *j*. The per capita property tax variable, *PCPROPTXj*, has a negative sign and is also statistically significant at the 1% level. Thus, the higher the per capita property tax in state *j*, the lower the gross in-migration rate to the state. Finally, the coefficient on variable *PPPUBEDSPj* is not statistically significant at even the 10% level indicating that public education spending per pupil did not influence gross state in-migration during the “Great Recession.”

In sum then, for the period 2008-2009 of the Great Recession, the gross state-level in-migration rate was an increasing function of expected per capita personal income, state parks per capita, and warmer January temperatures. For the same study period, the gross in-migration rate was a decreasing function of the cost of living, the poverty rate, the average state income tax rate, per capita property taxation, and hazardous waste sites. Finally, public education spending per pupil and the air pollution index both failed to influence the gross state in-migration rate for the study period.

Alternative Estimates and Robustness Checks

Next, we conduct several robustness checks by using alternate specifications such as the linear, and log-log models, and also by using alternate measures for weather and hazardous wastes. In Table 3 column (b), we re-estimate the model with an alternative measure of weather, “heating degree days,” which reflects colder weather patterns. Presumably, this variable should negatively influence the gross in-migration rate. The results in columns (a) and (b) are qualitatively very similar to one another, as one would presumably expect. In column (b), all ten of the estimated coefficients exhibit the expected signs, with five statistically significant at the one percent level and three statistically significant at the five percent level. In tandem, the coefficients of determination (R^2 and adjR^2) indicate that the model explains roughly three-fourths of the migration rate variation. The *F*-statistic is significant at the one percent level, indicating the overall strength of the model.

In this estimation, *expected* per capita personal income exhibits a coefficient that is positive and statistically significant at the 2.0% level. Hence, during the Great Recession, gross state in-migration was positively attracted to states with higher levels of *expected* per capita personal income. Next, the cost-of-living variable exhibits a negative coefficient that is statistically at the 1% level. Thus, during the Great Recession, a higher cost of living negatively impacted the gross state in-migration rate. As for the poverty variable, it is negative and statistically significant at the 5% level. Thus, a higher value for the *POVj* variable could be expected to have reduced the state gross in-migration rate to state *j* during the Great Recession.

As for the coefficient on *HDDj*, it is negative (as expected) and statistically significant at the 1% level in both estimates, suggesting that environments having colder climates are less attractive/appealing to migrants. Clearly, including such a climate variable, as an alternative to variable *JANTEMPj*, is of value and provides insights consistent with the variable *JANTEMPj* (Renas, 1983; Clark & Hunter, 1992; Saltz, 1998;Conway & Houtenville, 1998, 2001; Gale & Heath, 2000). The coefficient on the hazardous waste variable, *HAZARDPCTj*, is negative and statistically significant at the 2.5% level. Hence, a higher value in state *j* for this variable elicited a lower gross in-migration rate. Once again, in contrast to the statistically significant effects of *JANTEMPj* and *HAZARDPCTj*, the coefficient on the air pollution variable, *AIRPOLDEXj*, was statistically insignificant at even the 10% level and hence did not exercise a perceptible impact on the state gross in-migration rate over the study period.

Finally, the four variables reflecting our interpretation of the Tiebout or Tiebout-Tullock hypothesis are considered. The results in column (a) indicate that the coefficient on variable *STPARKSPCj* was positive and statistically significant at the 1% level, implying that the greater the number of state parks per capita in state *j*, the greater the gross in-migration rate to state *j*. Regarding the average effective state income tax rate in state *j*, *AVSTINCTRTj*, its coefficient is negative and also statistically significant at the 1% level, implying that the higher the average effective income tax rate in state *j*, the lower the gross in-migration rate to state *j* would be. As for the per capita property tax, this variable, *PCPROPTXj*, has a negative sign and is statistically significant at the 1% level as well. Thus, the higher the per capita property tax in state *j*, the lower the gross in-migration rate to the state. Finally, the coefficient on variable *PPPUBEDSPj* is not statistically significant at even the 10% level; hence, this public policy variable did not influence gross state in-migration during the study period.

We also estimate equations (3) and (4) in strictly linear form to examine whether the results shown in Table 2 hold up with an alternative specification. The results of these two estimations are provided in columns (c) and (d) of Table 2. In column (c), all ten coefficients exhibit the expected signs, with four statistically significant at the 1% level, two statistically significant at the 5% level, and two statistically significant at the 10% level. The R^2, adjR^2, and F-statistic values are similar to (albeit somewhat smaller than) those in the semi-log estimates found in columns (a) and (b). In the linear estimate in column (d), all ten coefficients exhibit the expected signs, with four statistically significant at the 1% level, three statistically significant at the 5% level, and one statistically significant at the 10% level. In addition, the R^2, adjR^2, and *F*-statistic values are similar to those shown in column (c). Overall, then, the linear estimation results provided in columns (c) and (d) of Table 2 provide support for the conclusions obtained from the semi-log estimates in columns (a) and (b) of the Table.

As a modest, simple test of the robustness of the basic model, we now provide in Table 4 four parallel estimates, with the modeling difference being the substitution of toxic chemical releases per square mile in state *j* in 2008 (*TOXICj*) rather than our hazardous waste variable, *HAZARDPCTj*,. As shown, the overall results are compatible with those in Table 2, lending further credibility to our basic conclusions. Namely, it appears that for the period 2008-2009 of the Great Recession, the gross state-level in-migration rate was an increasing function of expected per capita personal income, state parks per capita, and warmer January temperatures. For the same study period, the gross in-migration rate was a decreasing function of the cost of living, the poverty rate, the average state income tax rate, and per capita property taxation. Furthermore, as opposed to an aversion to hazardous waste sites *per se*, there is evidence, in these new estimates, albeit more modest, of an aversion on the part of migrants to states having higher levels of toxic chemical releases, which among other things can jeopardize the water supply and impose other costs on the population as well.

As a final test of the consistency of the model, we provide in Table 5 two additional estimates. Both are log-log estimations of the model in equation (3). The problem with this endeavor is the fact that nine of the states in the sample have no state income tax, i.e., *AVSTINCTRTj* = 0. To overcome this challenge, we first estimate the model after adding a tax rate to the average effective tax rate equal to 0.1% for all 50 states; thus, for estimation purposes, in order to include all 50 states, we artificially assume a tax rate of 0.1% in states not having an income tax. While this is not pure, the difference between a state income tax rate of 0% and 0.1% can probably be viewed as trivial in most cases. This log-log estimate is provided in column (a) of Table 3. Nevertheless, since only 41 states actually have a non-zero state income tax rate, the second estimation of the model looks solely at those 41 states, i.e., drops the nine no-state-income states from the estimation. This log-log estimate is provided in column (b) of Table 5.

The results in both columns of Table 5 are compatible with the four estimates in Table 2 with a single exception, namely, the state parks per capita variable, *STPARKSPCj*, is not statistically significant at the 10% level in these estimates. Otherwise, the results are effectively compatible with their counterparts in Table 2. Before closing, we interpret the results in column (a) of Table 5, so as to end this study with more precise conclusions. In these interpretations, the effects of the variables *STPARKSPCj, PPUBPEDSPj,* and *AIRPOLINDEXj* are not quantified because of their statistical insignificance in these two estimates.

Accordingly, we first observe that for the period 2008-2009 of the Great Recession, the gross state-level in-migration rate was an increasing function of expected per capita personal income and warmer January temperatures. For the same study period, the gross in-migration rate was a decreasing function of the cost of living, the poverty rate, the average state income tax rate, per capita property taxation, and hazardous waste sites. The impact of state parks per capita, while significant in the semi-log and linear estimates, was not statistically significant in the log-log estimates.

Finally, we observe that, based on column (a) of Table 5, which refers to all 50 states, the following appears to be the case: a 10% increase in expected per capita personal income raises the gross in-migration rate by 2.47%; a 10% higher cost of living reduces the gross in-migration rate by 2.11%; a 10% higher poverty rate reduces gross in-migration by 4.89%; a 10% warmer mean January temperature raise gross in-migration by 3.99%, and a 10% higher percentage in hazardous waste sites reduces gross in-migration by 0.75%. Furthermore, a 10% higher average effective state personal income tax rate reduces the gross in-migration rate by 0.22%; that is, a 10% higher average per capita local property tax reduce gross in-migration by 2.21%. The latter two results imply that the search for "fiscal surplus" appears to be ongoing.

Conclusions

This empirical study has investigated fiscal, as well as economic and non-economic (quality-of-life) determinants of gross state in-migration in the U.S. over the 2008-2009 period, with the specific intent of investigating whether there continues to be empirical support for the Tiebout (1956)-Tullock (1971) hypothesis even during the Great Recession.

The findings provided in this study support the hypothesis in terms of the contemporary mobility of consumer-voters. Our results suggest that even during the "Great Recession", consumer-voters evaluate *both* the government provision of goods and services *and* the tax burden in their migration decisions; however, during the "Great

Recession" some public goods factored more prominently in their migration decisions than others. Both the linear and semi-log specifications allow for three purely economic factors, three (or four) quality of life variables, and four fiscal factors. For the period 2008-2009 of the "Great Recession," the gross state-level in-migration rate was an increasing function of expected per capita personal income, state parks per capita, and warmer January temperatures. For the same study period, the gross in-migration rate was a decreasing function of the cost of living, the poverty rate, the average state income tax rate, per capita property taxation, and hazardous waste sites. All of the estimates yield results suggesting consistently, as in previous studies of earlier time periods, that migrants (consumer-voters) at the very minimum prefer lower state income tax burdens and lower property tax burdens. Consumer-voters' evaluation of government services in determining their choice of location during the "Great Recession" appears to depend upon the type of government service. While consumer-voters on average appear to prefer states with greater public provision of state parks, our results do not indicate a strong preference for states with higher per pupil outlays on primary and secondary public education.

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Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation
lnMIGj	1.0055	0.362
MIGj	2.91	1.038
EXPINCj	36,561	5.687
COSTj	99.3	17.31
POVj	12.36	3.22
AVSTINCTRTj	2.897	1.96
PCPROPTXj	1,145	1,652
PPPUBEDSPj	7,112	1,591
STPARKSPCj	0.00015	0.00074
JANTEMPj	32.709	12.646
HDDj	5,001	2,202
HAZARDPCTj	2.002	2.0654
AIRPOLDEXj	55,918	23,738

Table 2. Correlation Matrix among Explanatory Variables

	EXPINC	*COST*	*POV*	*AVSTINCTRT*	*PCPROPTX*	*PPPUBEDSP*	*STPARKSPC*	*JANTEMP*	*HAZARDPCT*	*AIRPOLDEX*
EXPINC	**1.0**									
COST	**0.269**	**1.0**								
POV	**-0.650**	**-0.412**	**1.0**							
AVSTINCTRT	**0.297**	**0.038**	**-0.281**	**1.0**						
PCPROPTX	**0.345**	**-0.242**	**-0.052**	**0.261**	**1.0**					
PPPUBEDSP	**0.470**	**-0.185**	**-0.016**	**0.315**	**0.491**	**1.0**				
STPARKSPC	**0.116**	**0.289**	**-0.134**	**-0.226**	**-0.106**	**-0.117**	**1.0**			
JANTEMP	**-0.211**	**0.088**	**0.497**	**-0.235**	**0.150**	**0.170**	**-0.101**	**1.0**		
HAZARDPCT	**0.310**	**-0.112**	**-0.149**	**0.313**	**0.757**	**0.420**	**-0.114**	**0.052**	**1.0**	
AIRPOLDEX	**0.109**	**0.049**	**-0.120**	**-0.142**	**-0.134**	**-0.144**	**-0.273**	**-0.029**	**-0.020**	**1.0**

Table 3. Determinants of Gross In-Migration in US States
Semi-log and Linear Models

Dependent Variable	*lnMIGj*	*lnMIGj*	*MIGj*	*MIGj*
Variable\Coefficent	(a)	(b)	(c)	(d)
EXPINCj	0.000002**	0.000002**	0.000006**	0.000007**
	(2.33)	(2.46)	(2.12)	(2.19)
COSTj	-0.0085***	-0.0001***	-0.0206***	-0.0187***
	(-4.77)	(-4.19)	(-3.78)	(-3.27)
POVj	-0.0379**	-0.0373**	-0.0993*	-0.091*
	(-2.11)	(-2.07)	(-1.93)	(-1.69)
AVSTINCTRTj	-0.0465***	-0.0512***	-0.156**	-0.1699***
	(-2.83)	(-3.08)	(-2.45)	(-2.62)
PCPROPTXj	-0.00004***	-0.00004***	-0.0001***	-0.0001***
	(-4.22)	(-4.19)	(-3.56)	(-3.54)
PPPUBEDSPj	-0.0000003	0.0000005	0.00001	0.00001
	(-0.05)	(0.07)	(0.63)	(0.65)
STPARKSPCj	0.107***	0.131***	0.434***	0.4736***
	(4.66)	(4.65)	(5.40)	(4.81)
JANTEMPj	0.0112***	-------	0.0258***	-------
	(4.59)		(3.26)	
HDDj	-------	-0.00006***	-------	-0.00013**
		(-3.39)		(-2.20)
HAZARDPCTj	-0.0488**	-0.0486**	-0.1208*	-0.1338**
	(-2.31)	(-2.35)	(-1.98)	(-2.04)
AIRPOLDEXj	-0.00145	-0.0014	-0.0041	-0.0039
	(-1.25)	(-1.19)	(-1.17)	(-1.11)
n	50	50	50	50
R^2	0.78	0.77	0.74	0.73
adjR^2	0.73	0.71	0.68	0.66
F	13.94***	12.97***	11.38***	10.44***

***statistically significant at 1% level; **statistically significant at 5% level;
*statistically significant at 10% level. Robust standard errors in parentheses.

Table 4. Determinants of Gross In-Migration in US States –Semi-log and Linear Models with Alternate Variables

Dependent Variable Variable\Coefficent	*lnMIGj* (a)	*lnMIGj* (b)	*MIGj* (c)	*MIGj* (d)
EXPINCj	0.000002** (2.03)	0.000002** (2.13)	0.000006* (1.98)	0.000007** (2.08)
COSTj	-0.0087*** (-5.46)	-0.0085*** (-5.53)	-0.0211*** (-4.35)	-0.02*** (-4.31)
POVj	-0.0402** (-2.54)	-0.044*** (-2.81)	-0.1057** (-2.34)	-0.109** (-2.36)
AVSTINCTRTj	-0.0457*** (-2.85)	-0.0487*** (-2.89)	-0.154** (-2.38)	-0.163** (-2.49)
PCPROPTXj	-0.00005*** (-6.35)	-0.00005*** (-6.78)	0.00014*** (-4.96)	-0.000142*** (-5.16)
PPPUBEDSPj	-0.000003 (-0.52)	-0.000002 (-0.39)	0.000004 (0.22)	0.000006 (0.35)
STPARKSPCj	0.094*** (3.55)	0.1246*** (4.27)	0.398*** (4.38)	0.458*** (4.39)
JANTEMPj	0.0125*** (5.47)	-------	0.0292*** (4.25)	-------
HDDj	-------	-0.00007*** (-5.05)	-------	-0.00017*** (-3.56)
TOXICj	-0.94* (-1.73)	-1.1848** (-2.30)	-2.601 (-1.54)	-3.11* (-1.90)
AIRPOLDEXj	-0.0021 (-1.63)	-0.0021 (-1.67)	-0.006 (-1.60)	-0.0058 (-1.57)
n	50	50	50	50
R^2	0.79	0.80	0.76	0.75
adjR^2	0.74	0.74	0.69	0.69
F	14.95***	15.21***	12.13***	11.67***

***statistically significant at 1% level; **statistically significant at 5% level; *statistically significant at 10% level. Robust standard errors in parentheses.

Table 5. Determinants of Gross In-Migration in US States – Log-log Model

Dependent Variable	*lnMIGj*§	*lnMIGj*§
Variable\Coefficent		
lnEXPINCj	0.247***	0.138***
	(6.36)	(2.84)
lnCOSTj	-0.211***	-0.203***
	(-3.26)	(-2.95)
lnPOVj	-0.489***	-0.415**
	(-3.25)	(-2.45)
lnAVSTINCTRTj	-0.022**	-0.02**
	(-2.14)	(-2.10)
lnPCPROPTXj	-0.221***	-0.12***
	(-5.21)	(-2.76)
lnPPPUBEDSPj	-0.008	-0.098
	(-0.15)	(-1.63)
lnSTPARKSPCj	0.013	0.017
	(0.35)	(0.39)
lnJANTEMPj	0.399***	0.387***
	(3.58)	(3.06)
lnHAZARDPCTj	-0.075***	-0.086***
	(-3.30)	(-3.58)
lnAIRPOLDEXj	-0.017	-0.009
	(-0.59)	(-0.30)
n	50	41
R^2	0.79	0.75
$adjR^2$	0.75	0.70
F	12.14***	13.02***

***statistically significant at 1% level; **statistically significant at 5% level; *statistically significant at 10% level. Robust standard errors in parentheses.
§ The first column includes all states; the second column includes only those states that collect personal income tax.