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December 17th 2007
Revised March 29th 2008

Evaluating the Elderly Retired in a Tiebout Context[1]

Abstract

This paper suggests that policy intervention by county administration to target the intuitively less mobile elderly retired (65-74) may not be necessary as they are candidates for Tiebout sorting given their location-invariant income and exodus from labor markets. A model based on Conway and Houtenville's model which eliminated central government effects was developed. Within North Carolina, the elderly retired displayed Tiebout-type movement, choosing to reside in county's that provided their optimal consumption of public services. The results show that the retired move to counties where services are funded more by sales and other taxes instead of property taxes.

Introduction

In this paper, evidence is produced that shows that the elderly-retired will self-optimize by moving to counties that provided the optimal mix of public services and taxation setting as predicted by the Tiebout effect. This is despite the natural belief that the demographic group is less mobile. By focusing the study within the state of North Carolina, the central-government effects are removed since elderly may chose to reside in particular states for political reasons. The important variables surfaced in this study are that elderly responded to the proportion of services funded by various types of taxes. Counties with larger expenditure borne by sales and other taxes instead of property taxes were attractive to the elderly population which is in line with model predictions that recognizes the elderly-retired's non-participation in labor markets and location-independent income.

Graves and Knapp suggest that the elderly-retired are a theoretically different demographic group when compared to other demographic age groups (<65) in part because retirees have exited the labor market (Graves and Knapp, 1988). A retiree's sources of income are pension and/or interests income and both are independent of location. In the Tiebout world, a community-consumer will self-optimize by moving to the municipality that provides the mix of public goods most in line with his consumption preferences (Tiebout, 1956). The consumer 'pays' for these public goods through the taxation setting each jurisdiction maintains. Intuition tells us that the mobility of working community-consumers and elderly-retired respond similarly to the level of amenities a municipality supports. Mobility increases are directed towards jurisdictions with more and better amenities. For the working population, the "cost" of these amenities has been capitalized in its land/housing (rental rate) and labor (wage rate) markets. For the retired population however, the actual "cost" of these amenities is lower since they do not suffer from the "lowered" wage rate. This is reason enough for the retired to reside in locations that both differ from working populations and are in general further from labor markets.

A second theoretical difference between the elderly-retired and the working population is that retirees are subject to a different taxation configuration. This arises because the unlike the retirees, the working population's income is invariably tied to the wage rate of his chosen residential community. Additionally, Conway and Houtenville warn that the absence of direct links between tax paid (or 'cost') and benefits received by individuals may attract particular groups to certain communities whose public services are uniquely financed by "specific types of taxes" (Conway, Houtenville, 2007). Opportunities for particular groups to "free ride" will emerge and as these groups move into these communities, a highly-skewed migration pattern develops. Cebula provides an instance of this adverse Tiebout effect by pointing out that empirically, the migration of Aid to Families with Dependent Children (AFDC) recipients are affected by "state-to-state differentials in benefits" (Cebula, 1979). AFDC recipients receive transfer payments (welfare) from the government and are contingent on non-standard work incentives. As such, they do not necessarily contribute to income tax revenues of state authorities. Cebula notes that future recipients are attracted to the communities that have higher transfer payments (benefits) and the subsequent rise in their numbers places extra burden on the tax base just to sustain the same level of public service provision.

The elderly-retired can be said to mirror AFDC recipients. Naturally, their preferred public service bundle (benefits) includes items like availability of medical services which deviate from the

desired bundles of the working population. This imitates the situation where AFDC recipients respond chiefly to the transfer payment level offered by various jurisdictions while other population groups do not. Both Conway and Houtenville and Graves and Knapp argue that the elderly-retired can actually "free-ride on the tax efforts of the non-elderly" by residing in municipalities that provide their desired public services at tax settings which favor them. Given the location-invariant income that retirees enjoy, further "free-ridership" occurs when retirees choose to live in areas where the value of amenities is largely capitalized in the labor market (affecting wage rate). Therefore, in theory, the elderly are possible choices for unbalanced Tiebout sorting.

Conway and Houtenville present the first study, to my knowledge, that evaluates the elderly retired (>65) population for Tiebout effects as theoretically suggested. They developed a model for the elderly migration decision accounting for the above-mentioned elderly peculiarities and for salient factors that potentially determine to elderly migration decisions. By using state migration data and state level financial data to replicate their identified parameters, they tested at state level to see if Tiebout results existed. Observing Tiebout results has severe policy implications. The elderly is easily characterized as a largely immobile population group; across all levels of government, intervention efforts strive to ensure that the elderly within each jurisdiction have access to adequate levels of public goods (services). The identification of Tiebout effects will imply that in equilibrium, each elderly retired is consuming his optimal bundle of public goods. Policy intervention by governments is unnecessary since the elderly retired are mobile. This allows policy adjustments or implementations that will better target the less mobile within the population ensuring that the social "pie" is as large as it can be.

In an extension to their study, I similarly assess if the Tiebout hypothesis applies to the elderly-retired. However, I choose to limit the scope of my study so as to minimize the effects of central authorities. In Conway and Houtenville's study, they studied elderly movements between states. A state government is unlike a local government in that it enjoys bigger budgets and can adjust expenditure patterns to cater to voter preference. Tiebout proposes that since local governments have small budgets and fixed expenditure patterns, they do not cater to voter wishes. However, optimality in public good provision is still achievable because each municipality becomes a particular bundle of public services and the community-consumer reveals his preferences by physically moving to his most suitable jurisdiction. At a state level, we cannot be as sure that optimality of public provision for elderly can be achieved even if we do observe Tiebout-type

movement of the elderly-retired. More pervasive reasons exist at state level that may propel the elderly to migrate such as identification with particular political groups.

In this study I first begin by modifying the theoretical model employed by Conway and Houtenville that highlights important factors behind elderly migration within the state. Following this, I conduct comparative static analysis to determine the effects each of my variables have on elderly migration. An empirical study is then conducted which uses county level data from North Carolina to represent the parameters in my model. The Tiebout hypothesis implies that municipalities with elderly-favorable tax and public service settings will lead to in-migration patterns with a significant elderly population. Using demographic data at county level, I test whether elderly migration patterns are in accord with Tiebout's theory. Put in another way, if the "free-riding" problem mentioned is observed, Tiebout's hypothesis holds for the elderly retired; consequently policy interventions targeted at public good provision for the elderly may be less important or need relooking.

Model

The model chosen in this analysis follows closely to models adopted by Conway and Houtenville and Graves and Knapp, but diverges eventually as my model aims to capture salient factors that affect elderly migration within a state so as to minimize central authority effects. The model essentially revolves around cost-benefit analysis of the retired individual consumer who seeks to maximize his utility through consumption of residential location. Variables considered in the models are founded on Tiebout's theory that a community consumer responds to the composite of 'prices' in terms of taxation, and basket of 'goods' in terms of public services a jurisdiction finances. The model is developed from a perspective of a community consumer's current location and predicts if he would exit his present jurisdiction after assessing the benefits availed to him in other municipalities.

I begin first by creating a utility function for a typical individual who is deciding on an optimal locality for him. The utility this consumer faces is a function of the composite of public

services (non-tradeable), S_i, composite of amenities (non-tradeable), A_i, housing, G_i and leisure time , $T - h_i$ he enjoys at his current i^{th} jurisdiction

$$U_i\left(S_i, G_i, A_i, T - h_i\right). \tag{1}$$

where T is the total number of hours he has in a week and h_i is the number of hours he spends working.

Given the geographical size of an American state, there is a need to factor for "non-tradeable" goods such as "mild climate" and "sea view" as directed by Graves and Linneman (1979). Such goods are available only at the location of consumption and these "amenities" will be pull factors for potential migrants. Another more concrete class of "non-tradeable" goods refers to human-developed amenities such as parks or hospitals. Similarly, these amenities can be said to be available on location and are hence "non-tradeable". The "non-tradeable" goods are by nature exclusive and community-consumers pay for them in both housing and labor markets. The amenities are clearly capitalized into the housing markets where home price/value and rental rates are higher to reflect the amenities available. Further, as a desirable locality draws more people, the supply of labor will increase, leading to a fall in the wage rate the jurisdiction offers. In equilibrium, all municipalities must provide the same level of satisfaction to the community consumers, i.e. the desirable amenities in one locale is offset by the higher wages/lower rental rates in another.

Tiebout hypothesizes that each municipality attracts different types of people since they provide dissimilar types and levels of services in education, health and public safety. This hypothesis is tested in the variable, S_i; it is "non-tradeable" in nature as well because the particular composite of public services can only be found in that jurisdiction and non-members of the community are excluded from consuming. Unlike typical utility functions, a variable for all other private goods (less housing) is neglected because these goods will be priced competitively (externally determined) and location-invariant and hence do not feature in the migration decision. The only private good that must be considered is housing, G_i, since the housing market has internalized the amenity benefits of a location. Expectedly, consumption of housing takes up a notable portion of an individual's budget and including housing in our model will be enough to reflect changes in real disposable income of the potential migrant. Lastly, like Conway and Houtenville, leisure time is accounted for since the life-cycle effect of retirement will lead to increased leisure time that may create incentives to move.

Accordingly the budget constraint the consumer faces is

$$p_{S_i}S_i + p_{G_i}(w_i,r_i)G_i = Y + w_i(A_i)h_i \qquad (2)$$

where

p_{S_i} is the "price" of one dollar of the "non-tradeable" composite of publicly provided services per capita at the current municipality (essentially the tax system the jurisdiction maintains);

$w_i(A_i)$ is the wage rate the current municipality offers which is dependent on the amenities it offers;

$r_i(A_i)$ is the rental rate the current municipality offers which is dependent on the amenities it offers;

$p_{G_i}(w_i,r_i)$ is the "price" of housing in the current location properly capitalized in the labor and housing markets by the wage rates and rental rates the current municipality offers;

Y is the income that is not dependent on work such as interests income and state transfers, and is invariant of location.

Therefore the optimality problem a potential migrant faces is:

$$\max U_i(S_i,G_i,A_i,T-h_i)\,s.t.\,p_{S_i}S_i + p_{G_i}(w_i,r_i)G_i = Y + w_i(A_i)h \qquad (3)$$

The theoretical differences of the elderly-retired means that $T-h_i$ becomes T since $h_i=0$ and real $p_{G_i}(w_i,r_i)$ falls since $w_i(A_i)$ does not apply to the retired. The elderly do not pay for the amenities they enjoy through a lowered wage rate and $p_{G_i}(w_i,r_i)$ is now strictly dependent only on $r_i(A_i)$ and hence becomes $p_{G_i}(A_i)$. The optimality problem potential an elderly migrant faces is then recast as:

$$\max U_i(S_i,G_i,A_i,T)\,s.t.\,p_{S_i}S_i + p_{G_i}(A_i)G_i = Y \qquad (4)$$

To further simplify this model, I assume that the non-labor income Y is a constant value. This replicates reality in that the non-labor income is unaffected by parameters that may encourage elderly to move. More importantly perhaps, this makes subsequent analysis more convenient. In reality, developed financial establishments present today justify Y's location-independence since state transfers or interests-income transactions occur through banks. Further, it is reasonable to assume that potential migrants do not actually consider the house they intend to purchase when deciding to migrate. They instead consider issues like property tax values and amenities before

deciding to move and settle on a residence after the migration decision. Hence to focus my analysis on S_i, by replacing G_i, the elderly attempts to

$$\max_{\{S_i, A_i\}} U_i \left(S_i, \frac{Y - p_{S_i} S_i}{p_{G_i}(A_i)}, A_i, T \right). \tag{5}$$

Beyond representing the "price" of public services, p_{S_i} also captures the tax system configuration of any locality. Hypothetically, if all the tax revenues were directed towards public expenditure, p_{S_i} will determine the proportion of the cost of public service each tax is responsible for. For purposes of highlighting the important factors, I propose that p_{S_i} be viewed as a function of three variables, property tax, sales tax and a composite of all other administrative taxes a location implements. In reality, many forms of tax are in practice, most of these taxes are put in place by state/federal governments and for the context of my model will not affect my analysis; other more peculiar taxes are best explored on a case to case basis if they lead to outliers in the analysis. Hence, in general,

$$p_{S_i} = C_{1_i} P_i^t + C_{2_i} \Gamma_i^t + C_{3_i} O_i^t \tag{6a}$$

where

P_i^t is the property tax per capita;

Γ_i^t is the sales tax per capita.

O_i^t is the composite of all other taxes per capita;

C_{1_i}, C_{2_i} and C_{3_i} are positive coefficients that each county's taxation system presents which determine the migrant's "price" for utilizing the municipality's public services based on his susceptibility to the three types of taxes explored in this model. As postulated, the elderly prefer areas that have the cost of public services largely funded by revenues from income taxation. This falls out of the context of an intra-state analysis since the income tax is a federally/state-level imposed tax. In reality, the elderly retiree is not likely to consider the income taxation regardless of the type of migration (across county or across state). This is because he is dependent on a pension scheme which is federally-determined. Similarly, if he were dependent on interests income only, a nationally consistent tax will be imposed on him that cannot influence his migration decision.

The elderly retired will choose to leave his current location if

$$l_i = \max\left(U_1, U_2, ... U_{i-1}, U_{i+1}, ... U_{99}, U_{100}\right) - U_i - K_i > 0 \qquad (7)$$

where

U_i is the utility associated with the ith jurisdiction;

K_i is the cost of moving from the present location;

K_i is representative of transaction costs involved with uprooting from the present locality and includes "psychic" costs e.g. costs of leaving friends and/or family behind.

Conducting comparative statics,

$$\frac{\partial l_i}{\partial S_i} = -\frac{\partial U_i}{\partial S_i} + \frac{p_{S_i}}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial S_i} \qquad (8)$$

$$\frac{\partial l_i}{\partial C_{1_i}} = \frac{P_i^t S_i}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial C_{1_i}} \qquad (9)$$

$$\frac{\partial l_i}{\partial C_{2_i}} = \frac{I_i^t S_i}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial C_{2_i}} \qquad (10)$$

$$\frac{\partial l_i}{\partial C_{3_i}} = \frac{\Gamma_i^t S_i}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial C_{3_i}} \qquad (11)$$

For the elderly migrant, equations (9), (10) and (11) are all greater than zero since the constants/parameters are all greater than zero by definition. (9) says that, in the present community, raising the proportion of public expenditure receipts that the property tax revenues covers will lead to migration from the current location. Intuitively, keeping the level of public service constant, an individual's utility suffers when he has to pay a greater sum of property tax in a particular location than before. Equation (10) and (11) says the same thing but for the cases of a sales tax and a composite of all other tax. This arises because from (7), the individual attempts to maximize the difference between the utility he derives from the current i^{th} location and his new location.

To develop visibility on the effects of different types of S_i, S_i can be remodeled as five separate variables, public safety, $PubSaf_i$, education, Edu_i, general government, Gov_i, human services, $HumSer_i$ and other services, $OthSer_i$, without affecting the results of our prior analysis. Hence equation (8) becomes

$$\frac{\partial l_i}{\partial PubSaf_i} = -\frac{\partial U_i}{\partial PubSaf_i} + \frac{p_{PubSaf_i}}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial PubSaf_i}; \tag{8a}$$

$$\frac{\partial l_i}{\partial Edu_i} = -\frac{\partial U_i}{\partial Edu_i} + \frac{p_{Edu_i}}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial Edu_i}; \tag{8b}$$

$$\frac{\partial l_i}{\partial Gov_i} = -\frac{\partial U_i}{\partial Gov_i} + \frac{p_{Gov_i}}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial Gov_i}; \tag{8c}$$

$$\frac{\partial l_i}{\partial HumSer_i} = -\frac{\partial U_i}{\partial HumSer_i} + \frac{p_{HumSer_i}}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial HumSer_i}. \tag{8d}$$

$$\frac{\partial l_i}{\partial OthSer_i} = -\frac{\partial U_i}{\partial OthSer_i} + \frac{p_{OthSer_i}}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial OthSer_i} \tag{8e}$$

In the more general form of (8), comparative static analysis reveals that changes in the level of public service provision at the current locale has ambiguous effects on the decision to leave. The $-\frac{\partial U_i}{\partial S_i}$ term implies that as S_i increases $\frac{\partial l_i}{\partial S_i}$ becomes negative but this is compensated by the $\frac{p_{S_i}}{p_{G_i}(A_i)}\frac{\partial U_i}{\partial S_i}$ term which makes $\frac{\partial l_i}{\partial S_i}$ positive. Whether $\frac{\partial l_i}{\partial S_i}$ is positive or negative and hence whether a potential migrant leaves or stays as S_i increases depends on the magnitude of $\frac{p_{S_i}}{p_{G_i}(A_i)}$.

Consistently, the equations say that by increasing public services provided, the utility derived at the current location increases; this in turn lowers the probability that the individual actually choose to migrate. However, increasing public services necessitates increasing public expenditure. Returning to equation (5), the terms $\frac{Y}{p_{G_i}(A_i)}$ and $\frac{p_{S_i}}{p_{G_i}(A_i)}$ are actually the actual disposable income and the actual cost of public service to a potential migrant at his current jurisdiction. Given that Y is a constant value, any increase in public expenditure translates to a diminished consumption of housing (representative of other private goods) and its associated amenities. In effect, the housing costs have been driven up by the rise in public service provision. Utility will be lower as a result and individuals become more prone to out-migrate.

Looking at the five classes of public services explored, retirees are sensibly more likely to value Human Services more which encompasses Medicaid covered medical services and facilities since they are susceptible to old-age ailments and tend to need medical facilities more. Good public safety, efficient government and general availability of other services are also logically desirable to elderly but observing significant Tiebout sorting seems unlikely since these two public services are attractive to all age groups. In the context of this study, I seek to verify that the Tiebout hypothesis is relevant to the elderly. If elderly do "vote with their feet", I expect human service levels to correlate positively with elderly in-migration and lower correlations should exist for the other three variables. In the case of education, it is unlikely to feature highly in the migration decisions of elderly-retired. If I can empirically demonstrate a negative correlation between this variable and in-migration levels of elderly, this will also serve as proof of Tiebout hypothesis' relevance. More will be said about the five classes of public services explored in the subsequent sections of the paper.

Empirical Study

- Data Issues

Tiebout argues that local governments are less able to cater to voter preferences unlike central governments which have larger budgets. The spending pattern of each jurisdiction is hence typically constant as such each municipality can be modeled as a particular bundle of public service provision. The 100 counties in the state of North Carolina are used to represent Tiebout municipalities in this study despite the fact that counties each have a number of municipalities. This arises to first simplify the data collection process since municipality-level (city/towns) data is hard to gather due to severe inconsistencies across municipalities in terms of expenditure areas[2]; secondly, the county governing body by its nature is the best approximation to a local government, whereas municipality 'governing' bodies often only have administrative purposes. Existing county financial data reveal that each county is consistently responsible for financing the 6 broad categories of education, debt service, human service, general government, public safety and other expenditures.

A proxy for migration was developed by measuring the change in county elderly population proportions (ages 65-74) between 2000 (July estimates) and 2005 (July estimates) for all 100 counties

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[2] Refer to www.nctreasurer.com.

in the state of North Carolina, denoted Mig_i. The information comes from the North Carolina State Demographics website and it is derived from the Census Bureau's decennial population census. Ages above 74 were ignored as amenity related movements after 74 is typically minimal and deviates from observing the effect retirement. As a state, North Carolina experienced a fall of 0.84% in elderly population proportions from 2000 to 2005. This is assumed to be a result of state policies and other reasons[3] that may have driven the elderly out of the state. On the assumption that state-level reasons contributed to the decline, the drop of 0.84% will not affect the coefficients of the variables tested since the drop applies across the state and not to any particular county.

Various issues need to be addressed with such a proxy. Over a five-year period, the population group from the 60-64 bracket in 2000 will enter the >65 bracket. Such a proxy runs the risk of overestimating migration levels for counties with high pre-retirement workers and underestimating migration levels for counties with low pre-retirement workers. However, such a proxy adequately captures the number of retirees who actually want to reside in the particular location. People from the 60 to 64 bracket in 2000 that remain in the same locality must choose to do so because such an arrangement is their optimal outcome.

The adequacy of the proxy suffers most from the natural decline of population in the age bracket >65. A county with a higher death rate may have a high in-migration rate. These contrasting effects will conceal the actual migration numbers. However, to separate natural population changes from our data demands complicated analysis. I offer justification for this approach by proposing that death rates are plausibly related to medical, public safety provisions in each county; better-serviced counties (health-wise) are likelier to enjoy higher in-migration rates and as a result a low death rate should correlate with a high in-migration rate. The converse is also true. If anything, the natural decline of population will help to amplify Tiebout results as more desirable counties (lower death rates) will enjoy higher in-migration while less valued municipalities (higher death rates) will suffer negative in-migrations. When data become available, this proxy must adjust for natural changes in the population for each county in the age bracket >65.

To measure the level of different public service provision, I use a county's expenditure on each type of public service as a proxy. The quantity and quality of public services can be measured directly by the size of the expenditure because the capital rental rate and labor wage rate involved in

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[3] In their nationwide state-level study (1988), Fournier et al. suggest that elderly mobility is also affected by family reasons, i.e. elderly will move to where their children reside. They demonstrate empirically that elderly will cross states to stay with their children.

providing the services are exogenously and competitively determined. Consequently, comparing public service expenditures across the counties is a robust measure of differences in public service provision by each county. Ideally, I will use the financial data just prior to 2000 (e.g. 1999) because I am measuring migration over a 5 year period from 2000 to 2005. Potential migrants will make their migration decision based on the current public service provision levels. However, in this analysis, 2002 data are to be used instead because 1999 data are unavailable. While this necessarily contradicts my earlier claim that potential migrants decide to migrate on current public service provision levels, using 2002 data may be more reflective of reality. This occurs because practically, the migration decision involves some amount of lag time between considering migration, choosing a locale and actually migrating. Using the 2002 expenditures data against the derived migration rate between 2000 and 2005 may even be more reflective. Nonetheless, the consistency of budget allocations of counties makes this issue trivial.

The North Carolina County and Municipal Financial Information website provides information on county expenditure by function. The functional expenditures of the county can be broadly classified into six categories: education, debt service, human services, general government, public safety and other services. Accordingly, the level of expenditure per capita on each of the six categories will represent the commitment to each particular service a county has. In my analysis, debt service is not considered as it deals with managing the existing debt a county has. A potential problem is identified at this stage. Human services encompass a wide range of public commitments a county has ranging from AFDC payments to Medicaid payments to public health expenditure. On the premise that the elderly-retired will be drawn towards counties with sizeable spending on public health, the Tiebout effect might be masked by the large number of other factors subsumed under Human Services such as AFDC and legal aid. The nature of the data is such that no resolution is actually available on how much the county spends per capita on public health. Table 1 describes each type of expenditure.

Expenditure by Function	Description
Education Edu_i	- appropriations to school administrative units and to community college systems for current operations and capital outlays
Debt Service	- principal, interest, and fees paid or accrued on debt
Human Services $HumSer_i$	- expenditures for the public health, mental health, and social services programs; veterans' service officers; legal aid; appropriations to hospitals; county's share of Medicaid payments, AFDC payments, and Special

	Assistance to Adults; county's share paid to multi-county health district and an area mental health authority
General Government Gov_i	- expenditures for the governing body, administration, elections, finance, revaluations, legal services, Register of Deeds, construction and maintenance of public buildings not related to other functions, court facilities, and central services
Public Safety $PubSaf_i$	- expenditures for the sheriff's department, jails, emergency communications, emergency management activities, fire protection, building inspections, rescue and ambulance services, animal control, and medical examiners or coroners
Other $OthSer_i$	- expenditures for transportation, solid waste, drainage and watershed, cemeteries, planning and zoning, economic and community development, agriculture extension programs, special employment programs, culture and recreation, water and sewer, unallocated fringe benefits, and Miscellaneous expenditures

Table 1: Description of each functional expenditures of counties as provided by the NC County and Municipal Financial Information website

As indicated in my model, increasing the proportion of public expenditure receipts that any of the three taxes (property, sales and other) must cover will unambiguously lead to exodus from the current location. In the case of the property tax proportion C_{1_i}, a representative real world term will be the ratio of per capita revenue from the property tax to per capita total expenditure of the county. The same technique can be applied to develop representations of C_{2_i} and C_{3_i}, using per capita revenue from sales tax and per capita revenue from the composite of other taxes. Per capita revenues from property taxes, sale taxes and the composite of other taxes are taken from 2002 data from the North Carolina County and Municipal Financial Information for consistency.

- Results/Analysis

To analyze the data, I conduct bi-variate and multi-variate ordinary least squares regression analysis for the following variables S_i, Edu_i, $HumSer_i$, Gov_i, $PubSaf_i$, $OthSer_i$, C_{1_i}, C_{2_i} and C_{3_i} against Mig_i, where the real world equivalent of S_i is the total sum of public service expenditure. Scatter plots and the least squares fit line are plotted through the data points for each least square regression analysis as shown in the Figures 1 through 9. From the initial nine plots, I proceed to look for outliers which I suspected may conceal the relationship between Mig_i and each

of my nine variables. Nine outliers[4] are found and a binary variable for presence of sea view is created given that these outlying counties were mostly coastal counties.

In essence, I try to identify Tiebout effects for each of the tested variables. Strong Tiebout presence in the form of significantly skewed migratory patterns suggests that elderly are mobile and that in a steady state, optimization of public goods is achieved for this demographic group. The correlation coefficients for my OLS regressions are as follows:

Variable	Pairwise Correlation	Coefficient	Standard Error	P-value	R^2
Education	-0.1363	-0.003288	0.0022877	0.154	0.0186
Human Services	-0.0388	-0.0010006	0.0019866	0.616	0.0015
General Government	0.1267	0.0070613	0.0044894	0.119	0.0161
Public Safety	0.1003	0.0071231	0.0048318	0.144	0.0101
Other Services	0.0583	0.0012589	0.0016752	0.454	0.0034
Total Expenditure	-0.0026	-0.0000264	0.000904	0.977	0.0000
Coast	0.1595	1.631983	0.8254567	0.051	0.0254
Property Tax Revenue/Total Expenditure	-0.0430	-0.0012777	0.0032655	-0.696	0.0018
Sales Tax Revenue/Total Expenditure	0.1742	0.0187775	0.0090619	0.041	0.0303
Other Tax Revenue/Total Expenditure	0.0928	0.0055412	0.002106	0.010	0.0086
In-Migration Levels (2000 – 2005)	*1*	NA	NA	NA	NA

Table 2: Pairwise Correlation and binary OLS regression results for each of the variables against the in-migration level[5]

Variable	Coefficient	Standard Error (SE)	t-statistic	P-value	Coefficient × SE
Education	-0.0048616	0.0030771	-1.58	0.118	-1.496E-5
Human Services	0.0001664	0.0026769	0.06	0.951	4.454E-7
General Government	0.0003872	0.0085026	0.05	0.964	3.292E-6
Public Safety	-0.0031773	0.0130302	-0.24	0.808	-4.140E-5
Other Services	0.0002619	0.0025764	0.10	0.919	6.748E-7
Coast	1.692735	1.217765	1.39	0.168	2.061E0
Property Tax Revenue/Total Expenditure	-0.0056356	0.0048542	-1.16	0.249	-2.736E-6
Sales Tax Revenue/Total	0.0384618	0.0183192	2.10	0.039	7.046E-4

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[4] Outliers were Dare, Camden, Durham, Bladen, Hertford, Currituck, New Hanover, Hyde and Jones Counties. Dare and Currituck were frequent outliers for many of the variables and this may be explained by the waterfront, bay and ocean facing nature of the counties. In a prior study, Durham County spends significantly on Human Services because it maintains a health/medical system that serves the larger American public and using expenditures to measure human services provision may not be relevant.

[5] The constant of regression is not presented because it has no economic interpretation

Expenditure					
Other Tax Revenue/Total Expenditure	-0.0056356	0.009056	0.04	0.968	-5.104E-5
Constant of Regression	-2.186208	2.147493	-1.02	0.311	NA

Table 3: Multiple regression with in-migration level as dependent variable

With reference to Table 2, in-migration of elderly retirees does not seem affected by increasing public expenditure all public services since the correlation is close to zero and the R^2 is 0.0. The coefficient is not significantly different from zero given the high p-value for the null hypothesis that the coefficient is zero. This does not contradict the result from comparative static analysis of the model which predicted that in-migration will be ambiguous. These plots are also in line with Tiebout hypothesis since the total size of public services spending does not influence in-migration. Tiebout predicts that sorting is evident only if there were elderly-desired public goods provided but S_i encapsulates all the different types of public service a county provides. Masking effects between different public services may exist hence interpreting the in-migration patterns is difficult. While no clear conclusions can be made from the graphs, we can safely say that the plots do not exclude elderly populations are from Tiebout effects.

Looking at Table 2, the bi-variate regression results weakly suggests that as the level of education services provided increase, the elderly are more likely to leave a location. This is plausible because the elderly-retired are very unlikely to utilize the education services available. The education setup in most counties is inherently not targeted for the elderly, and the probable elderly migrant will be more likely to leave a location if his "real" consumer power decreases from the heightened level of education as a result of higher taxes in this location. The empirical results discloses that the elderly migrant probably suffers the dip in disposable income with a rise in education spending and the utility "lost" is not compensated by the utility "gain" from the presence of better/more educational facilities. Some Tiebout effect is plausibly present here however the result is not significant given the p-value of 0.154 for the null hypothesis that the coefficient is zero.

In the multiple-variable regression setting, when compared to the other variables tested (Column 6[6] Table 3), education levels is relatively important as a variable to elderly exodus which

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[6] To develop a sense of relative importance of different variables in a multiple variable regression setting, the coefficient is multiplied by its standard deviation

echo the possibility of Tiebout sorting established from the bi-variate regression. Likewise, the high p-values again suggest that there is no statistical significance for the variable Edu_i.

Table 2 paints a slightly different picture for $HumSer_i$. The near-zero slope implies that increasing human service provision is not correlated with increased in-migration of the elderly within a state. The low R^2 values inform that only a small proportion of the variation in in-migration values can be explained by the linear model which states that with every unit of per capita increase in Human Service provision, practically no change in elderly population will occur. This result is not unexpected since the comparative static analysis predicts as much. This result also argues that the provision of health services and Medicaid related medical services may not rank as highly as previously thought to elderly in their migratory decisions. On deeper thought, it is possible also that there are masking effects present. As suggested in the Data Issues section, the fact that too many components comprise the Human Service expenditure service will, on average, diminish any clear correlations. Future studies can just focus on county Medicaid-related medical service expenditure for greater clarity.

When viewed from a multivariate setting, the high p-value implies that the null hypothesis that the coefficient is zero is not rejected. The relative unimportance of $HumSer_i$ as seen in Column 6 of Table 3 echoes much of what the bi-variate regression tells us. It is not unfair to say that some Tiebout sorting is in play here but nothing further can be said.

Positive correlation is observed for in-migration of elderly with public expenditure on government. The correlation here is comparatively weaker than that observed in education since the coefficient (gradient term) is around slightly smaller. However, given that the coefficients are already of such low magnitudes, there does not seem to be any deeply rooted reason for the difference. In a multivariate setting, Gov_i is not relatively important as a variable as all while the high p-value suggests the coefficient could very well be zero. Higher government services may lead to an influx of post retirement elderly migrants but this result is not significant.

Much like education and human services, the absence of Tiebout effects is probably untrue. It is possible that government services are just as valued across all demographic groups. A public service that is just as valued across all demographic groups will see absolute increases in population numbers across but the proportions will remain constant. Interpreting the data more deeply, my

measure of migration is the percentage change in elderly population proportions between 2000 and 2005. This presentation does not allow me to make cross demographic age groups comparison. If elderly migration is seen to positively correlate with an increase in a particular public service level, I have no visibility on the corresponding effect on other demographic groups. While this setup allows me to capture Tiebout patterns in elderly populations it severely limits the interpretative value of the analysis. A potential study can look into the changes in population proportions of other demographic groups as well, so as to identify how the population demographics are shifting.

Tables 2 and 3 give some indication that public safety and other services do not matter much to the elderly which is again in line with model predictions. Increased public safety and other services spending did not change the in-migration percentage which remained constant at about +1%. In the case of other services, a plethora of small expenditures fall under this category. The nature of the taxes under this category typically account for a minute portion of the elderly (possibly applies to all demographic groups as well) and it is intuitively unlikely to feature much in the migration decision of the elderly. Public safety is likely to resemble government services in that it is just as attractive to all demographic groups from the results of bi-variate regression. The ambiguity predicted by the model regarding $PubSaf_i$ is reflected by a positive coefficient in the bi-variate setting but a negative coefficient in the multi-variate setting. At best, Tiebout effects cannot be ruled out.

The results from multiple variable regression display that the greater the proportion of public expenditure funded by property tax, the more likely the elderly migrant will leave the municipality. This relationship is a weak one since the correlation coefficient is small and that p-value for the null hypothesis (coefficient =0) is high. Comparatively, this variable is not as important to the elderly compared to the proportion of public expenditure funded by sales tax. This corresponds with what comparative static analysis reveals (Equation 9). The peculiar nature of elderly migrants means that, in theory, they feel the greatest pinch when property taxes account for larger percentages of public service expenditure. This result resonates with Tiebout principles that community-consumers optimize by residing in jurisdictions with the most preferred bundle of "goods" given the "prices" they face.

Finally, the regression results show that there are substantial negative correlations between sales and composite tax proportion of public expenditure and in-migration levels of elderly. The high relative importance (Column 6, Table 3) that elderly migrants place on these variables and the fact that the p-value for sales tax proportion is low and statistically significant at 5% level suggest that this variables are major consideration for the elderly retirees in the migration decision.

This is the first instance that our model fails to predict correctly the expected trend. The reason for this discrepancy is the fundamentally different nature of elderly migrants. As posited beforehand, in a cross state setting, elderly migrants will prefer a jurisdiction that finances a majority of its expenditures on services with the income tax, since they will not be subject to that form of taxation. In the county setting, since income tax does not feature, elderly migrants will tangibly prefer funds to be heavily collected through sales or other taxes and with minimal weight on property tax. Property tax is unavoidable for the elderly since they will be residing in the municipality and they cannot substitute away from this consumption good unless they migrate. Sales tax and other tax allow for substitution within the community and a greater dependence on these taxes for county revenues will present a more beneficial tax setting to the elderly. This noteworthy correlation implies that there is Tiebout behavior observed. Comparing the results of sales and other tax with property tax, Tiebout hypothesis is verified to apply to the elderly retirees as well.

Conclusions/Further Studies

There are a number of inadequacies in this study that must be highlighted. Firstly, data-wise, the proxy for migration is not the most ideal because it does not externalize the effects of natural population changes. The actual movement of the elderly is not perfectly captured and hence the derive results may not be accurate. When the data become available, it is more appropriate to use actual cross county migration data for analysis.

The model developed is not utilized fully. Comparative static analysis and empirical study of the variable A_i was not attempted beyond the dummy variable for presence of sea view. As defined in the model, amenities are quintessentially non-tradeable location-based goods; studying this variable in depth detracts from identifying Tiebout effects which point to optimality in public good provision for elderly. That said, in my study, data from Dare and Currituck counties are significantly affected by amenity issues (presence of sea-view) and by not analyzing amenities, I equivalently fail

to present the complete picture for a state. The same can be said of assessing the effects of increased leisure time. Studies already exist on the effect of increased leisure on elderly migration decisions (Graves and Knapp, 1988); a further field of study can be to reveal the effects of the amenity provision to elderly. Such studies must be conducted with an aim to establish means to remove its effects on elderly mobility patterns so that we can test for Tiebout effects more clearly. Further, some amenities (variable A_i) are complements to leisure. Consumption of such amenities requires time which is not captured in the model developed. Considering a time-dependent variable $A_i(T - h_i)$ instead would have been more revealing.

An initial posit in this study is that the elderly are candidates for adverse Tiebout sorting, if certain counties have both elderly-favorable public service settings and favorable tax settings. A subsequent study that identifies the counties that have exceptionally high in-migration rates and makes cross comparisons to establish if their tax settings and public service provisions are markedly more elderly-friendly will also show that the elderly respond in a Tiebout fashion.

The results demonstrate that Tiebout migration cannot be ruled out for the elderly retired despite the rational suspicion that this demographic group may not be as mobile. The weak positive correlations with human services and the weak negative correlations with education service are the first indications that elderly will move to optimize their level of public provision. The clearest suggestion that Tiebout principles apply is seen when we look at the proportions of expenditure financed by different taxes. Considerable positive correlation with proportion of funding borne by sales and other taxes express the fact that elderly will move to where it is optimal for them to live. The generally weak correlations do not suggest causality however since factors like political affinity and proximity to children (Fournier et al., 1988) are determinants of elderly migration and are innately more causal.

In general, the elderly retired must be treated differently as compared to the working populations due to the fact that it enjoys a non-labor and location-independent income. However, the theoretical differences do not exclude this demographic group from behaving rationally and subsuming themselves to Tiebout theories. This suggests that policy intervention that local governments to ensure an optimal level public provision may not be necessary or a revision to target the more immobile groups are needed so as to achieve greatest social benefit.

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