

AN ABSTRACT OF THE THESIS OF

Kenneth B. Hill for the degree of Master of Science in Agricultural and Resource Economics presented on August 30, 1996. Title: Retirees and Local Governments in Oregon: An Empirical Study of the Tiebout Sorting Hypothesis.

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Abstract approved: _____

Bruce A. Weber

Six Oregon counties have been classified as retirement economies by the USDA Economic Research Service; half of these counties are located on the Oregon coast.¹ During the 1980's, 29 of Oregon's 36 counties experienced a 10% or greater increase in their elderly population age 65 and over. The growth of Oregon's elderly population in the past two decades (1970-1990) was 73%; moreover 30% of this growth can be attributed to in-migration.² Communities often perceive a net benefit from retiree development through increased local employment; however they may not realize the impacts on the demand for public services and the impacts on tax burden, property taxes, and other local revenues. Whether retiree in-migration results in a net fiscal gain is uncertain. The ability to reduce this uncertainty may help communities,

¹The USDA, Economic Research Service defines a retirement destination/economy as "The population aged 60 years and over in 1990 increased by 15 percent or more during the 1980-90 through in movement of people."

²Seidel, Karen; Conway, Flaxen, "Oregon's Elderly Population," Oregon Profiles, no. 3, May 1994.

and their policy makers, to avoid pursuing development and growth plans that could result in a net fiscal deficit.

Charles Tiebout developed an economic theory and model explaining an individual's selection of a residential community. His model assumes that individuals weigh the benefits of a community's public goods bundle against their tax liability; they then choose a community with the greatest surplus of benefits (public services) over costs (tax liability). Tiebout's community sorting hypothesis may explain the recent elderly population growth in Oregon. Retirees may be sorting into communities offering local tax and public service bundles suiting their individual preferences.

This paper attempts to answer two questions: What are the economic and fiscal impacts from retiree in-migration? Is a Tiebout community sorting process present concerning retirees? The first question is answered through a literature review of past empirical research. An answer to the second question is attempted through an empirical test of Tiebout's community sorting hypothesis.

Prior empirical research identifies both positive outcomes and consequences associated with retiree in-migration. Retirees stimulate job growth and provide recession insurance to local economies. The net public sector fiscal benefits are uncertain; retiree in-migration may be associated with increased revenue effort.

Three econometric models are developed to empirically test a Tiebout community sorting hypothesis among Oregon's retirees. The first two econometric models describe the retiree sorting process as a process in which an individual shops for a residential community by weighing the benefits of local public services against the costs. The first and

second econometric models attempt to proxy public service levels by using housing value controlled for various types of factors that would be capitalized into housing values (i.e., property taxes, size, income, amenities).

The third econometric model describes the retiree sorting process as a process in which an individual shops for a residential community by weighing the community's tax/spending bundle against housing price. To account for possible feedback influences (i.e., median voter process and property capitalization) the retiree sorting process is modeled as a simultaneous system of equations. The results from the third econometric model suggest retirees weigh the community's tax/spending bundle against housing price, and verifies endogeneity concerns. A community's retirement population positively affects property tax rates. A one percent increase in the retirement population results in .09 percent increase in a community's consolidated property tax rate, on average. Also, retirees do not affect housing prices.

The statistically significant structural coefficients suggest a simultaneous systems model more accurately represents the Tiebout sorting process concerning retirees in Oregon. The reduced form equations are useful for policy analysis.

Retirees and Local Governments in Oregon:
An Empirical Study of the
Tiebout Sorting Hypothesis

by

Kenneth B. Hill

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Completed August 30, 1996
Commencement June 1997

Master of Science thesis of Kenneth B. Hill presented on August 30, 1996

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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DEDICATION

I'd like to take this space to express my appreciation to a few individuals for their guidance, encouragement, support, and patience throughout my graduate studies at Oregon Sate University and during my masters thesis research project.

For guiding me through my graduate studies and masters thesis project, I'd like to thank Rebecca Johnson and Bruce Weber. My thesis advisor, Rebecca Johnson, provided me the opportunity to explore this thesis topic. Bruce Weber gave me the ability to appreciate the forest when I was lost graduate student looking at the trees. He also helped me understand how property taxes "really" work in Oregon.

For encouraging me to change my life's path by getting me to explore my passion of learning, I'd like to thank Marshall English. Marshall put the "graduate school bug" in my ear, and he showed me how to enjoy life's many challenges.

Several individuals were supportive of my thesis project. I'd like to thank the staff at the Oregon Department of Revenue for providing me much of the data for this project. I'd like to thank Diane English for her word-smithing and grammar lessons, as well as the time she spent proof reading the thesis copy. I'd like to thank Jane Moore for letting me adjust my work schedule to complete this thesis.

Finally, I'd like to express my appreciation to my wife Kathie and daughter Emma for their patience. Time and responsibility as a husband and father were traded for late nights in the basement office while working on this thesis. I look forward to returning my attention to being a husband and father.

Retirees and Local Governments in Oregon: An Empirical Study of the
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INTRODUCTION

Before retiring in 1989, the Deatons took periodic vacations to a little resort community along the Oregon coast. For the mainstay of their working years they lived in Anaheim, California. When Mr. Deaton retired from the United States Post Office they decided to relocate to the little resort community where they spent their vacation seasons. Over the past five years the Deatons have seen their little retirement community of Bandon grow. Like Bandon, many similar cities along the Oregon coast have experienced a tremendous increase in their retirement population.

Six Oregon counties have been classified as retirement economies by the USDA Economic Research Service. These counties are Curry, Deschutes, Jefferson, Josephine, Lincoln, and Tillamook.¹ Half of these counties are located on the Oregon coast.²

Between 1980 and 1990, 29 of Oregon's 36 counties experienced a 10% or greater increase in their elderly population age 65 and over. The growth rate of Oregon's elderly population in the past two decades (1970-1990) was 73%; moreover 30% of this growth can be attributed to in-migration.³ The Deatons are a prime example of tourism's indirect influence on elderly population growth. The Deatons chose Bandon as

¹The USDA, Economic Research Service defines a retirement destination/economy as "The population aged 60 years and over in 1990 increased by 15 percent or more during the 1980-90 through in movement of people."

²See Appendix A for a description of the fiscal impacts on four Oregon coastal retirement communities.

³Seidel, Karen; Conway, Flaxen, "Oregon's Elderly Population," Oregon Profiles, no. 3, May 1994.

their retirement destination because they enjoyed this tourist town during their career years.

Proponents of attracting retirees as an economic development strategy cite two major underlying objectives: income stability and job growth. Retiree income is believed to be a stable source of income that is not responsive to a local community's economic fluctuations; therefore retiree income can smooth recession shocks. Also, retiree immigration is believed to positively stimulate a community's economy through job growth. Retiree income is spent on local goods and services thereby increasing demand for local goods and services. In the six Oregon retirement counties, mentioned above, total job growth was 23.4% between 1979 and 1989; however real earnings per worker fell 15.5%.⁴

Changing demographics can place fiscal strain on Oregon's coastal local governments concerning the provision of public services. As people age, their preferences, and hence their demand, for public services change. One could argue that families with children have a higher preference for public services such as public parks, libraries, and schools compared to the young adult portion of the population. Similarly, when retirement begins preferences for such public services may be quite low. This segment of the population has completed its family building role; thus it may have a low preference for these public services compared to families with children. However, when retirees get older preferences may shift again. The elderly's fear of illness, fear of criminal victimization, or lack of mobility may increase demand for local health and safety public services. Increases in local taxes may

⁴"Economic Research Service's 1989 Revised County Typology for Oregon," Economic Research Service, USDA, January 1995.

be necessary to cover changes in the demand for expansion of these public services.

Increased assessed values may increase residents' property tax burden; however the net effect on an individual's property tax burden is dependent upon the relative changes in the tax rate and property value. A residential property owner's overall tax bill will increase if both the tax rate and property's assessed value increase, or the tax rate increases more than the property's assessed value decreases, or the property's assessed value increases more than the tax rate decreases. Increases in property tax rates and/or assessed property values may place additional strain on retirees as well as non-retirees within the community through higher property tax bills.⁵

The fiscal impacts from increased retiree in-migration in Oregon are not well understood. Understanding the fiscal ramifications can be helpful to the local government policy maker in the budgeting process. For example, communities often perceive a net benefit from retiree

⁵Bruce A. Weber and Karen Seidel "Why Haven't My Property Taxes Gone Down Yet?" Oregon Fiscal Choices, Oregon State University Extension Service, April 1994. In Oregon a residential homeowner's tax bill equals the sum of the county tax, school district tax, and taxes to other local governments such as city government, cemetery districts, and community college districts. The taxes paid to each government unit is equal to the tax rate multiplied by the assessed value of the residential homeowner's property. The tax rate is calculated as: (the government unit's tax levy) / (the assessed value of all property within the government unit's jurisdiction). In other words $R = L/A$, where R is the tax rate, L is the levy, and A is the assessed value of all property. The Oregon constitution limits the primary tax levy's growth, without voter approval, to 6% per year. Measure 5 limits the size of an individual property's tax rate to \$10 per \$1,000 of assessed value for non-school local governments (i.e., counties, cities, and special districts). If the tax rate is greater than the Measure 5 limitation then the residential homeowner tax is based on the Measure 5 rate. In general, county government has not seen much compression of tax revenues because of Measure 5. In 1993, county property taxes were 3.4% less than they would have been without the Measure 5 limits.

development through increased local employment; however they may not realize the impacts on the demand for public services and the impacts on tax burden, property taxes, and other local revenues. Whether retiree in-migration results in a net fiscal gain is uncertain. The ability to reduce this uncertainty may help communities, and their policy makers, avoid pursuing development and growth plans that could result in a net fiscal deficit.

Charles Tiebout developed an economic theory and model explaining an individual's selection of a residential community. His model predicts individuals weigh the benefits of a community's public goods bundle against their tax liability; they then choose a community with the greatest surplus of benefits (public services) over costs (tax liability). Tiebout's community sorting hypothesis may explain the recent elderly population growth in Oregon. Retirees may be sorting into communities offering local tax and public service bundles suiting their individual preferences. The net result for many individuals is homogenous communities. If this Tiebout sorting process is occurring in Oregon, then local governments may be able to influence retiree migration patterns through local policy.

This paper attempts to answer the following questions: What are the economic and fiscal impacts from retiree in-migration? Is a Tiebout community sorting process present concerning retirees in Oregon? If so, can Oregon's local governments be successful with retiree attraction strategies? The first question is answered through a literature review of past empirical research. Answers to the second and third questions are attempted through an empirical test of Tiebout's community sorting hypothesis.

The literature review evaluates both economic and fiscal benefits and consequences from retiree in-migration. The literature review begins with a theoretical foundation used to guide the past research. Next, the empirical studies by Sastry, Summers and Hirschl, Fagan and Longino, Glasgow and Reeder, Hass and Serow, and Miller summarize the positive outcomes from retiree in-migration. Empirical research of the unintended consequences is discussed through the work completed by Hoppe, Glasgow and Reeder, Ladd, Mullins and Rosentraub, and Deller. Finally, the literature review concludes with a summary of the key outcomes and unintended consequences revealed thus far. Also, fiscal impacts to Oregon's coastal local governments from retiree in-migration are explored in Appendix A.

An empirical test of the Tiebout community sorting hypothesis is conducted through econometric regression techniques. The Tiebout community sorting hypothesis predicts individuals will sort themselves into communities with similar preferences for public goods and services. In other words, individuals with higher demands for public goods and services will sort themselves into communities with higher public spending compared to individuals with lesser demands for public goods and services. If retirees are low demanders of local public goods and services, then the Tiebout hypothesis predicts they will sort themselves into communities with relatively low public spending. Likewise, if they are high demanders of local public goods and services the Tiebout hypothesis predicts they will sort themselves into communities with relatively high levels of public spending. Three econometric models are developed to test the Tiebout community sorting hypothesis regarding retirees in Oregon. The models help answer the following questions:

Does the Tiebout community sorting hypothesis apply to Oregon retirees?

Are retirees in Oregon sorting themselves into communities based on local property tax rates and local public services?

WHAT ARE THE ECONOMIC AND FISCAL IMPACTS FROM RETIREE IN-MIGRATION? A
LITERATURE REVIEW

Economic Development: Retiree In-migration

The current growth model literature can be described as demand or supply driven. Demand driven models imply that increases in the demand for goods and services produced within the region result in increased labor demand within the region. The increased labor demand bids up wages given an initial fixed supply of labor. As a result, in-migration from surrounding regions will equalize wages in both regions. Supply driven growth models suggest business and jobs follow migration. In other words, people first migrate to amenity rich areas and businesses relocate where an excess supply of labor exists thereby facilitating economic growth. Although retirees do not migrate in search of employment, the independence of their income from the destination region means their consumption acts as an exogenous increase in the region's final demand. Put another way, the economic impacts from retiree in-migration stem from their purchases of goods and services produced within the destination region, or retiree in-migration is expanding the destination region's export base. This increase in exports is what drives economic growth under export base development theory.⁶

Through the multiplier process, the total economic impact from retiree in-migrants is greater than the sum of these in-migrants' direct spendings. For example, retiree in-migrant spending is respent by recipients to purchase additional goods and services, to pay wages of

⁶M. Lakshminarayan Sastry "Estimating the Economic Impacts of Elderly Migration: An Input-Output Analysis," Growth and Change, 23 (Winter 1992) : 62.

employees, to purchase inputs, and to pay local, state, and federal taxes. This "multiplier" process recognizes that a dollar of consumption is circulated (or multiplied) through an economy several times resulting in additional dollars of total consumption and production. This specific multiplier is called a consumption or output multiplier. Other multipliers, calculated in a similar fashion, can be used to describe additional impacts to a local economy from the injection of an additional dollar of spending. An employment multiplier coefficient shows the number of new jobs created by an increase of an additional dollar of export income.

Given the independent nature of retirement income, the regional economic impacts from in-migration may be stronger than an increase in exports of an existing regional industry as well as non-retiree consumption expenditures. This happens because retirees tend to buy more labor intensive services than durable goods; hence a larger share of retirees' purchases occurs within the local economy compared to an existing regional industry's input purchases or non-retirees' consumption. Therefore greater regional economic impacts may be reaped through increased elderly consumption than through an equal dollar increase in a local paper mill's exports, for example; however it would take a lot of retirees to equal the dollar exports of a paper mill. The net result is fewer leakages with increased retiree consumption compared to increases in non-retiree consumption and individual regional industry exports. Put another way, retiree expenditures have a greater multiplier effect compared to non-retiree consumption and increased exports from existing industries.

Positive Outcomes - Job Growth, Income Stability, and Recession Proofing

M. Sastry 1992:

Sastry estimates the economic impacts of elderly in-migration on output, earnings, and employment (by industry) for the state of Florida using an Input-Output (I/O) model.⁷ The I/O model showed overall employment increased by 160,000 workers due to elderly in-migration. Retail trade, health services, eating and drinking establishments, personal services, and business services showed the largest employment growth resulting from the elderly in-migration I/O model shock.⁸ Services, trade, transportation, communications, and utilities experienced the greatest impacts on output.

To compare Florida's net gains from retirement in-migration, Sastry compared the increased retiree expenditure model shock results with a model shock simulating an increase in non-retiree expenditures. This alternative shock is an additional \$448 million of residential investment and a \$4.5 billion of additional non-retiree consumption expenditure. Sastry suggests this alternative exogenous shock may be reflective of "... a composite regional growth strategy that may include ... higher exports or increased tourism among other components."⁹ Job creation is greater under the retiree in-migration shock simulation. Sastry uses his model results to contradict the commonly held belief that retirees create low wage jobs:

⁷The Regional Input-Output Modeling System (RIMS II) was used.

⁸Sastry demonstrates an elderly in-migration shock by increasing elderly expenditures by an additional \$5 billion.

⁹Ibid. , p.71.

Average earnings per worker are \$17,900 as a result of elderly in-migrants' consumption expenditures, while it is \$17,500 for the jobs created by non-elderly spending a similar amount.¹⁰

This difference of \$500 is relatively small; moreover the average employment impact per \$1 million of total output was greater for the non-retiree model. In other words, retirees tend to consume goods with relatively low employment per dollar of output. The total employment impact from retiree expenditures is greater due to fewer leakages. Retirees' expenditures have a greater impact on total output.

Sastry's study suggests that retiree in-migration has a positive impact on the destination economy through total employment impacts by increasing the region's economic base. Thus, local development policies to attract retirees appear to be an effective development tool. However, Sastry does not carry the analysis beyond the specific empirical results of the input-output model. For example, the empirical results show 20.3% of all employment occur in the retail trade sector from increased retiree expenditures. The second largest impacted sector is health services with 7.3% of employment. Clearly, a significant amount of job creation is in the low wage retail sector. Additionally, Sastry's use of average annual earnings can be misleading, especially for employment sectors traditionally characterized as part-time employment with no health insurance benefits. Employment growth in industrial sectors with such employment characteristics may place increased demands on local public services. In the above example, additional part-time retail jobs with no health insurance benefits may increase demand for local public health services. Fiscal impacts on local governments from retiree in-migration are not addressed. This

¹⁰Ibid. , p. 72.

type of analysis is absent from Sastry's study and is difficult for input-output analysis techniques to evaluate.

Summers and Hirschl 1985:

Several other studies have shown that growth in specific types of retirement income creates jobs in rural communities. Gene Summers and Thomas Hirschl cite two such studies. Research conducted by Floyd Harmston, an economist at the University of Missouri, and Eldon Smith, in Kentucky, show direct positive correlation between retiree income type and job growth. Harmston's study infers \$1.22 of additional local income and business revenue is generated by an additional \$1.00 of retiree spending. Smith's study of 170 rural US counties suggest one new job created for every \$4,000 of Social Security payments. The job creation power of retiree's transfer income is quite impressive when compared to \$91,743 of manufacturing payroll or \$64,516 of agricultural sales to create one job.¹¹

Summers and Hirschl identify four ways retirement income can help boost a local economy: 1) direct additional demand for local goods and services, 2) direct source of investment funds for local needs, 3) provision of a growing export market, and 4) tremendous national capital stock that provides development funds for local projects.¹² Since retirees spend a large portion of their income on local goods and services, the multiplier impact from retiree spending is relatively large. The elderly are a potential source of capital funds, and local

¹¹Gene F. Summers and Thomas A. Hirschl, "Retirees as a Growth Industry," Rural Development Perspectives, February 1985 : p. 14.

¹²Ibid. , p.15.

entrepreneurs can capitalize on this source of local capital funds for business expansion and development. A rural community may be able to export a product to the larger retirement population. Pension funds are accessible from all over the U.S. for projects in rural communities. Put another way, multiplier effects from retirees transfer income are not the only vehicle to capture economic gains from retirees.

Fagan and Longino 1993:

Job growth stemming from retiree in-migration is shown to have greater impact than job growth strategies targeting manufacturing development in a study conducted by these two sociologists. Fagan and Longino suggest small communities may be more successful with a "retiree attraction development plan" than a "manufacturing attraction development plan." Smaller communities do not have the level of infrastructure in place that is attractive to manufacturing operations searching for expansion locations.

Retirees have "recession proof incomes (largely discretionary), and substantial assets that they transfer" to a destination community.¹³ The retirees' demand for goods and services provides a positive exogenous shock to real estate, financial, health care, recreational, utilities, insurance, and retail industries. Fagan and Longino provide a strong case for attracting tourists and retirees as a mean of achieving economic development for rural communities. They suggest retirement regions result, or evolve, from regions with high levels of

¹³Mark Fagan and Charles F. Longino, Jr. "Migrating Retirees: A Source for Economic Development," Economic Development Quarterly. (February 1993) : 98.

tourism, and that tourism and retiree attraction development strategies may result in more efficient utilization of local resources than manufacturing development. They support these hypotheses with data showing the "diversifying and stabilizing nature of tourism and retirement."¹⁴

One advantage to recruiting retirees is their relatively stable demand for goods and services since their sources of income tend to be stable. One-fourth of retirees' income in metro and non metro regions comes from property income, usually in the form of interest earned on savings from financial institutions insured by FDIC. Other sources of retiree income are Social Security payments and private pensions. This income tends to remain relatively stable as a local economy experiences fluctuations. Fagan and Longino assert local tax bases increase from retiree in-migration, and it does not place additional demands for large infrastructure investments. "Inmigrating retirees will not strain social services, health care services, school systems, the local criminal justice system, or the natural environment."¹⁵ However, additional research into retirees' impacts on local government comes to an opposite conclusion (Mullins & Rosentraub). This concept will be discussed later.

Nina Glasgow 1990 and Nina Glasgow & Rick Reeder 1990:

Nina Glasgow's study was a data analysis of metropolitan and non metropolitan areas. Her research of post-1980 job growth revealed that non metropolitan retirement county job growth outweighed similar job

¹⁴Ibid. , p. 99.

¹⁵Ibid. , p. 103

growth in non-retirement, non-metropolitan counties; moreover her study shows that local governments have responded to the increased public service needs of retirees by raising taxes and operating fees (Glasgow 1990).

Glasgow and Reeder also evaluated local government expenditure data over the same time period. They found local government expenditures for five public services were lower in retirement oriented counties.¹⁶ The lower local government spending in retirement areas may be attributed to a variety of factors. Retirement in-migration may broaden local tax bases. These areas may benefit from economies of scale with the provision of public services as population increases. Retirement oriented areas may be associated with fiscal conservatism that pressures local governments to cut budgets. Glasgow and Reeder suggest that additional research is needed to specifically address why spending levels vary between retirement oriented and non retirement oriented areas.

Haas and Serow 1990 and 1992:

In their study, Haas and Serow collected data on expenditures and assets for a sample of 814 retirees who had recently moved into the western North Carolina counties around Asheville. They collected asset and expenditure data in a "log book" fashion where individuals recorded a week's worth of daily expenditures within and outside their county of residence. This included data on health care expenditure, large purchases such as housing, vehicles, and durable goods; as well as non

¹⁶The public service programs are education, highways, welfare, health/hospitals, and utilities.

cyclic expenditures such as travel expenses. The profile of the study group cannot be considered representative of the study area's general elderly population. Close to 60% had a college degree, the median household income was greater than \$36,000, and less than one-fourth of the survey population was single, divorced, or widowed. Haas and Serow stress that their results are in no way reflective of all retirement in-migration outcomes in that "all retirement migration pays for itself."¹⁷ Their study is denotative of an economic outcome that could be experienced by an affluent retirement community.

Haas' and Serow's study attempts to show the additional revenues generated by retiree in-migrants outweigh the additional public service expenditures. Using customary economic multiplier analysis, they conclude that retirement migration in this region represents a net economic gain for both the private and public sectors.¹⁸ Regarding private sector impacts, the total impact of consumption expenditure in the local economy was greater than \$45 million, or \$71,600 per household. The largest component of this impact (one-third) is attributed to home purchases. Haas and Serow also estimated the number of jobs created from the expenditures of the sampled households. They showed a total of 943 new jobs were created as a result of the sampled

¹⁷William J. Serow and William H. Haas III, "Measuring the Economic Impact of Retirement Migration: The Case of Western North Carolina," The Journal of Applied Gerontology 11 (June 1992) : 202.

¹⁸They used output multipliers generated from the U.S. Department of Commerce's Regional Input-Output Modeling System (RIMS II) for North Carolina. The output multipliers are used to evaluate the impact to the private economy. Public expenditure multipliers are derived from data collected in the U.S. Census of Governments. These multipliers are based on "actual observed differences among municipalities and counties in terms of population size and population growth rates." By applying the multipliers to the "log book" data, they are able to compare revenue and expenditure estimates.

households' expenditure pattern. The largest shares of these jobs were in the construction and real estate industries followed by jobs created in health care, transportation maintenance, personal care, and restaurants. They estimated the average earnings associated with the new jobs created in the non construction and non real estate sectors to be about \$14,900 per worker. These earnings are slightly lower than the prevailing earnings throughout the region. Haas and Serow attribute this to the concentration of employment in the service industries.¹⁹

The authors also looked at the potential impact of retirees on the revenues and increased demands for public service expenditures of local governments. Their main concern in this study was the scope in which additional state and local tax revenue generated by in-migrating retirees pay for the increased expenditure levels made on behalf of those retirees. They estimated the value of taxes paid by their sample to be about \$2.1 million or roughly \$3,300 per household.²⁰ Roughly two-thirds of this total tax revenue is paid to the state. Thus, the average tax payment to local governments was \$1,136 per household. To estimate the impact on the demand for public expenditures, Haas and Serow calculated public service expenditure multipliers for five public service categories: general government, public safety, public works, health and welfare, and culture and recreation.²¹ The multiplier's value provides an estimated per capita cost of providing services to an

¹⁹Ibid. , p.207.

²⁰Tax revenue includes taxes paid on income, intangible personal property, city and county taxes on real estate, and combined state-county sales taxes.

²¹These expenditures include expenditures for county and municipality government within the study area. Haas and Serow ignored education expenditures because of the absence of children in the sample's population.

additional member of the community, relative to existing per capita cost.²² With their public service expenditure multiplier estimates they estimated the average cost of providing services to a new resident in the study area at \$632; this is roughly \$90 more than existing expense levels.

From their estimated extra tax revenue (\$1,136 per household) and additional public service expenditure demands (\$1,118 per household), Haas and Serow conclude that the additional costs to local governments attributed to retiree in-migration is covered by the additional revenue generated by elderly in-migrants. In other words, retirees do pay for their share of the increased demands they place on local government services. However, in the long run previous cohorts of amenity seeking elderly in-migrants may make more intensive use of public services without contributing offsetting tax revenue contributions. This study of retirement in-migration impacts is a temporal analysis. Haas and Serow recognized the need to reach beyond this spacial limitation.

To truly understand the long-term consequences of elderly migration, one must be prepared to follow the migrant population over time and assess the extent to which, if any, the relative costs and benefits to both the public and private sectors change as the individuals in question age and experience an increasing risk of dependence.²³

Over time increased public service demands may change the revenue structure of local governments. For example, fixed income retirees may vote to finance a capital renovation project (such as a water treatment facility) through a general obligation bond rather than an increased

²²Ibid. , p. 211. The multiplier allows for the existence of economies or diseconomies of scale. In other words, the additional cost of a new resident may be, on average, less or greater than current per capita costs.

²³Ibid. , p. 201.

property tax levy. General obligation bonds are generally repaid by future property tax levy increases, and may be viewed as transferring the cost of growth to the community's future generations. Although Haas' and Serow's study remains in the temporal paradigm, one attempt to overcome this obstacle was recently completed (Ladd 1992).

Miller 1993:

Several university extension programs have conducted detailed economic and fiscal impact studies of specific community retirement developments (Miller 1993, Siegel and Leuthold 1992, and Barkley and Henry). These studies take a "cost accounting" approach in assessing the local government fiscal impacts from a specific retirement community development project. Wayne Miller's study of the Hot Springs Village in Garland and Saline Counties of Arkansas provides a good example of this "cost accounting" approach.

Hot Springs Village is a planned recreation and retirement community. Miller estimates the additional revenues generated and expenses incurred from the development of the retirement community. To calculate the net fiscal benefit to county governments, Miller subtracts the Hot Springs Village residents' share of total county expenditures from the total property tax revenue from the Hot Springs Village development.²⁴ Since the property tax revenue exceeds the retirement community's share of the county expenses Miller concludes the Hot

²⁴The share of expenditures is calculated as the per capita expenditure from local revenue sources multiplied by the population of the retirement community. The total property tax revenue from the Hot Springs Development is the county government mill rate multiplied by the assessed value of Hot Springs Village property.

Hot Springs Village retirement community generates a net fiscal benefit to Garland and Saline counties. Finally, projected fiscal impacts are calculated simply by increasing the property tax revenues and county government expenses by the same percentage increase in population of Hot Springs Village.²⁵ Miller concluded that total benefits accrue to the county governments and school districts because of higher than average assessed property values within the retirement community, and a resulting larger share of property taxes paid per household in the Hot Springs Village retirement community.

The interpretation of Miller's results, and other similar study designs, must be approached with caution. The method of calculating net fiscal benefit ignores basic economic concepts of economies and diseconomies of scale. Future public service demands are estimated by multiplying the community's current per capita expenditure for public services by the additional retiree population. This process assumes that the cost of providing public services remains constant as the community's population grows. As was demonstrated in Haas' and Serow's study using multiplier analysis, various public services experience economies or diseconomies of scale (Haas and Serow 1990 1992). Haas and Serow estimated the average cost of providing services to a new resident at roughly \$90 more than existing expense levels. Miller's approach at estimating future public spending most likely underestimates the "true" impact to public spending from growth.

²⁵Miller calculates similar current and projected net benefits to the two school districts surrounding the Hot Springs Village retirement development.

Unintended Consequences - Low Wage Jobs, Fiscal Impacts, and Tax Burden

Robert Hoppe 1991:

Robert Hoppe highlights some cautions in targeting retiree income as a rural development strategy. In other words, he addresses some of the unintended consequences. Hoppe confirms the widely held belief that retiree unearned income "can help local economies become more stable and less susceptible to variations in employment by local industries."²⁶ This is because unearned income is typically sheltered from local economic fluctuations; however retiree income is vulnerable to fluctuations in the non local economy. For example, changes in federal legislation affecting Social Security or other income transfer programs may act as a negative exogenous shock to the local economy. The elderly are dependent upon unearned income compared to income earned from wages. The majority of the unearned income comes from federal transfer payments. For 1983-84, 53% of non metro elderly income came from federal transfer programs.²⁷ Moreover, the elderly's dependence on government transfer programs is greater in non metro areas than in metro areas.

Hoppe discusses the marketing problem of attracting retirees. Obviously, the best retirees to attract, from a development perspective, are the higher income retirees. Appealing to this group of retirees reduces the potential market. For example, a community restricting its attraction plan to retirees and elderly with incomes that is at least

²⁶Robert A. Hoppe "The Elderly's Income and Rural Development: Some Cautions," Rural Development Perspectives. (February-May 1991) : p.27.

²⁷Ibid. , p. 28. Social Security represented 40% of the elderly's income in non metro areas.

four times the poverty level would have a target market consisting of 20% of the elderly population, or 5.4 million.²⁸ The lower the target income level of retiree migrants, the greater likelihood of attracting dependency migrants; thus increasing the unintended consequences. Also, the elderly seldom move; most reside in the area where they spent most of their working years. They are less likely to migrate than other segments of the population. For example, less than 0.9 % of the population over the age of 65 migrated between states among 1986 and 1987; where 3.1% of the non elderly moved between states in this period.²⁹

However, Hoppe confirms that "property and transfer incomes have strong income and employment multiplier effects in rural areas" (including Social Security). Not all job growth created by retiree spending is in the high-wage health sector. Many of these jobs are categorically low-wage in the retail and service industries. Also, some rural areas may not have the business base to benefit from multiplier effects. In other words, there may not be enough local business for the elderly to shop.

Regardless of the potential positive impacts from retirees' property and transfer income, Hoppe suggest retirees should not be viewed as the economic development savior for rural communities. Many of the rural elderly are poor and their dependency for local services places additional strain on local governments. This fiscal strain will worsen as the retiree's age in their destination community.

²⁸Ibid. , p. 30.

²⁹Ibid. , p. 30.

Glasgow 1990, Glasgow and Reeder 1990:

Nina Glasgow published two studies in 1990 that compared local county government fiscal data from the country's 3,097 counties, or county equivalents over the period 1970 and 1980. Approximately 20% of all non metropolitan counties are retirement oriented.³⁰ Glasgow's and Reeder's work is more descriptive than predictive, and laid the foundation for future research attempting to explain fiscal impacts from retirement in-migration.

Glasgow reports two findings about revenue characteristics of retirement oriented counties. First, she reports tax and revenue burdens from 1977 to 1982 are lower in retirement oriented non metropolitan counties than other non metropolitan counties.³¹ In other words, the share of local income going to local taxes and revenues was lower in retirement oriented non metropolitan counties. Glasgow suggests this adds weight to retirement oriented areas' ability to attract retirees, and corroborates earlier studies indicating the location decision making of retirees is based on local taxes and revenue effort. Second, in this same period these retirement oriented counties experienced growth in per capita income concurrent with increased revenue effort. This finding supports the hypothesis that retirees place increased demands for certain local public services. Moreover, local governments are responding through increased taxes and other revenue sources to cover the increased costs of providing public

³⁰The retirement county classification is identified by a classification scheme developed by the U.S. Department of Agriculture.

³¹Revenue burden is the sum of local taxes, user charges, and other local revenue expressed as a percentage of local income.

services. This may suggest retirement oriented areas are losing their comparative advantage (i.e., lower taxes and revenue effort) in the ability to attract retirees over time.

Ladd 1992:

This study measures the average impacts on local governments' per capita spending and tax burdens from local population growth over the period 1978 to 1985. Two of several questions addressed in this study are: Which spending and revenue categories are impacted the most from population growth? Can spending and revenue impacts be attributed to specific population age groups?³² Ladd recognizes that there is no clear economic theory to predict how growth impacts local government spending and tax burdens.

On the one hand, the publicness of publicly provided goods or economies of scale or density could lead to lower per capita spending. On the other hand, to the extent that growth produces a harsher environment for providing public services, it would result in higher per capita costs and consequently higher per capita spending.³³

Intuition can guide one to expect total spending to increase as population grows; however determining if spending growth will increase faster or slower than population growth is difficult.

Using national data on per capita spending and revenue by type for 248 large counties, Ladd uses ordinary least squares (OLS) regression techniques to estimate the impacts of population and economic growth on

³²Helen Ladd, "Effects of Population Growth on Local Spending and Taxes," Part V in Research in Urban Economics, vol. 9 (JAI Press, 1993), p. 182.

³³Ibid., p. 221.

the change in local governments' per capita spending and revenues. The general form of the OLS regression equation for per capita spending is:

$$\text{EXPCH} = a + b \text{POPPCH} + c \text{POPPCH}^2 + e$$

where EXPCH is the percentage change in per capita expenditure. POPPCH and POPPCH² are percentage change in population and population squared respectively. In subsequent expenditure equations, Ladd adds additional independent variables to proxy for growth (i.e., percentage change in real per capita income and number of jobs per resident), to proxy for population composition (i.e., percentage change in the share of population age 19 years and younger and share of population age 65 and older), and to proxy the level of local expenditure subsidy (i.e., percentage change in the ratio of local spending to state and local spending for specific spending categories). The addition of these additional independent, or control, variables allow for extracting the impacts of specific growth items that are hidden in the general OLS regression equation; moreover including additional explanatory variables improves the explanatory power of the model as measured by R-squared. Similar equations are used to estimate percentage change in tax burdens. Ladd defines tax burden "on a per capita basis and relative to the income of county residents."³⁴

Evaluating the predictive impacts on spending from population growth are fairly clear; rapid population growth places pressures on local governments to increase per capita public expenditures. The most noticeable impacts are in transportation expenditures and debt interest payments.³⁵ The variables of interest, for the purpose of this paper,

³⁴Ibid. , p. 184.

³⁵Ibid. , p. 202

are the percentage change in the under 20 population (AGE 19) and the percentage change in the over 64 population (AGE 65). With respect to expenditure impacts, the regression coefficients on these two variables of interest can be interpreted as follows. First, an increase in the share of the elderly population has no statistically significant impact to specific per capita spending areas with the exception of direct general expenditures. Ladd's results indicate a statistically significant negative relationship between growth in the share of the elderly population and growth of direct general expenditures. A 10% increase in the share of the population over 64, *ceteris paribus*, results in a 20% reduction in per capita direct general expenditures on average. Second, increases in the elderly population tend to reduce current expenditures and capital outlays. Specific spending categories negatively impacted by a growing elderly population include education, housing/environment/urban development, and administration expenditures. Third, elderly population growth tends to increase expenditures for transportation, public safety, and social service programs.

Local governments' revenue come from a variety of sources. These include own source revenue and intergovernmental revenue. Own source revenue includes property taxes, sales taxes, and fees and charges. Intergovernmental revenue is aid from federal and state governments. The property tax is the major own source revenue for county governments; however property taxes represent a much smaller share of own source revenue for municipalities. In assessing revenue impacts from population growth, Ladd focuses on the concept of tax burdens. Tax

burden provides a measure of how much income goes to taxes.³⁶ The foundation behind a tax burden approach is that a given level of taxes imposes a greater hardship on low-income individuals compared to high-income individuals. The regression results indicate that elderly population growth is associated with reduced burdens of total own-source revenues, total taxes, property taxes, and sales taxes *ceteris paribus*. For example, a 10% increase in elderly population growth reduces average burden of total taxes by 31%. In other words, the amount of income going to all taxes is reduced on average. The statistically significant AGE 65 coefficient about the own source revenue and total tax OLS regressions may be considered consistent with the hypothesis that elderly voters tend to keep their tax burdens down.

The emphasis of Ladd's study was to assess the impact of general population growth on local government spending, revenue, and tax burden for the period 1987 to 1985; however her results do provide some insight on the fiscal impacts from retirement in-migration. In summary, Ladd's study indicates elderly population growth has a statistically significant negative influence on total tax burden. In areas experiencing growth in the share of their elderly population tax burdens are reduced and the demands for some public services increase. Ladd's study is unable to determine specific impacts to revenues from elderly population growth. In other words, one cannot interpret the statistical relationship between elderly population growth and the change in total tax revenue over the study period. This is because she did not conduct her revenue regressions with control variables as in the earlier

³⁶A simple definitional equation for tax burden is: $\text{Tax Burden} = \text{Tax} / \text{Income}$.

expenditure regressions. This information would be helpful in answering the following questions: How does elderly population growth influence local governments' revenue raising abilities? Do areas experiencing rapid elderly population growth change the revenue structure of local governments? Are areas experiencing rapid elderly population growth paying their share of development's costs or are they shifting that burden onto future generations?

Mullins and Rosentraub 1992:

This study analyzed how near retirement and post retirement populations impact local government expenditures. In other words, Mullins and Rosentraub attempt to evaluate people's demand for local public services as they near retirement, as well as during the retirement years. Using local government expenditure data for 741 counties in metropolitan statistical areas, an ordinary least squares (OLS) model specification was used to assess "the impact of changes in the relative proportion of retirement- or near-retirement-age population on local government expenditures within counties."³⁷ To isolate the effect of other social, economic, and locational characteristics of the county on expenditures several control variables were included in the model.³⁸

Mullins and Rosentraub express local governments' expenditure for public services as a function of the county's physical characteristics, population and income distribution characteristics, the local

³⁷Daniel R. Mullins and Mark S. Rosentraub, "FISCAL PRESSURE? The Impact of Elder Recruitment on Local Expenditures," Urban Affairs Quarterly 28 (December 1992) : 340.

³⁸Ibid. , p. 340.

governments' resource base, the level of intergovernmental revenue from the state, and internal and external demand preferences.³⁹ Mullins and Rosentraub estimated total per capita expenditures, as well as individual program per capita expenditures: per capita expenditures for capital outlays, education, library services, public hospitals, health services, police, sewerage, sanitation, and parks.

Their results indicate a strong and statistically negative relationship between the share of the population over 55 and direct general expenditures. At first glance, this suggests that retirees place no additional demands for local public services; however the model shows a positive relationship between the share of the over 55 population that is over 65 and direct general expenditures. This positive relationship is significant at the 10% level. In other words, although an increase in the over 55 population reduces the demand for local public services as they move into retirement (over 65) their demands for local services increases. At some point the increased demands could offset the benefits of reduced public service demands associated with the near-retirement age population.⁴⁰ Mullins' and

³⁹The specific model can be expressed as: Local Per Capita Expenditures = f (55 or Older, Retire, Population, Population², Growth, School Age, Private School, Density, Per Capita Income, % Poverty, Social Security, Pre-1940, Tax Share, Employment, Manufacturing, Retail, Service, Household Size, Property Tax, State Government, Service Responsibility, Service Preference).

⁴⁰Ibid. , p. 351, footnote 6. After considering the results of their individual service program estimates, Mullins and Rosentraub are uncertain that the increased expenditures associated with the retiree population are a result of greater demand, social conscience, or a price effect from a unit cost reduction for services consumed by the non retiree population. For example, retirees are not direct consumers of public education, but an increase in the retiree population will reduce the unit cost of providing education through their contribution to an increased tax base. Hence, the consumers of public education will

Rosentraub's model results indicate that a 10 percentage point increase in the retiree population will increase direct local public expenditures by \$33.75 per capita, or an amount equivalent to 3.5% of total per capita expenditures.⁴¹

Next, the researchers used the same general functional model specification to assess how population age distribution impact spending on specific public services: capital outlays, per student and per capita education, library, hospital, health, police, sewerage, sanitation, parks, and housing. In all public service programs expenditures with a statistically significant coefficient on the over 55 variable, with the exception of hospitals, the result was a negative impact on expenditures. However, an increased portion of the over 55 population that is beyond retirement age (over 65) results in increased public service expenditures for all categories, with the exception of natural resources. The authors also estimated per capita expenditures for public welfare, highways, fire, and correctional services; however they found insignificant parameter estimates regarding the coefficient on the over 55 proxy and therefore did not publish the results for these specific public services estimates.

Community economic development strategies attracting the near retirement age population may, in the short run, provide fiscal benefits to local governments in the form of reduced service expenditures. In the longer run, however, such fiscal benefits deteriorate as the portion

demand more education services due to a lower unit cost that is equivalent to a reduced unit price of education.

⁴¹Ibid. , p. 344.

of the community's population enters retirement age (65 and older) and expenditures on local public services increase.⁴² The authors conclude:

From a public policy perspective, then, targeting programs to attract a specific age cohort of older citizens can be seen to be *both* fiscally and socially unsound. From a financial perspective, immediate windfalls from attracting higher-income, low-service-demanding elders will give way to an older population that will want and need a more expanded public sector. As a result, any fiscal gains will be quite temporary.⁴³

Rather than adopting a strategy to attract any specific age cohort of people that may provide immediate public fiscal benefits and will then become a burden on the public sector, it may be preferable (socially and economically) for local community governments to ensure a natural age mix of their population. Socially, this would reduce friction between age groups competing for scarce public services and limited resources. Economically, maintaining a natural population age mix may be more efficient concerning the provision of local public services.⁴⁴

Mullins' and Rosentraub's study focused on one fiscal impact ramification: the impact on local public expenditures. No attempt was made to estimate the impact on local revenues such as property taxes and local fees and charges.

⁴²Ibid. , p. 349. These results were achieved while controlling for a variety of other factors that affect local government expenditures.

⁴³Ibid. , p. 349.

⁴⁴See Robert M. Schwab's and Wallace E. Oates' model of efficient community composition with respect to the price of final output. They find a general efficient community composition does not involve the typical Tiebout homogenous community. "Community composition and the provision of local public goods: A normative analysis," Journal of Public Economics, 44 (1991) : p. 218.

Deller 1995:

The most recent published research on the economic impacts of retirement migration was completed by Steven Deller. Deller used the regional economic modeling system (REMI), developed by George Treyz, to examine the impact to a regional economy from a hypothetical retiree attraction policy adopted by the state of Maine.⁴⁵ The hypothetical retiree attraction policy is simulated by adjusting the REMI model to account for the number of in-migrating retirees to increase by 5,000 annually from 1992 through 2000. Deller focused on private sector impacts by evaluating changes in employment (i.e., employment multipliers). The simulation calculated an overall "implicit employment multiplier of .5545."⁴⁶ In other words, one job is created for every two new retiree in-migrants. The retail sector has the largest employment multiplier of .1392. This is consistent with similar input-output simulations.

Although the focus of Deller's study is on changes in private sector employment, he does address public sector fiscal impacts from the hypothetical retiree attraction policy. His approach to public sector fiscal impacts is through the public sector employment multiplier. The public sector employment multiplier is the second largest multiplier

⁴⁵Steven C. Deller, "Economic Impact of Retirement Migration," Economic Development Quarterly 9 (February 1995). REMI is an input-output and econometric simulation model. It has been previously used in the state of Maine for policy analysis and regional economic forecasting. REMI is similar to traditional input-output models that calculate direct and indirect multipliers in employment and income. This multiplier data is then transferred into the econometric component of the model where estimates of wages, migration levels, population, and demand/supply of commodities are calculated.

⁴⁶Ibid. , p. 33.

(.0860) next to the retail sector. This fairly large employment multiplier tends to add support to the notion that retirees place additional demands for certain public services. As the region's population increases, aggregate demands for public services increase; thus public sector employment increases.

The magnitude of the public sector employment multiplier appears inconsistent with the findings of Glasgow and Reeder; they found expenditures for local public services in retirement oriented rural counties to be much lower than non-retirement oriented rural counties. Glasgow and Reeder also found local tax revenue to be lower in retirement oriented rural counties. Deller's policy simulation model is unable to assess the impact to local tax revenue; however it is reasonable to hypothesize that local tax revenue may increase to support the employment multiplier's magnitude. As Deller suggests, "Clearly, more analysis of the impact of retirement migration on the public sector is needed."⁴⁷

Summary of Key Impacts & Unanswered Questions

What are the economic and fiscal impacts from retiree in-migration? The prior empirical research reveals both positive outcomes and unintended consequences associated with retiree in-migration. An answer to this question is summarized in the following seven summary points:

1. Retirees stimulate job growth: The bulk of the literature on retirement in-migration's positive economic impacts supports the

⁴⁷Ibid. , p. 35.

hypothesis that retirement income acts as an exogenous shock to a local economy, thereby stimulating job growth through the multiplier process. Most of the additional jobs are in retail trade, personal services, health services, and food and beverage services (Sastry). Although retiree income can stimulate job growth, not all jobs are in high-wage industries or occupations. Most of the jobs are in relatively low-wage retail and food service industries (Hoppe).

2. Retirees provide recession proof insurance to local economies:

Although retiree income can stabilize local economic fluctuations, retiree income is vulnerable to non local government legislation regarding pension and federal transfer income (Hoppe).

3. Inconsistent fiscal impacts: Local public service expenditures and local tax revenue tend to be lower in retirement oriented rural counties (Glasgow and Reeder); however a retiree in-migration policy simulation model shows a fairly large public sector employment multiplier (Deller). This multiplier suggests retiree in-migration places increased demands, and spending, for local public services. The current research has focused on the economic benefits from amenity seeking retirement migrants; the research has not thoroughly evaluated unintended consequences from amenity, or dependency, seeking retirement migrants.

4. Difficulty with using economic theory to guide fiscal impact analysis: There is no clear economic theory to predict how growth impacts local government spending and tax burdens. Economies of scale may lower per capita spending on public services; however growth may lead to additional difficulties in providing public services that can result in higher per capita spending (Ladd).

5. Net fiscal benefits are uncertain: Some studies suggest that retirees pay their fair share of taxes (Haas and Serow, Miller). The long term fiscal impacts from retirees may result in a net loss to local governments (Mullins and Rosentraub). Near retirement age populations tend to have a low demand for local public services; however as the composition of the over 55 age group consists of more retirees this group tends to place greater demands on public services. These services include: capital outlays, per student education, library, hospital, police, sewerage, sanitation, parks, and housing.
6. Retiree in-migration may be associated with increased revenue effort: Between 1977 and 1982, retirement counties showed per capita income growth concurrent with increased local government revenue effort (Glasgow). In other words, retiree in-migration may be associated with an increased share of local income going to local property taxes and local government revenue.
7. Fiscal impacts on local governments may be larger than first expected: One tool used by state and local governments to attract retirees is the reduction of pension income and property taxes. The consequence of this tool is reduced revenues to provide public services. This result, combined with the increased expenditures associated with retirees, may actually increase fiscal stress placed on local governments.

The demand driven growth model can be used to explain the positive outcomes from retiree in-migration. This is especially apparent concerning job growth; however the wage impacts may not conform to the model's prediction. The model predicts wages to initially increase in

the region where increase demand is experienced. In equilibrium, wages would drop and may remain higher than the pre exogenous demand increase period. The empirical evidence suggests retiree income does stimulate job growth; however the wages associated with the bulk of this job growth are in the relatively low-wage retail and food service industries. Between 1979 and 1989, Oregon's six retirement oriented counties experienced 23.4% job growth while earnings per worker declined 15.5%.

There is no clear economic theory to predict how growth impacts local government operations. Much of the empirical work has focused on per capita expenditure impacts; however recent work has begun to address revenue and tax burden impacts. The fiscal impact analysis has been limited to county level governments. A focus on municipal governments may reveal different results since people usually choose their relocation destination as a city, not a county.

IS A TIEBOUT COMMUNITY SORTING PROCESS PRESENT WITH RESPECT TO RETIREES
IN OREGON? AN EMPIRICAL TEST OF THE TIEBOUT MODEL

Tiebout's Community Sorting Hypothesis

Those who are tempted to compare this model with the competitive private model may be disappointed. Those who compare the reality described by this model with the reality of the competitive model - given the degree of monopoly, friction, and so forth - may find that local government represents a sector where the allocation of public goods (as a reflection of the preferences of the population) need not take a back seat to the private sector.

*Charles M. Tiebout
from A Pure Theory of Local Expenditures.*

In 1956, economist Charles Tiebout laid a theoretical foundation of local government expenditures for public goods and services. This seminal piece is a refinement of the earlier works in public finance theory completed by Richard Musgrave and Paul Samuelson. Tiebout's refinement is focused on two aspects of the nature underlying public goods: 1) the problem for an individual consumer of public goods to register their true preferences for such goods, and 2) the differences between federally and locally provided public goods. Musgrave and Samuelson defined a public good as a good in which the consumption by one individual does not diminish the consumption of another. In other words, public goods are non-rivalrous.

Tiebout posits that many public services are not provided by a central, or federal, government. Services such as police protection, fire protection, and education are provided by local governments, not a central federal government. Hence, Tiebout describes a simple model that "yields a solution for the level of expenditures for local public

goods that reflects the preferences of the population more adequately than they can be reflected at the national level."⁴⁸

The problem of individual consumers to register their true preference for public goods is the cornerstone of Musgrave's and Samuelson's work, and it is the foundation of Tiebout's model. According to Tiebout, Musgrave and Samuelson describe consumers being "surrounded by a government whose objective it is to ascertain his wants for public goods and tax him accordingly."⁴⁹ Thus, a tax collected by a governmental unit would represent the collective preferences of the consumers within the jurisdiction of the governmental unit. This is true if all consumers state their true preferences for public goods and services to the governmental unit. However, Tiebout noticed that there is no process that forces consumers to present their true preferences. Rational consumers will attempt to understate their true preferences to enjoy a public good or service without paying a tax.⁵⁰ This is the classical free-rider problem associated with public goods and services.

Tiebout believes social institutions exist that force individual to reveal their true preferences for public goods and services, thereby allowing local governments to tax.⁵¹ The existence of many communities with different tax/expenditure patterns allows preferences for public goods and services as well as the taxes to pay for them. For example, consider a university student in a small college town completing his/her graduate education and preparing to commence his/her career in the "real

⁴⁸Charles M. Tiebout "A Pure Theory of Local Expenditures," The Journal of Political Economy, vol. LXIV, no. 5 (1956) : p. 416.

⁴⁹Ibid. , p. 417.

⁵⁰Ibid. , p. 417.

⁵¹Tiebout defines an individual as a "consumer/voter." A consumer voter is a taxpayer who votes in local elections.

world." What variables will influence his/her relocation decision? The most evident variable is the relative success of landing a job. While s/he may prefer to remain in a small college town, it may not have as many employment opportunities as a larger municipality. If the graduate student has children, then a high level of expenditures on education, libraries, and parks may be important variables. If this graduate student can be gainfully employed in any location, then this individual will pick a community (city or municipality) that best satisfies his/her preferred bundle of public goods and services.⁵²

Now consider a person entering his/her retirement years. What variables will influence his/her relocation decision? If this retiree believes that increased age increases his/her chance of becoming a victim of crime, then expenditures on police protection may be an important variable. Moreover, since the retiree is likely to not have school age children, expenditures on public education may be less important. Also, a "limited income" retiree may desire to maximize disposable income by seeking an area with low taxes. Thus, this individual will also pick a community that best satisfies his/her preferred bundle of public goods and services and taxes. The net result is that the graduate student and the retiree are likely to relocate to different communities.

The above example is an abstract of Tiebout's model. Given revenue and expenditure patterns of local governments, individuals relocate to communities whose local government best satisfies their

⁵²Tiebout's model assumptions preclude job market characteristics in an individual's relocation decision.

preferred bundle of public goods and services.⁵³ The greater selection of communities facing the individual then the greater likelihood the individual will realize his/her preferred bundle. Tiebout's model has the following assumptions:

1. Full mobility of individuals: Individuals are fully mobile and will seek the community that provides their preferred bundle of public goods and services.
2. Perfect knowledge of government operations: Individuals are fully knowledgeable of local governments' expenditures and revenues to comparatively shop.
3. Multiple communities: There are many communities for individuals to choose as their residential destination.
4. Employment opportunities are not considered: Employment opportunity within a community (i.e., unemployment rate) is not a variable in an individual's relocation decision. Tiebout assumes "all persons are living on dividend income."⁵⁴ This assumption fits extremely well with this specific study of retiree population.
5. No spillover affects between communities: Public services provided in one community do not provide external economies or diseconomies to a neighboring community. In other words, increased police patrolling in one community does not result in chasing criminals into a neighboring community.

⁵³Ibid. , p. 418. Tiebout observes a difference between central level public finance and local level public finance. "At the central level the preferences of the consumer-voter are given, and the government tries to adjust the pattern of these preferences, whereas at the local level various governments have their revenue and expenditure patterns more or less set." In Tiebout's model the revenue and expenditure patterns are assumed fixed.

⁵⁴Ibid. , p. 419.

6. Optimal community size: For each community's bundle of public goods and services, with a corresponding level of expenditures and revenues, there is an optimal community size. In other words, there is an optimal number of residents that can be served with the given bundle of public goods and services. This is the number that is served at lowest average cost. This implies a U-shaped average cost curve; hence some production factor is fixed. The fixed factor may be the geographic land size of the community.

7. Communities seek the optimum community size: Communities below their optimum size attempt to attract new residents to lower the average cost of providing public goods and services. Communities above their optimum do the opposite. In other words, communities optimize their population to reach the low point on their average cost curve.

The Tiebout sorting hypothesis works as follows. In disequilibrium, there is a set of individuals who are unsatisfied with the bundle of public goods and services provided by their community. There is another set of individuals who are satisfied with the bundle of public goods and services provided by their community. Under the above assumptions, migration from communities above optimal size to communities below optimal size occurs. In other words, the dissatisfied individual migrates to a community that satisfies his/her preferred bundle of public goods and services. The action of moving, or not moving, is equivalent to the concept of willingness to pay in private markets. It also reveals the individual's demand for public goods,

given fixed local government expenditure patterns.⁵⁵ Tiebout gives an excellent description of the mobility process:

Just as the consumer may be visualized as walking to a private market place to buy his goods, the prices of which are set, we place him in the position of walking to a community where the prices (taxes) of community services are set. Both trips take the consumer to market. There is no way in which the consumer can avoid revealing his preferences in a spatial economy. Spatial mobility provides the local public-goods counterpart to the private market's shopping trip.⁵⁶

If individuals are perfectly mobile then they choose the local government whose revenue and expenditure pattern is reflective of their preferred bundle.

In long run equilibrium, individuals sort themselves into communities offering their preferred bundle of public goods and services at preferred tax levels. In the above example of the graduate student and the retiree, each will choose a community reflective of a preferred bundle. The graduate student with children will choose a community with relatively high expenditures on schools, libraries, and parks. The retiree will choose a community with relatively low expenditures on schools but relatively high expenditures on police protection and low property and income taxes. The net result in this model is homogenous communities regarding bundles of public goods and services and tax levels. In other words, communities can be characterized as retirement communities, tourist communities, educational communities, etc.

There have been several criticisms of Tiebout's model. These criticisms focus on the model's assumptions. The two most widely criticized assumptions are "full mobility of individuals" and dividend

⁵⁵Ibid. , p. 420.

⁵⁶Ibid. , p. 422.

income (i.e., employment opportunities are not considered in an individual's relocation decision). These two criticisms appear obvious upon first observation. Individuals may not be fully mobile due to current job commitments and family ties. However, the characteristics of amenity seeking retirees seem to fit nicely with the assumptions of this theoretical model. Amenity seeking retirees do not relocate to a community due to the relative success of securing employment. Hence, the level of expenditure on local public goods and services (and the level of taxes) should influence the community's attractiveness to retirees.

Another criticism of Tiebout's model centers on the ability to achieve a Pareto optimum allocation of public goods and services. A Pareto optimum allocation of public goods and services is an allocation in which there exist no other allocation of public goods and services that makes every consumer as well off or better. Put another way, a move away from a Pareto optimum allocation result in one consumer being worse off. The stringent assumptions set forth in Tiebout's model results in a Pareto optimum only if there are as many communities as there are individuals. In other words, each individual lives in their own community.⁵⁷ Tiebout realizes this shortcoming of his model, but

⁵⁷See Truman F. Bewley, "A Critique of Tiebout's Theory of Local Public Expenditures," Econometrica, May 1981, for a thorough analysis of this criticism. Robert M. Schwab and Wallace E. Oates, "Community composition and the provision of local public goods," Journal of Public Economics, vol. 44, 1991, present an optimal public goods allocation model that involves a trade-off between the benefits of a community with homogenous public goods demand and benefits from a heterogeneous community with respect to the production of public goods. They find homogenous community composition does not result in efficiency. Keith Dowding, "Tiebout: A Survey of the Empirical Literature," Urban Studies, vol. 31, May 1994, provides an excellent review of previous Tiebout sorting hypothesis empirical research.

his model is not intended to estimate reality. He presents his model "to show the assumptions needed ... which yields the same optimal allocation that a private market would."⁵⁸ Despite the criticisms of Tiebout's model, it serves as a useful theoretical foundation in answering the second question of this thesis: "Is a Tiebout community sorting process present concerning Oregon's retirees?"

Tiebout's community sorting hypothesis serves as the theoretical foundation for the task of evaluating Oregon's local governments' potential success with encouraging retiree in-migration. The hypothesis posits that local governments can attract retirees into their jurisdiction by shaping the local public goods and tax bundle to meet the desires of retirees. A community's potential residents weigh the benefits of a community's public goods bundle against their tax liability; they then choose a community with the greatest surplus of benefits (public services) over costs (tax liability).

The following models start with an initial hypothesis that local governments can shape local fiscal policy (property taxes and spending) to meet the desires of retirees and thereby encouraging retiree sorting. Retiree sorting implies more than just retiree in-migration. It also implies out-migration of other population groups.

Using the Tiebout community sorting hypothesis as a theoretical foundation, a community's retirement age population can be expressed as a function of the public services and local tax bundle the local government provides its residents. The general form of this model with

⁵⁸Charles M. Tiebout "A Pure Theory of Local Expenditures," The Journal of Political Economy, vol. LXIV, no. 5 (1956) : p. 421.

the following equation, with i representing a specific community or city, is:

$$\text{Retirement Population}_i = f (\text{Public Services and Tax Bundle}_i);$$

This general functional form describes an econometric Ordinary Least Squares (OLS) multiple regression model specification. Three econometric models are developed. All models draw on a cross-sectional data set of 208 Oregon cities. Implicit in the use of a cross-sectional data set is that each observation represents individual equilibrium points. This seems appropriate given the Tiebout process involves individuals comparing communities. Put another way, this process is a matter of comparative statics; thus a cross-sectional data set is appropriate.

Model I: Public Services Capitalization

Tiebout (1956) hypothesized that individuals choose to live in a community based on a tax-expenditure package offered by the community's local government; thus tax-expenditure packages offered by communities are hypothesized to influence an individual's residential locational choice. Put another way, individuals can be visualized as shopping around for the best tax-expenditure package offered by neighboring and distant communities. This could be considered a process similar to an individual consumer shopping for a durable good, such as a dishwasher, where the purchase involves choosing the best price-value package offered by various brands.

In the equation below, four explanatory variables (C, O, S, H) attempt to capture the Tiebout tax-expenditure bundle.

$$R = \beta_0 C^{\beta_1} O^{\beta_2} S^{\beta_3} H^{\beta_4} A^{\beta_5} B^{\beta_6} I^{\beta_7} P^{\beta_8}$$

Dependent Variable:

R = Population 65 years of age or older

Tax-Benefit Surplus Components:

C = City tax rate

O = County tax rate

S = School district tax rate

H = Median house value; level of public services

House Value Control Variables:

A = Median age of a home in the city (1995 minus median year built)

B = Average number of bedrooms of occupied and vacant homes.

I = Median Household Income

P = Population

C, O, and S are tax variables. They are the city property tax rate, county property tax rate, and the school district property tax rate respectively. An individual property is taxed by these three taxing jurisdictions.⁵⁹ The tax rates, when multiplied by the

⁵⁹Additional taxes are levied for other special districts (i.e., rural fire, cemetery, port, water districts, education service districts) and for the repayment of principle and interest of general obligation bond levies. City, county, and K-12 school district tax rates are used in the model because they are the largest and most stable tax rates.

property's assessed value, determine the tax bill. The tax bill is the price an individual property owner pays for public services offered by the city, county, school district, etc. during the fiscal year. Thus, the tax rate proxies for the annual price an individual property owner pays for public goods and services, the tax portion of Tiebout's tax-expenditure bundle. The signs of the tax (price) coefficients are expected to be negative; higher taxes (prices of public services) make a community's public services more expensive given the level of public services held constant. This is synonymous to the basic law of demand; less of good is demanded as its price increases.

The median value of a house (H) enters the model as an exogenous explanatory variable which proxies for the level of the city's public services. Previous empirical research has shown that the level of public services is capitalized into housing value. Oates (1969) hypothesized that the value of local public goods and services are capitalized into a community's property value. Following Tiebout's model, a community's potential residents weigh the benefits of a community's public goods bundle against their tax liability; they then choose a community with the greatest surplus of benefits (expenditure on public services) over costs (tax liability). The community's level of public goods attracts households thereby increasing property values. Specifically, high level of public goods and services increase property values and low level of public goods and services decrease property values.⁶⁰ Incorporating Oates' capitalization conclusions into the

⁶⁰Oates regressed property values (median value of owner occupied dwellings - house and lot) on housing characteristics, commuting distance, household income, community status, per pupil education expenditure, and the effective property tax rate. The estimated

model support the use of median home value as a proxy for the level of public services. Put another way, a city's median housing value significantly captures the level of the city's public services bundle. Higher median housing value suggests higher levels of public services. The expected sign on the estimated coefficient of H is indeterminate and is to be determined empirically. If retirees are high demanders of public services then the sign should be positive suggesting retirees migrate to communities with relatively greater levels of public services (i.e., greater median housing values) given the tax price of public services held constant. On the other hand, if retirees are low demanders of public services then the sign should be negative suggesting retirees migrate to communities with relatively lower levels of public services (i.e., lesser median housing values) given the tax price of public services held constant.

The next four explanatory variables (I , A , B , and P) are included to control the (H) variable as a proxy for the level of public services. Income (I), the age of a house (A), the number of bedrooms (B), and population (P) can be expected to be correlated with the house value, or housing prices. Since these controls tend to be correlated with housing value, their inclusion narrows the interpretation of the estimated coefficient on the (H) explanatory variable. Peter Kennedy provides an excellent explanation of including correlated explanatory variables as controls and how inclusion of these control variables can alter interpretations of estimated coefficients.

regression revealed a statistically significant positive coefficient on the per pupil education expenditure; thereby suggesting increased education expenditures leads to increased property value - capitalization.

Consider the case in which a dependent variable is being regressed on two highly correlated independent variables. Variation in the two regressors can be classified into three types: variation unique to the first regressor, variation unique to the second regressor, and variation common to both. In measuring the effect of the first regressor on the dependent variable (i.e., in estimating the coefficient) only variation in the first regressor unique to that regressor can be used; variation in the first regressor that is shared by the second regressor cannot be used because there would be no way of knowing whether the dependent variable variation was due to variation in the first or in the second variable. The OLS procedure uses only variation unique to the first regressor in calculating the OLS estimate of the coefficient of the first regressor; it uses only variation unique to the second regressor in calculating the coefficient estimate of the second regressor. For the purpose of calculating the coefficient estimates, the common variation is ignored.⁶¹

For example, if income (I), the age of the house (A), the number of bedrooms (B), and population (P) are correlated with the value of a house (H) then the OLS estimator produces a coefficient estimate of H using only variation in the H regressor; it does not use variation shared by the other correlated regressors (I, A, B, and P). Put another way, the estimated coefficient of H excludes the impacts income (I), the age of the house (A), the number of bedrooms (B), and population (P) has on the value of a house (H). Likewise, shared variability between H and the tax rates (C, O, and S) are not used in estimating the parameter estimate of H. Put another way, the coefficient on H excludes property tax capitalization. Incorporating the control variables, and being guided by Oates' capitalization findings, the estimated coefficient on the (H) explanatory variable can be interpreted as the percentage change in retiree population due to a percentage change in the level of public

⁶¹ Peter Kennedy, A Guide to Econometrics, pgs. 177-178. If there is very high correlation between the independent variables then problems associated with multicollinearity arise. Correlation between the explanatory variables is not excessively high (i.e., greater than 0.80).

services since other influences (variability) on home value has been controlled for. By controlling for income, house age, number of bedrooms, population, and property taxes the model assumes only the variation in house value (H) due to variation in the level of public services is used to estimate the coefficient on H.

The choices of the four control variables (I, A, B, and P) were selected based on the results of previous empirical studies of housing value. The selection of the income (I) control variable comes from Oates' empirical work. In his original property capitalization study, Oates (1969) regressed property values (median value of owner occupied dwellings - house and lot) on housing characteristics, commuting distance, median household income, community status, per pupil education expenditure, and the effective property tax rate. Household income was an explanatory variable because it is expected to be a determinant of the demand for housing. Increase in income leads to increased housing demand; thus implying housing is a normal good. Oates found a statistically significant positive relationship between median household income and property values. He also found a statistically significant negative relationship between the property tax rate and property values, and a statistically significant positive relationship between the level of public services and property values.⁶² The tax and expenditure results suggest tax and public service level capitalization. Oates' empirical findings imply income and property tax rates influence housing value; therefore the use of tax variables (C, O, and S) and income (I) as controls are supported, a priori.

⁶²Per-pupil expenditures on education proxied for the level of public services in Oates' model.

The selection of the A, B, and P variables is supported by the previous empirical fiscal impact analysis of Buchannan and Weber (1989, 1992). They conducted a fiscal impact analysis of the effects on local property tax bills from population growth. Their model included econometric estimation of the taxing district's net levy, assessed value, and the average value of a residential property. The equation estimating the average value of a residential property expressed the average residential property values as a function of population, per capita income, population density, the number of homes built before 1940 (a proxy for housing stock age), and the number of bathrooms per household (a similar proxy as the number of bedrooms).⁶³ Their findings showed a statistically significant positive relationship between population and the average value of a residential property, a statistically significant negative relationship between housing stock age and residential property value, and an insignificant positive relationship between housing size (i.e., number of bathrooms) and residential property value. Buchannan's and Weber's empirical findings imply population and housing stock age influence housing value; therefore the use of population (P) and median house age (A) as controls are supported, a priori. The average number of bedrooms (B) is included to control for the influence of house size on the price of a house.

⁶³In the Buchannan and Weber models, housing stock age and number of bathrooms proxy for housing characteristics that were hypothesized to influence housing prices. Newer housing stock was hypothesized to have a positive influence on housing prices since newer homes are usually preferred to older homes, and the number of bathrooms was a proxy for house size with a hypothesized positive influence on housing prices assuming bigger houses are preferred over smaller houses.

The data used for the econometric model comes from a variety of sources. Published data for the fiscal variables C, O, and S come from the Oregon Department of Revenue Property Tax Statistics for fiscal year 1989. Population estimates used for the population explanatory variable P comes from Portland State University's Center for Population Research and Census, Population Estimates 1980-1990.⁶⁴ The data for the demographic variable R comes from unpublished data provided by the Oregon Department of Revenue. R is the number of single and joint tax filers for the 1989 tax year indicating their age as 65 or older. The use of tax filing data was necessary due to limited municipality population data in the US Census and limited disaggregated population estimates from Population Estimates for Oregon 1980 - 1990. The 1990 US Census provides the data for the variables I, H, A, and B.

The city, or municipality, level was chosen as the observation unit in the data set for two purposes. First, prior work on retiree migration and fiscal impacts from retirees have focused on the county level of government and geography. It seems reasonable that individuals choose a specific city, community, or municipality as their residence rather than a specific county. This community, or city, level data set attempts to address this difference. Second, the use of a more specific observation unit should provide additional insight into the topic of interest and improve the quality of empirical research in this area.

The OLS regression equation is estimated in a log-log functional form. Incorporating a log-log functional form adds to the model in two

⁶⁴Portland State University's annual population estimates are certified by Oregon's Secretary of State, and the estimates are used in various formulas allocating intergovernmental revenue to local governments.

ways. First, it accounts for the concept of diminishing marginal returns put forth by neoclassical economic theory; specifically that additional increments of the independent variables yield additional increments of the dependent variable at a diminishing rate. Second, it provides computational ease in calculating partial elasticities between the dependent and independent variables.

The Tiebout model predicts individuals choose their residential community based on the tax-expenditure bundle offered by the local government. As stated earlier, individuals weigh the cost of public services (taxes) against the benefits (level of public services received) and choose a community with the greatest surplus of benefits over costs. It seems plausible that additional increments of the local tax-expenditure bundle yield additional increments of retirees at a diminishing rate; holding all other independent variables constant.⁶⁵ An example illustrates this plausibility.

Consider two retirees, Joe and Bob, with the same tax-benefit surplus considering a move to community Z. Currently, both Joe's and Bob's tax-benefit surplus are equal between their current place of residence and community Z. If community Z increases its local public services (H), with no corresponding change in taxes (C, O, and S), both retirees' tax-benefit surpluses increase if they move to community Z. However, once Joe migrates to community Z less public service benefit is available for Bob since Joe now uses a share of the initial public service level increase. Bob will not migrate to community Z if the tax-benefit surplus in community Z is less than or equal to the tax-

⁶⁵ An increase in the tax-expenditure bundle implies either an increase in service levels, a decrease in local taxes, or both.

expenditure surplus in his original residence. Thus a linear relationship between public service levels and retiree population growth is not intuitively supported, and a non-linear (logarithmic) relationship that captures diminishing marginal returns is intuitively more appropriate.

To perform an OLS regression on the model that accounts for a non-linear relationship, the dependent and explanatory variables must be transformed into a linear relationship. This is accomplished by taking the natural log of both the left-hand and right-hand sides of the following equation:

$$R = \beta_0 C^{\beta_1} O^{\beta_2} S^{\beta_3} H^{\beta_4} A^{\beta_5} B^{\beta_6} I^{\beta_7} P^{\beta_8}$$

or

$$\ln R = \ln \beta_0 + \ln \beta_1 C + \ln \beta_2 O + \ln \beta_3 S + \ln \beta_4 H + \ln \beta_5 A + \ln \beta_6 B + \ln \beta_7 I + \ln \beta_8 P$$

When an OLS regression is performed on the transformed model the estimated coefficients are no longer interpreted as marginal impacts of the explanatory variable on the dependent variable. The estimated coefficients are interpreted as elasticities. In other words, the estimated coefficient β_1 is interpreted as the percentage change in R due to a percentage change in C. Appendix B outlines a proof showing the estimated coefficient β_1 is an elasticity. Elasticities are useful in economic analysis because an elasticity describes the rate of change in a dependent variable due to the rate of change in an explanatory variable. Since the topic of interest is to evaluate local governments' success in attracting retirees (retiree population growth) through local

fiscal policies (tax and public service level changes), elasticity estimates seem appropriate for analyzing this topic of interest.

In designing this model, statistical implications from simultaneity and autocorrelation were explored. A brief explanation of their impacts is warranted. First, this model does not account for the possibility that retirees shape the local tax-expenditure bundle within their community. One could argue that retirees shape the local tax-expenditure bundle through the voting process, either directly through tax levy increases or indirectly through electing council representatives. If this is true the coefficients on C, O, S, and H will be correlated with the error term.⁶⁶ The fiscal impacts retirees place on local government expenditures and taxes has been investigated quite thoroughly and is detailed in this thesis's previous literature review section. The results of this body of empirical research are inconclusive. Given such inconclusive results, this model assumes retirees do not influence the local tax-expenditure bundle. Therefore econometric problems associated with simultaneity are not anticipated nor explored in this model.

Second, this model assumes the regression's disturbance term, or error, for one observation is not correlated with the disturbance term for another observation. If such a correlation between the errors exists then the regression's disturbance terms are considered autocorrelated. In cross-sectional data sets, observation specific error correlation can be attributed to a random shock affecting one city that indirectly affects a neighboring city because of close economic

⁶⁶This implies simultaneous equation bias between some of the independent variables and the dependent variable.

ties with the neighboring city. With autocorrelation present the estimated coefficients remain unbiased; however they are no longer efficient. In other words, the variance of all the estimated coefficients no longer has minimum variance; thus interval estimation and hypothesis testing are inaccurate.⁶⁷ The original Tiebout model assumes no spillover affects between communities. Given wide geographic dispersion of the data set, increased police protection services provided by one community does not result in more criminal activity in a neighboring community. There should be no correlation between observation disturbance terms; thus autocorrelation is not anticipated nor explored.

Multicollinearity is a violation of the classical linear regression model (CLRM) assumption. It can occur when there are more explanatory variables than there are data observations, or when there exists an exact relationship between the independent variables in the regression equation. If multicollinearity is present the ordinary least square (OLS) estimator is unbiased and has minimum variance. In other words, the OLS estimator remains BLUE (best linear unbiased estimator) and the R^2 statistic is not affected. However, the variances of the OLS estimates are very large (even though they are a minimum). The large variance of the OLS estimates implies that the parameter estimates are not accurate in that they provide wide confidence intervals thereby making hypothesis testing inaccurate.⁶⁸

In this model there are 208 observations in the data set. The regression equation contains eight explanatory variables. Thus, there

⁶⁷ Kennedy, Peter A Guide to Econometrics p. 114-115

⁶⁸ Ibid., p. 176-183.

is no multicollinearity due to more explanatory variables than data observations.

Multicollinearity due to an exact linear relationship between the independent variables in the regression equation can be detected through analyzing a correlation matrix of the independent variables in each regression equation. Table A shows the correlation matrix of independent variables and descriptive statistics. A high absolute correlation value (greater than 0.80) between two independent variables indicates high correlation between the two variables.⁶⁹ In Table A, there are no pairs of independent variables with a correlation greater than 0.80. Therefore, multicollinearity does not appear to be a problem. In the second model the population variable is dropped to resolve possible multicollinearity problems attributed from the population variable.

⁶⁹ Peter Kennedy suggests the correlation benchmark of greater than .80 for detecting multicollinearity with respect to two specific independent variables. *Ibid.*, p. 180.

Table A: Correlation Coefficients and Descriptive Statistics

	R	C	O	S	H	A	B	I	P
R	1.00								
C	0.29	1.00							
O	-0.25	-0.04	1.00						
S	0.15	0.10	0.05	1.00					
H	0.56	-0.11	-0.30	0.07	1.00				
A	-0.29	0.11	0.18	-0.18	-0.55	1.00			
B	-0.46	-0.19	0.29	-0.18	-0.09	0.23	1.00		
I	0.21	0.01	0.13	0.18	0.51	-0.22	0.24	1.00	
P	0.91	0.33	-0.18	0.15	0.49	-0.32	-0.43	0.30	1.00

	Mean	Standard Error	Median	Standard Deviation	Minimum	Maximum	Count
R	1225.32	363.17	316.00	4372.36	29.00	57853.00	208.00
C	5.49	0.20	5.17	2.95	0.09	13.59	208.00
O	3.02	0.12	2.89	1.80	0.23	10.99	208.00
S	14.88	0.35	15.35	5.03	0.07	27.73	208.00
H	52428.37	1206.01	50000.00	17393.32	26300.00	142500.00	208.00
A	31.99	0.69	30.00	10.02	12.00	56.00	208.00
B	2.71	0.02	2.65	0.28	1.89	4.06	208.00
I	23343.40	360.79	22750.50	5203.38	12115.00	51499.00	208.00
P	8066.61	2244.96	1625.00	32377.31	20.00	432175.00	208.00

The following table (Table B) presents the results of the OLS regression. The table shows the estimated coefficients, standard errors, t-statistics, and p-values for the explanatory variables.

Table B: Model I Results

Retirement Population				
R Square	0.87			
Adjusted R Square	0.86			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Statistic</i>	<i>P-value</i>
Intercept (b_0)	-4.66	2.21	-2.11	.04
C (β_1)	.003	.042	.062	.95
O (β_2)	-.001	.051	-.027	.98
S (β_3)	.079	.054	1.477	.14
H (β_4)	1.252	.181	6.897	.00
A (β_5)	.479	.141	3.408	.00
B (β_6)	-1.968	1.076	-1.829	.07
I (β_7)	-.958	.224	-4.288	.00
P (β_8)	.748	.033	22.915	.00

Before interpreting the results of the OLS regression, a test of the model's viability is needed. The OLS regression equation's viability can be tested through an F-test that tests a zero null hypothesis for all response coefficients. If the null hypothesis that all response coefficients equal zero cannot be rejected then the OLS regression equation is not viable. Put another way, the explanatory variables (C, O, S, H, A, B, I, and P) do not explain a substantial proportion of the variation in the dependent variable (R). To test the model's viability the following null and alternative hypotheses are established:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$$

H_a : at least one estimated coefficient is non-zero

If the null hypothesis (H_0) is true, then none of the explanatory variables influence the dependent variable, and the model is considered not viable. However, if the null hypothesis can be statistically rejected then at least one explanatory variable explains a portion of the variation in the dependent variable. The F-statistic is computed as:

$$F = \frac{\text{Explained Variation} / (K-1)}{\text{Unexplained Variation} / (T-K)}$$

The computed F-statistic for the OLS regression is:

$$F = \frac{334.54 / (9-1)}{49.15 / (208 - 9)}$$

$$F = 169.98$$

The 5% critical value for the F-statistic with (8, 199) degrees of freedom is $F_c = 1.94$. Since $169.98 > 1.94$ the null hypothesis is rejected, and conclude the estimated OLS regression relationship is valid (statistically significant). Since the model's viability has been demonstrated, the next step is to proceed with interpreting the results of the estimated coefficients.

The estimated coefficients of interest are the coefficients for the three tax variables β_1 , β_2 , β_3 , and the coefficient for the public service level proxy variable β_4 . As mentioned earlier those coefficients can be interpreted as elasticities, or the percentage change in retiree population resulting from a percentage change in various local tax rates and the level of public services. The standard errors (se) of the four coefficient estimates of interest are

$se(\beta_1)=0.042$, $se(\beta_2)=0.051$, $se(\beta_3)=0.054$, and $se(\beta_4)=0.181$. The standard error for β_4 is small relative to the magnitude of β_4 . This implies the coefficient for the level of public service proxy (β_4) has been estimated with fairly good precision.

A measure of the model's accuracy, or goodness-of-fit, is the R^2 statistics. In this model the $R^2=0.87$; thereby implying that, in this sample, a good proportion of the dependent variable's variability about its mean is explained by the independent variables. Put another way, the various local property tax rates, the level of public services, and the control variables explain a good portion of retiree population's variability about its mean. The R^2 statistic also suggests the model's functional form (log-log) may be a good specification to describe the relationship between retiree population and local government fiscal policy.

Interval estimates, or confidence intervals, can be calculated from the regression's point estimates and respective variances of the unknown parameters. An interval estimate is a probability statement about the endpoints of a random interval containing the unknown coefficient β_i . Interval estimates are usually calculated with a 95% probability level. Interval estimates are useful because the true value of the coefficient β_i is unknown. The interval estimate provides a range that works 95% of the time to contain the unknown parameter β_i , given a specific point estimate and variance. It is preferable to have small, or narrow, interval estimates. Small interval estimates imply more accurate estimates. The larger the interval estimate, the less precise the estimate, and therefore the less informative the estimate.

Given each parameter's point estimate and variance the interval estimate is calculated as:

$$P[b_i - t_c \{se(b_i)\} \leq \beta_i \leq b_i + t_c \{se(b_i)\}] = 0.95$$

Using the above equation, interval estimates are calculated for the four coefficients of interest with a 95% confidence level. In this regression equation $n=208$ and there are $n-9=199$ degrees of freedom. The critical value of t is $t_c=1.972$.⁷⁰

$$C=b_1: P[.0026 - 1.972(.0417) \leq \beta_1 \leq .0026 + 1.972(.0417)] = 0.95$$

$$P[-.0797 \leq \beta_1 \leq .0849] = 0.95$$

$$O=b_2: P[-.0013 - 1.972(.0514) \leq \beta_2 \leq -.0013 + 1.972(.0514)] = 0.95$$

$$P[-.1028 \leq \beta_2 \leq .1000] = 0.95$$

$$S=b_3: P[.0796 - 1.972(.0539) \leq \beta_3 \leq .0796 + 1.972(.0539)] = 0.95$$

$$P[-.0266 \leq \beta_3 \leq .1858] = 0.95$$

$$H=b_4: P[1.2517 - 1.972(.1814) \leq \beta_4 \leq 1.2517 + 1.972(.1814)] = 0.95$$

$$P[.8938 \leq \beta_4 \leq 1.6096] = 0.95$$

The three property tax rate interval estimates include negative and positive values. The interval estimation procedure that works 95 times out of 100 implies that every 1% decrease in the city property tax rate (C) results in a change in retiree population somewhere between +.08% and -.07%. Put another way, it is unknown if a decrease in the city property tax rate will result in an increase or decrease in retiree population. An interval estimate with negative and positive values implies the interval estimate is not reliable. Since the other property

⁷⁰The critical value of t , $t_c=1.972$, is the t value at the 95% level with 200 degrees of freedom. A table with 199 degrees of freedom was not available, and SPSS computed the actual interval estimate.

tax interval estimates also contain both positive and negative values, their estimates are imprecise.

The interval estimation procedure that works 95% of the time, for the level of public services coefficient (H), implies every 1% increase in the level of public services will result in an increase in retiree population between .89% and 1.60%. Another way of stating this is that a 10% increase in the level of public services will result in an increase in retiree population between 8.9% and 16.09%, 95% of the time in repeated samples. This interval estimate is fairly narrow and does not include zero; therefore the interval estimate is informative.

Besides providing information with respect to the accuracy of a coefficient's estimate, an interval estimate is useful aid in hypothesis testing. The interval estimate provides endpoints to a range the unknown value β_i may take, given a specific point estimate and variance. A null hypothesis where the value of β_i is not within the endpoints of the interval estimate will be rejected. For example, if we want to see if a one percent change in the school property tax rate will result in a one percent change in retiree population, the interval estimate can be used. Since the interval estimate for the school property tax coefficient is $(-.02, .18)$, we know the value one does not fall within the interval estimate. Therefore a one percent change in the school property tax rate does not result in a one percent change in retiree population, on average.

Three general hypotheses are tested to aid in interpreting the estimated coefficients of interest:

1. Do local property tax rates and the level of public services have an effect on retiree population?

2. Do the individual local property tax rates have equal effects on retiree population?
3. Do the level of public services and the local property tax rates have equal effect on retiree population?
4. Will a one percent increase in the level of public services lead to a greater than one percent increase in retiree population?

The first hypothesis can be described by the following null and alternative individual hypotheses that ask the question if the three local property tax rates and the level of public services affect the level of retiree population:

$$H_0: \beta_1=0 \quad H_1: \beta_1 \neq 0$$

$$H_0: \beta_2=0 \quad H_1: \beta_2 \neq 0$$

$$H_0: \beta_3=0 \quad H_1: \beta_3 \neq 0$$

$$H_0: \beta_4=0 \quad H_1: \beta_4 \neq 0$$

Given the information in the preceding table, the above hypotheses can be tested. If the ratio of the estimate's coefficient to it's standard error is absolutely greater than 2, then the above null hypotheses are rejected.⁷¹ With a 95% significance level, $\alpha/2=0.025$, and 199 degrees of freedom the critical t-value is $t_{(C)}=1.653$.⁷² Given the estimated model and assuming the null hypothesis is true, the results are as follows:

$$\beta_1/se(\beta_1) = .0026/.04178 = .0622 < t_c \therefore \text{do not reject } H_0$$

$$\beta_2/se(\beta_2) = -.0013/.0514 = -.0252 < t_c \therefore \text{do not reject } H_0$$

⁷¹The ratio of a coefficient's estimate to it's standard error is the t-value used to test the null hypothesis against a critical value of t.

⁷²The actual t-value $t_{(199)}$, with 199 degrees of freedom, is not available in the statistical tables available to the author; therefore $t_{(200)}$ is used.

$$\beta_3/\text{se}(\beta_3) = .0796/.0539 = 1.4768 < t_c \therefore \text{accept } H_0$$

$$\beta_4/\text{se}(\beta_4) = 1.252/.1814 = 6.9018 > t_c \therefore \text{reject } H_0$$

These results imply the prices of local public goods (as proxied by local property tax rates) do not effect retiree population; however the level of public services (as proxied by the controlled home value) does have a statistically significant effect on retiree population.

The second hypothesis to test checks if the three local property tax rates have equal effects, or equal elasticities, on retiree population. These hypotheses can be constructed through the following null and alternative hypotheses:

$$H_0: \beta_1 - \beta_2 = 0 \quad \text{and} \quad H_1: \beta_1 - \beta_2 \neq 0$$

$$H_0: \beta_1 - \beta_3 = 0 \quad \text{and} \quad H_1: \beta_1 - \beta_3 \neq 0$$

$$H_0: \beta_2 - \beta_3 = 0 \quad \text{and} \quad H_1: \beta_2 - \beta_3 \neq 0$$

Using a 95% significance level with a two-tailed test, $\alpha/2=0.025$, the critical t-value is $t_{(200)}=1.972$. Given the estimated model, the results are as follows:

$$\{(\beta_1 - \beta_2) / [\text{var}(\beta_1) + \text{var}(\beta_2) - 2\text{cov}(\beta_1, \beta_2)]\} = .0039/.0638 = .0611$$

$$\{(\beta_1 - \beta_3) / [\text{var}(\beta_1) + \text{var}(\beta_3) - 2\text{cov}(\beta_1, \beta_3)]\} = -.0770/.0669 = -1.1509$$

$$\{(\beta_2 - \beta_3) / [\text{var}(\beta_2) + \text{var}(\beta_3) - 2\text{cov}(\beta_2, \beta_3)]\} = -.0809/.0715 = -1.1314$$

Since the three calculated t-values are smaller than the critical t-value 1.972 and greater than the critical t-value -1.972, we cannot reject the null hypothesis that the property tax elasticities are equal. This implies city, county, and school property tax rates may have equal effects, elasticities, on retiree population.

The third hypothesis tests if the three property tax rates and the level of public services have equal effects, elasticities, on retiree population. The null hypothesis can be written as follows:

$$H_0: \beta_1 - \beta_4 = 0 \quad \text{and} \quad H_1: \beta_1 - \beta_4 \neq 0$$

$$H_0: \beta_2 - \beta_4 = 0 \quad \text{and} \quad H_1: \beta_2 - \beta_4 \neq 0$$

$$H_0: \beta_3 - \beta_4 = 0 \quad \text{and} \quad H_1: \beta_3 - \beta_4 \neq 0$$

Using a 95% significance level with a two-tailed test, $\alpha/2=0.025$, the critical t-value is $t_{(200)}=1.972$. Given the estimated model, the results are as follows:

$$\{(\beta_1 - \beta_2) / [\text{var}(\beta_1) + \text{var}(\beta_2) - 2\text{cov}(\beta_1, \beta_2)]\} = -1.2491 / .1777 = -7.0292$$

$$\{(\beta_1 - \beta_3) / [\text{var}(\beta_1) + \text{var}(\beta_3) - 2\text{cov}(\beta_1, \beta_3)]\} = -1.253 / .17 = -7.3705$$

$$\{(\beta_2 - \beta_3) / [\text{var}(\beta_2) + \text{var}(\beta_3) - 2\text{cov}(\beta_2, \beta_3)]\} = -1.1721 / .1844 = -6.3562$$

Since the three calculated t-values are smaller than the critical t-value (-1.972), we can reject the null hypothesis that the level of public services elasticity is equal to any one of the three property tax elasticities.⁷³ This implies the level of public services has different effects on retiree population than local property tax rates.

After learning from the first hypothesis test above that local property tax rates have no impact on retiree population, a fourth hypothesis can be tested evaluating the effectiveness of increasing local public services as a means of encouraging retiree sorting. The point estimate implies each percentage increase in the level of public services results in 1.25% increase in retiree population. Does this point estimate imply a greater than unitary elasticity? A local policy maker (i.e., city council person) may be interested if a one percent increase in the level of public services will result in a greater than one percent increase in the retiree population. This hypothesis can be written as:

⁷³In absolute value $|t| > t_c$ therefore the null hypothesis is rejected.

$$H_0: \beta_4 \leq 1 \text{ and } H_1: \beta_4 > 1$$

The null hypothesis (H_0) says the percentage change in the level of public services is less than or equal to the percentage change in retiree population. The alternative hypothesis (H_1) says the percentage change in the level of public services is greater than the percentage change in retiree population. Rejection of the null hypothesis thus implies the elasticity between the level of public services and retiree population is greater than unity (i.e., the partial elasticity is elastic rather than unitary or inelastic). To compute the t-statistic we use $\beta_4=1$ since this is the least favorable position within the null hypothesis. Setting $\beta_4=1$ establishes the null hypothesis of unitary elasticity.

Using a 95% significance level with a one-tailed test, $\alpha=0.05$, the critical t-value is $t_{(200)}=1.653$. Given the estimated model, the result can be calculated as:

$$t = \{(b_4 - \beta_4) / \text{se}(b_4)\} = \{(1.2517 - 1) / .1814\} = 1.3875$$

Since 1.3875 is less than the critical t-value 1.653 we fail to reject the null hypothesis of greater than unitary elasticity. Given this result, the policy maker can expect a percentage increase in the level of public services may result in an equal percentage increase in retiree population. In other words, the sample evidence does not allow rejection of the hypothesis of greater than unitary elasticity between the level of public services and the retiree population.

The model's parameter estimates can be interpreted as follows. Local property tax rates have no effect on retiree population within Oregon cities, ceteris paribus. As a proxy for the price of public services, the signs on the tax coefficients were expected to be

negative. One of the three tax rate point estimates had a negative sign. All three property tax rate coefficients were statistically insignificant. A one percent increase in the level of local public services results in an average 1.25% increase in retiree population. Put another way, there is unitary elasticity between the level of public services and the retiree population on average, and this elasticity is statistically significant (i.e. significantly greater than zero). A hypothesis test, with a 95% confidence level, does not provide statistical support that this elasticity is greater than unity. The positive sign on this coefficient suggests retirees are relatively high demanders of local public services.

From the results of this OLS multiple regression and hypothesis tests it appears complete Tiebout community sorting does not take place with respect to retirees. The level of public services are more important than property taxes with respect to influencing retiree sorting. More specifically stated, local property tax rates have no effect on retiree sorting and the level of public services has a significantly positive effect on retiree sorting. The Tiebout model predicts individuals weigh the cost and benefits of local public services, choosing as their residence the community with the greatest surplus of benefits over costs. The sample evidence in this model suggests retirees do not consider the cost of local public services (as measured by local property tax rates) in their residential location choice; however the sample evidence does support the Tiebout prediction that the level of local public services (as measured by controlled residential home value) effects a retiree's residential location choice. Holding population, housing characteristics, and taxes constant,

retirees will move to where there are more public services. Thus retirees look for surplus of benefits over costs.

MODEL II: Cultural and Physical Amenities Capitalization

Model I used a controlled explanatory variable, median home value, as a proxy for the level of, or benefit from, local public services. This controlled variable was used because of difficulty in collecting local government expenditure data at the municipality level. The use of this controlled variable as a proxy for the level of public services may present some ambiguity. In other words, what exactly is "the level of public services?" Given that the median house value was controlled for influences on housing value (i.e., capitalization from income, taxes, population, and size) the "level of public services" can be interpreted as the average capitalized value of the community's local public services. Put another way, it is the average benefit received by a home owner, or household, from the city's public services that is capitalized into the value of a home.

In the previous regression, extracting public service capitalization from median housing value may not have been completely controlled by income, taxes, population, housing age, and housing size. Cultural and physical amenities may also be capitalized into housing values. Oregon is well known for its abundance of outdoor recreation facilities and cultural climate. A nationally respected Shakespearean theatrical festival in Ashland, Oregon and the Oregon Trail Interpretive Center are examples of the state's cultural amenities. The Mt. Hood wilderness, the Columbia River Gorge, Crater Lake, and the John Day Fossil Beds are examples of Oregon's physical amenities. Such physical

amenities may affect Oregon's attractiveness as a migration destination for businesses, families, and individuals.

Given that the previous econometric model did not account for possible cultural and physical amenity capitalization, it may not be accurate to interpret the estimated coefficient on the median house value variable (b4) as the capitalized value of public services. A more appropriate interpretation may be the capitalized value of amenities and public services. Controlling for possible capitalization from cultural and physical amenities is difficult. Assigning quantitative measures to cultural and physical amenities may be considered subjective at best; however an attempt is made to capture such amenity capitalization through three additional variables:

E1 = Population share not attaining a High School Diploma

E2 = Population share attaining a High School Diploma

E3 = Population share attaining a college and/or graduate degree

The data for educational attainments comes from the 1990 US Census.

Adding these additional variables to control for amenity capitalization in housing values, the regression equation can be rewritten as:

$$R = \beta_0 T^{\beta_1} H^{\beta_2} A^{\beta_3} B^{\beta_4} I^{\beta_5} E1^{\beta_6} E2^{\beta_7} E3^{\beta_8}$$

As mentioned earlier, a community's cultural and physical amenities may be considered subjective; however it is not unreasonable to expect a community's "niceness" is capitalized into housing values. The so called "high rent" districts are easily recognizable. Front yards are meticulously landscaped, houses look as if they've been

freshly painted, and property crime is rare. What determines a community's amenities may be a matter of individual opinion. Educational attainment may reflect one's upbringing and may reflect the value one places on specific amenities. Put another way, educational attainment may determine a community's cultural and physical amenities (i.e., theatrical performances, art and history museums, etc.). Since there is no social or economic theory to guide this relationship, the expected sign on this estimated coefficient is indeterminate. It will be determined empirically.

This model uses the consolidated property tax rate (T) to proxy the price of local public services whereas the previous model itemized each property tax rate variable for the specific government unit (i.e., city, county, and school district property tax rates). Use of the consolidated property tax rate can be explained as follows. Tiebout's model predicts individuals weigh the cost (taxes) against the benefits (expenditures) of living in various communities (cities), then choose to live in the community with the greatest public services benefit surplus. This second model assumes an individual bases his/her cost (taxes) on the net property tax that is the sum of all tax rates, and an individual bases his/her benefit (expenditures) on all public services provided in the community that are capitalized in property values.

For example, a retiree may desire a community with a low crime rate. The benefit from the low crime rate is capitalized in the value of property. The retiree's cost for the low crime rate is the city's property tax rate; however living in the community with a low crime rate entails paying property taxes for other government services (county services, school district, etc.). If s/he is a rational economic agent

the retiree will balance the various types of property taxes (city, county, school) in assessing his/her cost for receiving the benefit of living in a low crime rate community. Therefore, if the retiree is given the choice of two communities with the same crime rate and one community has a lower city property tax rate than the other, then the retiree could choose to live in the community with the higher city property tax rate. Why? If the other property tax rates (county, school, special districts, bond levies) are lower in the community with the higher city property tax rate then the consolidated property tax rate may be lower in the city with the higher city property tax rate. The table below provides an example:

<u>City A Property Tax Rate</u>	<u>City B Property Tax Rate</u>
City Tax Rate: .25	City Rate: .50
County Rate: .75	County Rate: .75
School Rate: .75	School Rate: .50
Special District Rate: .75	Special District Rate: .75
Bond Levy Rate: .75	Bond Levy Rate: .50
Consolidated Rate: 3.25	Consolidated Rate: 3.00

Given the inavoidability of paying property taxes for specific levels of government not rated highly beneficial by the individual, it seems reasonable to assume a rational economic agent will base their cost (tax) assessment on the consolidated tax rate rather than the property tax rate of the government entity providing the specific public service. Thus the retiree will choose community B with the higher city property tax rate to receive the same low crime rate benefit. Put another way,

use of the consolidated tax rate implies the individual is a rational economic agent.

As detailed in the first model, the tax rate when multiplied by the property's assessed value determines the tax bill. The tax bill is the price an individual property owner pays for public services offered by the city, county, school district, etc. during the fiscal year. Thus, the tax rate proxies for the annual price an individual property owner pays for public goods and services; the tax portion of Tiebout's tax-expenditure bundle. The expected signs of the tax (price) coefficient is expected to be negative; thereby implying that higher taxes (prices of public services) make a community's public services more expensive given the level of public services held constant. This is synonymous to the basic law of demand; less of good is demanded as its price increases.

The median value of a house (H) enters the model as a controlled exogenous explanatory variable which proxies for the level of the city's public services. As mentioned in the first model, previous empirical research has shown the level of public services is capitalized into housing value (Oates, 1969). The expected sign on the estimated coefficient of H is indeterminate and is to be determined empirically.

Similar to the first model, the explanatory variables (I, A, and B) are included to control the (H) variable as a proxy for the level of public services. Income (I), the age of a house (A), and the number of bedrooms (B) can be expected to be correlated with the value, or price, of house. Since these controls tend to be correlated with housing value, their inclusion narrows the interpretation of the estimated coefficient on the (H) explanatory variable. Incorporating the control

variables implies that the estimated coefficient on the (H) explanatory variable can be interpreted as the percentage change in retiree population due to a percentage change in the level of public services since other influences (variability) on home value has been controlled for. The first model provides more detail on the use of control variables in an OLS regression.

The choices of the control variables (I, A, and B) were selected based on the results of previous empirical studies of housing value. Explanations for their inclusion in the regression are detailed in the first model.

The data used for the econometric model comes from a variety of sources. Published data for the fiscal variables C, O, and S come from the Oregon Department of Revenue Property Tax Statistics for fiscal year 1989. The data for the demographic variable R comes from unpublished data provided by the Oregon Department of Revenue. R is the number of single and joint tax filers for the 1989 tax year indicating their age as 65 or older. The use of tax filing data was necessary due to limited municipality population data in the US. Census and limited disaggregated population estimates from Population Estimates for Oregon 1980 - 1990. The 1990 U.S. Census provides the data for the variables I, H, A, B, E1, E2, and E3.

As with the first model, this OLS regression equation is estimated in a log-log functional form. Incorporating a log-log functional form adds to the model in two ways. First, it accounts for the concept of diminishing marginal returns put forth by neoclassical economic theory. Second, it provides computational ease in calculating partial elasticities between the dependent and independent variables.

Similar to the first model, this model does not account for the possibility that retirees shape the local tax-expenditure bundle within their community. Therefore econometric problems associated with simultaneity are not anticipated nor explored. The issue of endogeneity is explored in a third econometric model. Also, problems arising from autocorrelation and multicollinearity are not anticipated nor explored in this model. More detailed explanations on the autocorrelation and multicollinearity issues can be found in the first model.

Population is dropped from the regression equation. Some explanation for dropping the population (P) variable is warranted. As previously mentioned, the population variable had a very high level of statistical significance on retiree population in the first model. Such a high level of statistical significance from one explanatory variable suggests a high level of correlation between the two variables (dependent and independent) and impacts the R-square measure. A high correlation between an independent and dependent variable is not necessarily bad in regression analysis (if fact it is quite good); however when specifying an economic relationship one must balance theory and knowledge of regression analysis.

In specifying the first model, population (P) is included as a control variable. The inclusion of P in the regression equation is

based on a theoretical relationship between P and another independent variable (H); P is not included because of a theoretical relationship with the dependent variable. Including P as an explanatory variable adds extraneous information into the model. Including extraneous information into a regression model does not bias parameter estimates; however it can result in inefficient parameter estimates and low t-statistics.

In an attempt to improve efficiency (i.e., make more precise parameter estimates) the extraneous P variable is dropped in the second model. The model's efficiency is improved by dropping the P variable. The parameter estimate on the tax (T) variable becomes statistically significant.⁷⁴ Since P is highly correlated with the dependent variable (R) the model's R-square is expected to fall after dropping the extraneous P variable.

The alternative to dropping the P variable is the potential of creating biased parameter estimates if P is a relevant variable. The magnitude of the bias created by omitting a relevant variable is directly related to the correlation between the omitted variable and the other explanatory variables. If the correlation is low then the bias will be low.⁷⁵ Since the correlation coefficients between P and the other explanatory variables are low (i.e., less than 0.50), any bias created is fairly low.

Parameter estimates are biased if a "relevant" variable is omitted from the regression model. In econometric analysis, theory guides one

⁷⁴Please refer to Appendix C for a comparison of models including and excluding the population explanatory variable.

⁷⁵William S. Brown, Introducing Econometrics, p. 152.

in identifying "relevant" variables. Economic theory cannot explain a "relevant" relationship between R and P; thus P is believed to be "irrelevant" with respect to explaining R and is therefore considered extraneous.

Is population (P) a "relevant" variable? If P is a "relevant" variable then bias created by its omission is relatively small given P's low correlation with the other explanatory variables. Answering this question is an example of the "bias-efficiency" trade-off in regression analysis. Sometimes, to improve a model's efficiency unbiasedness must be sacrificed. Given the relatively low bias, if any, created by dropping P the benefits of improved efficiency are acceptable to this researcher.

The following table presents a correlation matrix and the results of the OLS regression. The table includes standard errors, calculated t-statistics, calculated p-values, and interval estimates (lower 95% and upper 95%) for each estimated coefficient. T-statistics, p-values, and interval estimates are calculated at the 95% confidence level.

Table C: Correlation Matrix, Descriptive Statistics and Model II Results

	R	T	H	A	B	I	%E1	%E2	%E3
R	1.00								
T	0.06	1.00							
H	0.56	-0.30	1.00						
A	-0.29	0.13	-0.55	1.00					
B	-0.46	-0.10	-0.09	0.23	1.00				
I	0.21	0.12	0.51	-0.22	0.24	1.00			
%E1	-0.29	0.11	-0.54	0.12	-0.22	-0.59	1.00		
%E2	-0.29	-0.05	-0.27	0.17	0.18	-0.08	-0.03	1.00	
%E3	0.48	-0.07	0.60	-0.16	0.06	0.55	-0.79	-0.34	1.00

	Mean	Standard Error	Median	Standard Deviation	Minimum	Maximum	Count
R	1225.32	303.17	316.00	4372.36	29.00	57853.00	208.00
T	27.77	0.42	27.44	6.12	14.01	44.99	208.00
H	52428.37	1206.01	50000.00	17393.32	26300.00	142500.00	208.00
I	23343.40	360.79	22750.50	5203.38	12115.00	51499.00	208.00
A	31.99	0.69	30.00	10.02	12.00	56.00	208.00
B	2.71	0.02	2.65	0.28	1.89	4.06	208.00
E1	0.24	0.01	0.25	0.08	0.03	0.55	208.00
E2	0.56	0.00	0.57	0.06	0.37	0.68	208.00
E3	0.19	0.01	0.18	0.09	0.02	0.60	208.00

Retirement Population							
R Square	0.57						
Adjusted R Square	0.55						
	Coefficients	Standard Error	t-Stat	P-value	Lower 95%	Upper 95%	
Intercept (β_0)	-8.54	5.55	-1.54	.12	-19.47	2.39	
T (β_1)	1.12	.33	3.44	.00	.48	1.77	
H (β_2)	2.29	.37	6.26	.00	1.57	3.02	
A (β_3)	.28	.26	1.08	.28	-.23	.80	
B (β_4)	-5.34	.74	-7.18	.00	-6.81	-3.88	
I (β_5)	-.69	.44	-1.57	.11	-1.58	.18	
E1 (β_6)	.34	.33	1.02	.31	-.31	.98	
E2 (β_7)	.38	.76	.51	.61	-1.12	1.88	
E3 (β_8)	1.16	.31	3.67	.00	.54	1.78	

The estimated coefficients of interest are the coefficients for the consolidated property tax rate (β_1) and the public service level proxy (β_2). As mentioned earlier these coefficients can be interpreted as elasticities, or the percentage change in retiree population resulting from a percentage change in the consolidated property tax rate and the level of public services. The standard errors (se) of the coefficient estimates of interest are $se(\beta_1)=0.33$ and $se(\beta_2)=0.47$. These standard errors are small relative to the magnitude of the respective estimated coefficients; suggesting the coefficients for the consolidated property tax rate and the level of public services proxy have been estimated with precision.

A measure of the model's accuracy, or goodness-of-fit, is the R^2 statistics. In this model the $R^2=0.57$ thereby implying that, in this sample, more than half of the dependent variable's variability about its mean is explained by the independent variables.

The model's results imply local property tax rates and public service levels influence retiree sorting in Oregon cities. On average, each one percent increase in the consolidated property tax rate results in a 1.14 percent increase in a city's retirement population. Moreover, the estimated coefficient is statistically significant at the 95% level. Each one percent increase in the level of public services results in a 2.32% increase in a city's retirement population, on average. The level of public services is statistically significant at the 95% level. The point estimates on both the tax and public service level variables suggests these partial elasticities are fairly elastic. Given these fairly elastic estimates, it is useful to know if these point estimates imply a greater than unitary elasticity. In other words, does a one

percent increase in the level of public services result in a greater than one percent increase in the retiree population? Does a one percent increase in the consolidated property tax rate result in a greater than one percent increase in the retiree population? Such hypothesis tests can be written as:

$$H_0: \beta_1 \leq 1 \text{ and } H_1: \beta_1 > 1$$

$$H_0: \beta_2 \leq 1 \text{ and } H_1: \beta_2 > 1$$

Rejection of the null hypothesis thus implies greater than unitary elasticity.

To compute the t-statistic we use $\beta_i=1$, since this is the least favorable position within the null hypothesis. Setting $\beta_i=1$ establishes the null hypothesis of unitary elasticity. Using a 95% significance level with a one-tailed test, $\alpha=0.05$, the critical t-value is $t_{(169)}=1.65$. Given the estimated model, the result can be calculated as:

$$t = \{(b_1 - \beta_1) / \text{se}(b_1)\} = \{(1.12 - 1) / .33\} = .36$$

$$t = \{(b_2 - \beta_2) / \text{se}(b_2)\} = \{(2.29 - 1) / .36\} = 3.58$$

For the tax rate elasticity hypothesis test, since .36 is less than the critical t-value 1.65, we fail to reject the null hypothesis of less than or equal to unitary elasticity; thus the partial elasticity between the property tax rate and retirees cannot be said with confidence to be greater than unity. However, for the public service elasticity hypothesis, since 3.58 is greater than the critical t-value 1.654 we reject the null hypothesis of unitary elasticity. Therefore, the elasticity between the level of public services and retiree sorting is

greater than unity, or elastic. These results imply the elasticity between public service levels and retiree sorting is greater than the elasticity between property tax rates and retiree sorting.

The interval estimates for these two coefficients provide some further insight into the effect of property tax rates and public services on retiree sorting. The interval estimate on the consolidated property tax rate coefficient is ranges from .48 to 1.77. A one percent increase in the consolidated property tax rate could result in an increase in the retirement population ranging .48% to 1.77%, in a repeated sampling context.

This second econometric model was designed to account for amenity capitalization in housing values. An attempt to control for amenity capitalization was done by introducing three additional explanatory variables. Given the assumption that educational attainment controls for amenity capitalization, the results of this second OLS multiple regression and hypothesis tests suggest a Tiebout community sorting process is taking place with respect to retirees. The Tiebout model predicts that individuals weigh the cost and benefits of local public services; choosing the community with the greatest surplus of benefits over costs as their residence. The statistically significant results on the tax variable implies local property tax rates affect retiree sorting. The statistically significant results on the public services level proxy (median house value controlled for various types of capitalization) suggest the level of public services also affect retiree sorting. In this model, the level of public services are more important than property taxes with respect to retiree sorting.

This second model, as well as the first model, uses a controlled variable (median house value) to proxy for a measure of public services. By controlling for various influences on housing value in the regression equation, the coefficient on the housing value explanatory variable is estimated without shared variability between housing value and the control variables (i.e., income, house age, house size, property taxes, and amenities as reflected through the population's educational attainment). Therefore the coefficient on the housing value explanatory variable may be interpreted as the partial elasticity between the capitalized value of local public services and the retirement population. Put another way, it is the percentage change in a city's retirement population from a percentage change in the capitalized value of local public services. The selection of this proxy for a measure of local public services was necessary due to the lack of comparable city budget data. Economists are often faced with limited data to test theoretical models, and often artistic approaches to econometric modeling are necessary to test such theoretical models. This is another example of such a situation.

The questionability of using median house value controlled for capitalization as a proxy for the level of public services remains present in this second model due to the inability to completely control for cultural and physical amenity capitalization. Moreover, the use of the property tax rate as a proxy for the price of local public services may also be questionable and/or inappropriate. As a proxy for the price of public services, the signs on the consolidated property tax coefficient was expected to be negative; however the sign was positive. This unexpected result suggests one of two possibilities. First, local

public services are not normal goods to retirees. The demand for a normal good falls as its price increases. The coefficient's positive sign implies an increase in the price of local public services results in an increase in the city's retirement population, or an increase retirees' demand for local public services.

The second possibility is the demand for public services (as reflected by the property tax rate) may not be an exogenous variable in the model; it may be endogenous to the model, or determined within the model. If property tax rates are endogenous, then the model can be expressed as a system of simultaneous equations and the tax rate variable is contemporaneously (same time period) correlated with the error term. Running OLS with contemporaneous correlation due to simultaneity results in biased parameter estimates.⁷⁶ This bias is also asymptotic (bias with large sample sizes), thus possibly explaining the second possibility for the unexpected sign on the property tax rate coefficient. Accounting for simultaneity within the model is explored in a third econometric model.

Model III: Endogeneity and the Median Voter Process

The issue of endogeneity with respect to a Tiebout community sorting process was not addressed in the first two models. More specifically, the previous models did not account for the possibility that property taxes are endogenous in the Tiebout community sorting process. The models did not account for the possibility that retirees may shape the local tax-expenditure bundle within their community. One

⁷⁶ A biased parameter estimate does not provide a true estimate of the coefficient on average in repeated samples.

could argue that a community's residents shape the local government's tax and spending bundle. The theoretical and empirical literature on the median voter model is abundant. Individuals, or groups, may shape the local tax-expenditure bundle through the voting process directly through tax levy increases or indirectly through electing local city council representatives.

In Oregon, property tax rates are determined by the city's total assessed value of all property and the city's net levy. The relationship between the tax rate, net levy, and assessed value is:

$$NL / AV = TR$$

The net levy is the amount of taxes needed from local taxpayers to provide local public services. The levy is determined through the local government's budgeting process and local budget election results. In the budgeting process future expenditures and non property tax revenues (fees and charges) are determined, and the levy is the result of future expenditures less non property tax revenue. There are several types of levies a taxing district may levy: the tax base levy, the one-year levy, the serial levy, the safety net levy, the continuing levy, and bond and interest levies. The tax base levy is approved by majority vote and allows an annual levy which cannot exceed the prior three year's greatest levy, plus six percent. This is known as the six percent limitation. One-year and serial levies are approved by majority vote and are temporary levies allowing a specific dollar amount for one or more years. A safety net levy is an amount school districts may levy if voters do not approve the tax base, one-year, or serial levies that bring the school district levy to the prior year's level. The bond levy is approved by majority vote and pays for principal and interest on

bonded debt. Measure 5 tax rate limitations apply to the tax base levy, one-year, serial, safety net, and continuing levies; however the Measure 5 tax rate limitations do not apply to the bond levy for capital construction. Therefore, all levies represent the community's demand for all local government services through the budgeting and voting process.

The assessed value is the value of all nonexempt privately owned real and personal property in the taxing district. Prior to the passage of Measure 5, property was assessed at 100% of market value.⁷⁷ Part of Measure 5 redefined "assessed value" as the "real market value," or the minimum value the property would sell for in the year. Defining assessed value as the "market value" implies that assessed value is determined by demand and supply influences in the property market, including the housing market.

The property tax rate is simultaneously determined by the local government budgeting and voting process (the net levy) as well as demand and supply pressures in the property market (the assessed value). The median voter model suggests a community's population distribution shapes local government's fiscal operations through the voting process. This median voter process may be apparent in Oregon's levy-based property tax system. A community's population may also influence property values through a demand shock in the housing market. Given a fixed supply of the housing stock, an increase in population increases the demand for housing; thereby increasing housing values. Therefore, retirees may

⁷⁷Assessment of property at 100% of market value restarted in FY '86 after a period of assessments at less than market value.

shape property tax rates though their influences on the numerator (net levy) and the denominator (assessed value).

The Tiebout model predicts individuals choose a community with the greatest surplus of benefits (public services) over costs (taxes). Both the benefits (public services) and costs (property taxes) are capitalized in property values (Oates, 1969). Public services are positively capitalized into housing values, and property taxes are negatively capitalized into housing values. From the Tiebout "shopping trip" perspective, and given property capitalization influences, the "shopping trip" can be seen as process of balancing the price of a house and the property tax rate in choosing a residential community. In other words, the property tax rate and housing value are weighed to reveal an individual's preferred bundle of public services and taxes.

To explore the possibility of simultaneity within the Tiebout community sorting process, a third econometric model is presented. Incorporating the notion of simultaneity, the initial hypothesis to explore can be restated as local governments and existing residents can shape the level of retiree in-migration. A specific description of the simultaneous relationship can be written as:

$$(1) \quad R = \Gamma_0 T^{\gamma_1} H^{\gamma_2} I^{\gamma_3} A^{\gamma_4}$$

$$(2) \quad T = \Phi_0 R^{\phi_1} H^{\phi_2} I^{\phi_3} E^{\phi_4}$$

$$(3) \quad H = \Delta_0 R^{\delta_1} T^{\delta_2} I^{\delta_3} B^{\delta_4}$$

Endogenous Variables:

R = Population 65 years of age or older

T = Consolidated property tax rate

H = Median house value

Exogenous Variables:

A = Median age of a home (1995 minus median year built)

B = Average number of bedrooms of occupied and vacant homes

I = Median household income

%E3 = Share of the population attaining a college/graduate degree

The first equation describes the Tiebout community shopping trip. A community's retirement population is determined by the community's property tax rate (T), housing value (H), income (I), and housing stock age (A).

$$(1) \quad R = \Gamma_0 T^{\gamma_1} H^{\gamma_2} I^{\gamma_3} A^{\gamma_4}$$

The property tax rate (T) enters the equation as a Tiebout community sorting variable. The expected sign on this coefficient is indeterminate. The sign will be determined empirically.

Housing value (H) enters the equation as another Tiebout community sorting variable. As mentioned previously, property taxes and public services are capitalized into housing values. Also, since the price an individual pays for local public services is their property tax bill (house value multiplied by the property tax rate), an individual balances the house value with the property tax rate to get the greatest surplus of public service benefits over taxes. As with the tax rate variable, the expected sign on this estimated coefficient is indeterminate. The sign will be determined empirically.

Median household income (I) enters the first equation as an exogenous explanatory variable, and is used as a socio-economic

explanatory variable. The literature on retiree migration describes two types of retiree migrants: amenity seeking and dependency seeking. Amenity seeking retiree migrants are more affluent and choose communities for cultural and physical amenities; whereas dependency seeking retiree migrants choose communities for their public services. Amenity seeking migrants are described as well educated (having a college degree) and in the upper income ranges, more dependent on private pension retirement income, and less dependent upon social security income. Dependency seeking migrants are characterized as attaining an education up to a high school diploma, in the middle to lower income ranges, and more dependent upon social security income. The sign on this estimated coefficient is indeterminate and may provide some insight as to characterization of Oregon retirees as amenity seeking or dependency seeking.

The age of the community's housing stock (A) enters the first equation as an exogenous explanatory variable. This variable is used as a housing characteristic variable. The age of the housing stock is thought to influence retiree sorting depending on the type of retiree migrant (amenity seeking or dependency seeking). Higher income amenity seeking retiree migrants are believed to prefer more expensive newer houses with modern household amenities. Lower income dependency seeking retiree migrants are believed to prefer older less expensive houses given their budget constraints. As with the income variable, the sign on this estimated coefficient is indeterminate and may provide some insight as to characterization of Oregon retirees.

The second equation describes a community's property tax rate as determined through the housing market (H) and the community's population

characteristics (R, I, and %E3). The property tax rate is expressed as a function of the community's retirement population, housing value, income, and education attainment.

$$(2) \quad T = \Phi_0 R^{\phi_1} H^{\phi_2} I^{\phi_3} \%E3^{\phi_4}$$

The community's retirement population (R) enters the second equation as an endogenous explanatory variable. One component of the tax rate is the net levy. The state's tax levy process provides for voter approval of tax levies. Retirees may influence property tax rates through their tax levy voting behavior. Fiscally conservative retirees may keep tax levies down; whereas more fiscally liberal retirees may be more apt to approve tax levy increases. Thus, the sign on this estimated coefficient is indeterminate and will be determined empirically.

Housing value (H) enters the second equation as an endogenous explanatory variable to account for the denominator (assessed value) influence on property tax rates. The property tax rate is calculated as the net levy divided by assessed value. Oregon law defines a property's assessed value as the "market value." The median housing value (H) variable is the median housing "market value" determined in the housing market. The sign on this estimated coefficient is expected to be negative given the inverse relationship between assessed value ("market value") and the tax rate.

Median household income (I) enters the second equation as an exogenous explanatory variable. This is a socio-economic explanatory variable characterizing the community's population and voting behavior. The sign on this estimated coefficient is indeterminate. More affluent

communities, as measured by household income, may be fiscally conservative or liberal depending upon political views and valuation of public services. Fiscally conservative affluent communities may be more likely to keep tax levies low compared to more fiscally liberal affluent communities. Therefore the sign on this estimated coefficient will be determined empirically.

The share of the population attaining a college education (%E3) enters the second equation as another exogenous explanatory variable. This variable describes the community's population characteristics. It is believed one's educational attainment influences one's voting behavior on local tax and spending issues. The voting behavior may be both in choosing whether to vote or not to vote, as well as how one votes. Communities with higher educational attainments may have greater voter turnout with more informed voters. Educated people tend to have a greater general respect for public services; however their willingness to pay for these services is unpredictable. The expected sign for this coefficient is indeterminate.

The third equation in this system describes variables believed to explain housing value within a community's. A community's housing value is expressed as a function of the retirement population (R), property tax rates (T), median household income (I), and housing size (B).

$$(3) \quad H = \Delta_0 R^{\delta_1} T^{\delta_2} I^{\delta_3} B^{\delta_4}$$

The community's retirement population (R) enters the third equation as an endogenous explanatory variable. Retiree are believed to have different preferences for residential housing compared to other

population groups (i.e., families with school age children). Retirees may prefer smaller, and less expensive, homes compared to families given a retiree's children are more likely to live in another residential property. The sign on this estimated coefficient is expected to be negative given smaller homes are priced lower than larger homes. On the other hand, residents of the Oregon coast believe the recent growth of the retirement population in their communities contributes to rising housing price. If this is true, then the sign on this estimated coefficient is expected to be positive.

The consolidated property tax rate (T) enters the third equation as another endogenous explanatory variable. Property taxes are capitalized into housing values. This capitalization relationship between property taxes and housing value is inverse. Given two identical houses (i.e., same size, year built, etc.) but with different property tax rates, the house with the higher tax rate will have a lower market price. The sign on this estimated coefficient is expected to be negative, a priori.

Household income (I) enters the third equation as an exogenous explanatory variable. Household income is expected to be a determinant of housing demand. An increase in household income leads to increased housing demand; thereby implying housing is a normal good. The sign on this estimated coefficient is expected to be positive, a priori.

Average house size (B), as measured by the average number of bedrooms per housing unit in the community, enters the third equation as another exogenous explanatory variable. It is believed housing size has a positive influence on housing value assuming larger homes are

preferred over smaller homes. The sign on this estimated coefficient is expected to be positive.

The data used for the econometric model comes from a variety of sources. Published data for the property tax rate (T) comes from the Oregon Department of Revenue Property Tax Statistics for fiscal year 1989. The data for the number of retirees (R) comes from unpublished data provided by the Oregon Department of Revenue. R is the number of single and joint tax filers for the 1989 tax year indicating their age as 65 or older. The use of tax filing data was necessary due to limited municipality population data in the US. Census and limited disaggregated population estimates from Population Estimates for Oregon 1980 - 1990. The 1990 U.S. Census provide the data for the variables I, H, A, %E3 and B. The data set represents cross-sectional observations of 208 Oregon cities (n=208).

In this system of equations there are three endogenous variables (R, T, and H) and four exogenous variables (A, B, I, and %E3). The endogenous variables are determined within the system of equations and the exogenous variables are determined outside the system of equations. In a simultaneous equation model, all endogenous variables are random variables. A change in any equation's disturbance term changes all endogenous variables in the system. For example, the second equation states the property tax rate (T) is a function of the retirement population (R), median housing value (H), median household income (I), and the share of the community's college educated population (%E3). A change in this equation's disturbance term effects the property tax rate (T). Since this endogenous variable (T) appears in the other two equations as an explanatory variable, the other endogenous variables (R

and H) are affected. Thus, the endogenous variables (R, H, and T) used as explanatory variables are contemporaneously (same time period) correlated with the disturbance terms of all three equations.

The presence of contemporaneous correlation requires the use of an estimator different from the regular ordinary least squares (OLS) estimator. If the OLS estimator is used on the individual equations in the system the estimated coefficients are biased.⁷⁸ The selection of an appropriate estimator depends upon the equation system's identification. Each equation, in a simultaneous system of equations, can be under identified, over identified, or just identified. If an equation is under-identified then it cannot be estimated. If an equation is over-identified or just-identified then the equation can be estimated. If all equations are just-identified then the two-stage-least-squares (2SLS) is an appropriate estimator.

The system can be identified through checking the systems *rank* and *order* conditions when zero restrictions are placed on structural parameters.⁷⁹ The *order* condition is a *necessary* condition for identification, and the *rank* condition is a *necessary and sufficient* condition for determining the systems identification. The *order* condition requires of each equation in the system for "the number of excluded exogenous variables" to be "greater than or equal to the number

⁷⁸ This bias is asymptotic, with larger and larger samples.

⁷⁹ A zero restriction is an assumption about a parameters placement in the system of equations. For example, the age of the housing stock (A) is an explanatory variable in the retiree equation but does not appear in the tax rate or housing value equations. This implies the coefficient of this explanatory variable is zero in the tax rate and housing value equations. This is a zero restriction.

of included endogenous variables less one."⁸⁰ The order condition for each equation can be expressed as:

$$r_h \geq g^* - 1$$

where r_h is the number of restrictions in equation h (the number of excluded exogenous variables), and g^* is the number of endogenous variables in equation h . If $r_h = g^* - 1$ then the equation is *just* identified. If $r_h > 1$ then the equation is over identified. If $r_h < 1$ then the equation is under identified. In this system of equations, r_h is equal to 2 and g^* is equal to 3 for each of equation in the system; therefore $r_h = g^* - 1$ and all equations are *just* identified.

The rank condition for each equation is usually satisfied if the *order* condition is satisfied. Peter Kennedy points out that many economists rely solely on the *order* condition; however he does not recommend this "gamble."⁸¹ Each equation meets the *rank* condition; therefore the system of equations is identified.

In this system of equations each equation is just identified; therefore the 2SLS estimator is an appropriate estimator. As the estimator's name implies, the 2SLS process requires two steps. First, each endogenous variable in the equation system is regressed on all the exogenous variables in the system of equations. This is known as estimating the reduced form equations. From each reduced form equation the estimated values of the endogenous variables are calculated and saved. Second, each equation in the system is estimated via OLS using the estimated values of the endogenous variables as instrumental variables.

⁸⁰ Peter Kennedy, A Guide to Econometrics. p. 165.

⁸¹ *Ibid.*, p. 156.

The equations in the simultaneous system are referred to as the structural equations, and the explanatory variables in the structural equations are the structural parameters of the simultaneous system.

$$(1) \quad R = \Gamma_0 T^{\gamma_1} H^{\gamma_2} I^{\gamma_3} A^{\gamma_4}$$

$$(2) \quad T = \Phi_0 R^{\phi_1} H^{\phi_2} I^{\phi_3} \%E3^{\phi_4}$$

$$(3) \quad H = \Delta_0 R^{\delta_1} T^{\delta_2} I^{\delta_3} B^{\delta_4}$$

The reduced form equations express the systems endogenous variables as a function of all the exogenous variables in the system. Moreover, the unknown coefficients of the reduced form equations (π_j) can be expressed as functions of the structural coefficients (γ, ϕ, δ).

$$(4) \quad R = \Pi_0 I^{\pi_{11}} B^{\pi_{12}} A^{\pi_{13}} \%E3^{\pi_{14}}$$

$$(5) \quad T = \Pi_0 I^{\pi_{21}} B^{\pi_{22}} A^{\pi_{23}} \%E3^{\pi_{24}}$$

$$(6) \quad H = \Pi_0 I^{\pi_{31}} B^{\pi_{32}} A^{\pi_{33}} \%E3^{\pi_{34}}$$

Since the reduced form coefficients can be expressed as functions of the structural coefficients, the reduced form coefficients can be interpreted as equilibrium partial elasticities with respect to the endogenous variables. In other words, π_{j2} provides the effect a percentage increase in income (I) has on the three endogenous variables (R, T, and H) in equilibrium. Each one percent change in income results in π_{12} , π_{22} , and π_{32} percent change in retiree sorting (R), property tax rates (T), and house value (H) respectively in equilibrium. The estimated unknown coefficients in the reduced form equations are helpful for forecasting and policy analysis.

Each of the three equations follow the functional format of the previous models. A log-log transformation of the variables is conducted to perform the 2SLS regression procedures. As with the previous two

models, the estimated coefficients can be interpreted as partial elasticities.

The following table (Table D) presents the parameter estimates of the structural equations, or the results of the 2SLS regression process. The table includes standard errors, calculated t-statistics, calculated p-values, and interval estimates (lower 95% and upper 95%) for each structural coefficient. T-statistics, p-values, and interval estimates are calculated at the 95% confidence level.

Table D: Structural Equations

Retirement Population						
R Square		0.48				
Adjusted R Square		0.47				
	Coefficients	Standard Error	t-Stat	P-value	Lower 95%	Upper 95%
Intercept (Γ_0)	-62.26	6.41	-9.71	0.00	-74.90	-49.61
H (γ_1)	8.09	0.69	11.77	0.00	6.74	9.45
T (γ_1)	9.36	1.34	6.96	0.00	6.71	12.01
I (γ_1)	-5.47	0.65	-8.37	0.00	-6.75	-4.18
A (γ_1)	1.36	0.36	3.75	0.00	0.64	2.07
Property Tax Rates						
R Square		0.10				
Adjusted R Square		0.08				
	Coefficients	Standard Error	t-Stat	P-value	Lower 95%	Upper 95%
Intercept (F_0)	3.17	1.30	2.44	0.02	0.61	5.73
R (f_1)	0.09	0.03	3.35	0.00	0.04	0.15
H (f_2)	-0.50	0.15	-3.44	0.00	-0.79	-0.21
I (f_3)	0.48	0.11	4.39	0.00	0.26	0.69
%E3 (f_4)	-0.09	0.06	-1.57	0.12	-0.21	0.02
Housing Value						
R Square		0.60				
Adjusted R Square		0.59				
	Coefficients	Standard Error	t-Stat	P-value	Lower 95%	Upper 95%
Intercept (Δ_0)	8.26	0.82	10.05	0.00	6.64	9.88
R (δ_1)	0.03	0.04	0.74	0.46	-0.05	0.11
T (δ_2)	-2.46	0.38	-6.47	0.00	-3.20	-1.71
I (δ_3)	1.17	0.16	7.17	0.00	0.85	1.49
B (δ_4)	-1.26	0.44	-2.87	0.00	-2.13	-0.40

The two structural equations of interest are the retiree sorting (R) equation and the property tax rate (T) equation. These two

equations will be evaluated separately. Several hypothesis will be explored and tested in each equation.

The property tax rate (T) equation expresses the community's consolidated property tax rate as a function of the first stage predicted value of the retirement population (Predicted R), the first stage predicted value of the median housing value (Predicted H), median household income (I), and the share of the community's population attaining a college degree (ϕ_3). The R-square of .10 for this equation implies explanatory variables explains little of the dependent variable's variation about its mean. All estimated coefficients are statistically significant, at the 95% level, with the exception of the share of the population attaining a college degree (ϕ_4) variable. The statistically insignificant estimated coefficient for this variable suggests college educational attainment has no effect on the property tax rates.

The structural coefficients in the property tax rate equation can be used to answer the following question. Hypothesis tests provide a means of answering this question of interest.

1. Do retirees effect property tax rates within a community?
 Certain population groups may influence property tax rates through the voting process. Also, the previous models did not account for this type of endogeneity. A statistically significant hypothesis test result would suggest a simultaneous systems model design is a more accurate representation of the Tiebout process in Oregon.

The above question can be answered through a zero null hypothesis test of the estimated coefficient ϕ_1 . The 95% confidence interval for

the parameter estimate is (.04, .15). Since the value zero does not fall within the upper and lower limits of the 95% confidence interval, the zero null hypothesis is rejected. Therefore, we can say the sample evidence suggests retirees do effect property tax rates in Oregon's local communities. Each one percent increase in a community's retirement population results in a .09 percent increase in the community's consolidated property tax rate. The previous models did not account for any influences retirees may have on local property taxes. This statistically significant parameter estimate suggests this type of endogeneity is present, and a simultaneous systems of equation approach is a better functional form for explaining how the Tiebout community sorting process works in Oregon.

Three of the four explanatory variables in the property tax rate equation were statistically significant at the 95% confidence level: the predicted retirement population, the predicted median house value, and median household income. The estimated partial elasticities for each of these explanatory variables are fairly small. The partial elasticity for predicted retirement population variable is (.09). The partial elasticities for the predicted median house value is .50 (in absolute value) and median household income variable is .50. The three partial elasticities are not unitary in themselves. A quick evaluation of the three confidence intervals associated with each of the estimated coefficients show the value one does not fall within the lower and upper limits of the 95% confidence intervals; therefore each partial elasticity is inelastic (i.e., less than one).

The Tiebout sorting equation expresses the community's retirement population (R) as a function of the predicted value of median house

value (Predicted H), the first stage predicted value of the consolidated property tax rate (Predicted T), median household income (I), and the age of the community's housing stock (A).

The R-square of .48 for this equation implies the explanatory variables explains about half of the dependent variable's variation about it's mean. Moreover, all explanatory variables are statistically significant at the 95% level.

The structural coefficients in the Tiebout sorting equation can be used to explore answers to the following questions. Hypothesis testing provide a means of answering these questions of interest. Of interest to this thesis research project are the following points regarding the Tiebout community sorting process for retirees:

1. Do local property tax rates influence retiree sorting? In designing this model, it is hypothesized that the Tiebout "shopping trip" can be viewed as balancing the price of a home against it's property tax rate to reveal one's preferred bundle of public services and taxes. A statistically significant estimated coefficient on the property tax rate (T) variable would support this "shopping trip" hypothesis.
2. Do housing prices (median house value) influence retiree sorting? If the estimated coefficient on the house value (H) variable is statistically significant, then the hypothesized Tiebout "shopping trip" scenario (balancing house price against property tax rates) may be supported.

The first hypothesis test of the Tiebout sorting equation attempts to answer the following question, "Do local property tax rates influence retiree sorting?" A zero null hypothesis of the γ_1 estimated structural

coefficient can help answer this question. A 95% confidence interval can be used for this zero null hypothesis test. The lower and upper limits of this estimated coefficient's 95% confidence interval (6.71, 12.01) does not include the value zero. Therefore, we can reject this zero null hypothesis, and conclude that the estimated structural coefficient for γ_1 is statistically significant at the 95% level. Put another way, property tax rates affects retiree sorting. The coefficient's point estimate of 9.36 implies that each one percent increase in property tax rates results in a 9.36 percent increase in the retirement population, on average, and holding all other variables constant.

In designing this model, it was hypothesized that the Tiebout "shopping trip" can be viewed as balancing the price of a home against it's property tax rate to reveal one's preferred bundle of public services and taxes. The statistically significant estimated coefficient on the property tax rate (T) variable lends support to this "shopping trip" hypothesis.

The second hypothesis test attempts to answer the question, "Do housing prices (median house value) influence retiree sorting?" A zero null hypothesis of the γ_2 estimated structural coefficient can help answer this question, and a 95% confidence interval can be used to test the zero null hypothesis. The lower and upper limits of the confidence interval (6.74, 9.45) does not include the value zero; therefore we can reject the zero null hypothesis and we conclude that γ_2 is statistically significant at the 95% confidence level. House value does effect retiree sorting. Each one percent increase in a community's median

house value results in a 8.09 percent increase in the community's retirement population, on average and holding other variables constant.

As with the statistically significant point estimate on the property tax coefficient and the statistically significant point estimate on the housing value coefficient the hypothesized Tiebout "shopping trip" scenario appears to be supported. In other words, these results lend support to the initial hypothesis that retirees balance housing price and property tax rates in choosing their residential community and in revealing their preferred bundle of public goods and services. However, to determine if both housing value and property tax rates are balanced requires a joint hypothesis test.

Implying both housing value and property tax rates are balanced can be expressed in a joint null hypothesis that expresses one partial elasticity equals the opposite of the other partial elasticity.

$$\gamma_1 = - \gamma_2$$

or

$$\gamma_1 + \gamma_2 = 0$$

The joint null hypothesis says sum of the partial elasticities of housing value and property tax rates, together, sum to zero. In other words, the partial elasticity of housing value is offset by the partial elasticity of the property tax rate, and vice versa. If the joint null hypothesis is true then we can say housing values and property tax rates are balanced against each other, thereby not rejecting the hypothesized Tiebout "shopping trip" balancing of housing price and property tax rates. An F-test will be used to test this joint null hypothesis. The F-statistic can be written as:

$$F = \{[SSE_c - SSE_u]/J\} / \{[SSE_c / (T-K)]\}$$

To perform an F-test a constrained regression must be estimated to obtain the SSE_c (Sum of Square Errors). The constrained regression equation can be developed by substituting the null hypothesis into the original equation, as follows:

$$R = \Gamma_0 T^{\gamma_1} H^{\gamma_2} I^{\gamma_3} A^{\gamma_4}$$

The null hypothesis can be rewritten as:

$$\gamma_1 = 0 - \gamma_2$$

Substituting this into the original Tiebout sorting regression equation we get:

$$R = \Gamma_0 T^{(0-\gamma_2)} H^{\gamma_2} I^{\gamma_3} A^{\gamma_4}$$

Taking the natural log of both sides of the equation is needed to perform an OLS regression, as follows:

$$\ln R = \ln \gamma_0 + (0 - \gamma_2) \ln T + \gamma_2 \ln H + \gamma_3 \ln I + \gamma_4 \ln A$$

Gathering like terms and rearranging terms we get:

$$\ln R = \ln \gamma_0 - \gamma_2 \ln T + \gamma_2 \ln H + \gamma_3 \ln I + \gamma_4 \ln A$$

$$\ln R = \ln \gamma_0 + \gamma_2 \ln(H + T) + \gamma_3 \ln I + \gamma_4 \ln A$$

The constrained sum of square errors (SSE_c) is obtained by regressing the dependent variable ($\ln R$) on the constructed explanatory variable ($\ln [H+T]$) and the explanatory variables ($\ln I$), ($\ln A$). The SSE_c is 85.61. Having all the values for calculating the F-statistic, the F-statistic is:

$$F = \{[SSE_c - SSE_u]/J\} / \{[SSE_u/(T-K)]\}$$

$$F = \{[85.61 - 182.72]/1\} / \{[182.72/(208-5)]\}$$

$$F = -97.11 / .90 = -107.90$$

The joint null hypothesis is rejected if the F-statistic is greater than the critical value of the F-statistic (F_c). The critical value of the F-statistic (F_c), $F_{[(K-1),(T-K)]}$ or $F_{[4,203]}$, is 2.37. Since $-107.90 < 2.37$

we do not reject the joint null hypothesis. The partial elasticities may offset each other. Therefore, the sample evidence lends support to the Tiebout "shopping trip" hypothesis that both housing value and property tax rates are balanced against each other.

The estimated structural parameters of the three structural equations can be summarized as follows:

1. All structural parameters of the Tiebout sorting equation are statistically significant. House value, property tax rates, income, and housing stock age effect retiree sorting. Put another way, the Tiebout community sorting hypothesis is present in Oregon with respect to retirees. The house value and property tax rate partial elasticities are both elastic and positive.
2. Three of the four structural parameters in the property tax rate equation are statistically significant. The retirement population, house value, and income effect property tax rates; the share of the community's population with a college degree has no effect on property tax rates. The retirement population partial elasticity on tax rate is positive suggesting retirees put a burden on local taxes, on average. The signs on the coefficients for house value and income are negative and positive, respectively, as expected.
3. Three of the four structural parameters in the housing value equation are statistically significant. Property tax rates, income, and the housing stock's average house size effect house values. The retirement population does not effect house values. The signs of the coefficients for property tax rates

and income were negative and positive, respectively, as expected.

Two significant structural parameters suggest a simultaneous systems of equations specification represents the Tiebout community sorting process better than the previous two econometric models. The significant point estimate for the retirement population coefficient (ϕ_1) in the tax rate equation supports the argument that a community's retirement population affects property tax rates. Also, the significant point estimate for the property tax rate coefficient ($\hat{\delta}_2$) in the house value equation supports Oates' property tax capitalization findings. A simultaneous systems of equations approach to the Tiebout community sorting process accounts for feedback influences not accounted for in the previous two econometric models.

The positive sign on the tax rate variable (T) in the Tiebout sorting equation appears confusing at first glance and warrants further interpretation. This positive sign implies a percentage increase in the consolidated property tax rate results in a 9.36 percent increase in the retiree population, holding housing value, income, and housing age constant. Therefore it appears retirees sort to where tax rates are greater. The sign on the tax rate coefficient excludes variability from the other explanatory variables (house value, income, and housing age). House value is included in the tax rate variable ($T=NL/AV$). Because house value (H or AV) is used to determine the tax rate (T), and because of the econometric regression equation's specification, the point estimate of T excludes any affects housing value has on tax rates. This means the point estimate of T reflects (proxies) public service spending, or the net levy (NL). The positive sign on the tax variable

can be interpreted as the effect public service spending has on retiree sorting. Each one percent increase in local public spending results in a 9.36 percent increase in the retiree population. Retirees move to where public spending is greater.

Interpretation of the house value variable (H) in the Tiebout sorting equation follows along similarly. The estimated coefficient on H excludes affects of capitalization from property tax, income, and house age. Retirees move to where housing values are greater.

The reduced form equations for the Tiebout community sorting simultaneous equations model are presented in Table E. The point estimate, standard error, t-statistic, p-value, and the 95% confidence interval lower and upper limits are shown for each reduced form coefficient.

Table E: Reduced Form Equations

Retirement							
Population							
R Square		0.48					
Adjusted R Square		0.47					
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	
Intercept (Π_{10})	13.60	4.52	3.01	0.00	4.69	22.52	
I (π_{11})	0.30	0.42	0.70	0.48	-0.54	1.14	
B (π_{12})	-6.54	0.76	-8.61	0.00	-8.04	-5.05	
A (π_{13})	-0.46	0.24	-1.92	0.06	-0.94	0.01	
%E3 (π_{14})	1.49	0.20	7.63	0.00	1.11	1.88	
Property Tax							
Rate							
R Square		0.10					
Adjusted R Square		0.08					
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	
Intercept (Π_{20})	-0.53	0.99	-0.54	0.59	-2.49	1.42	
I (π_{21})	0.36	0.09	3.85	0.00	0.17	0.54	
B (π_{22})	-0.50	0.17	-3.03	0.00	-0.83	-0.18	
A (π_{23})	0.16	0.05	3.06	0.00	0.06	0.27	
%E3 (π_{23})	-0.11	0.04	-2.49	0.01	-0.19	-0.02	
Housing Value							
R Square		0.60					
Adjusted R Square		0.59					
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t-Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	
Intercept (Π_{30})	9.99	0.88	11.32	0.00	8.25	11.74	
I (π_{31})	0.30	0.08	3.59	0.00	0.13	0.46	
B (π_{32})	-0.23	0.15	-1.52	0.13	-0.52	0.07	
A (π_{33})	-0.41	0.05	-8.7.	0.00	-0.51	-0.32	
%E3 (π_{34})	0.31	0.04	8.06	0.00	0.23	0.38	

The reduced form equations reflect the relationship between each endogenous variable (R, T, and H) and exogenous variable (I, B, A, and %E3) in the simultaneous equation system after all feedback influences have taken place. The estimated coefficients of the reduced form equations are useful for predicting the system's equilibrium outcomes from changes in the exogenous variables.

The reduced form coefficients in each of the reduced form equations (I, B, A, and %E3) provide viable estimators. Put another way, each equation has statistically significant parameter estimates. The R-square for the housing value reduced form equation is .60. This implies the reduced form coefficients explain over half of the variation of the housing value (H) about it's mean. The R-square for the property tax rate (T) reduced form equation is .10; implying the system's reduced form coefficients explain little of the variation of the property tax rate variable about it's mean. Also, the R-square for the retirement population (R) reduced form equation is .48; implying the system's reduced form coefficients explain roughly one-half of the variation of the retirement population variable about it's mean. The fairly moderate size of the reduced form equations' R-squared values indicates the model's simplicity in explaining the variation in a community's retirement population, property tax rates, and housing values.

Not all of the reduced form coefficients are statistically significant, at the 95% level, in each equation. Three of the reduced form coefficients are statistically significant at the 95% level in the housing value reduced form equation. The community's median household income, age of it's housing stock, and share of it's population

attaining a college degree effect equilibrium housing value. The average house size in the community's housing stock does not effect house value. In the property tax rate reduced form equation, all four reduced form coefficients are significant at the 95% confidence level. Two of the four reduced form coefficients in the retirement population equation are statistically significant at the 95% level: average house size and the share of the population with a college degree. However, at the 90% confidence level the reduced form coefficient on the age of the housing stock parameter is statistically significant.

The only reduced form coefficient that is significant at the 95% confidence level in each equation is π_{i4} , or the coefficient on the share of the population with a college degree parameter. At the 94 % confidence level the reduced form coefficient on the age of the housing stock parameter (π_{i3}) is significant in all three reduced form equations.

SUMMARY AND CONCLUSIONS: MODEL COMPARISONS
AND SUGGESTIONS FOR FUTURE RESEARCH

Model Comparisons

The three econometric models presented in this thesis approach the Tiebout sorting hypothesis from different perspectives. The first two econometric models described the Tiebout sorting process as a process of weighing the benefits of local public services against the costs. The benefit from local public services was proxied by a controlled median housing value explanatory variable, and the price of local public services was proxied by the property tax rate variable(s). By controlling the housing value variable for capitalization influences from income, property taxes, house size, house age, and housing demand, it was expected the estimated coefficient on the house value parameter could be interpreted as the partial elasticity of the capitalized value of public services and retiree sorting. The first econometric model accounted for individual property tax rates (i.e., city, county, and school district); whereas the second econometric model used the consolidated property tax rate as a proxy for the price of local public services.

The results from the first econometric model suggest local property tax rates do not affect retiree sorting, but the capitalized value of local public services does affect retiree sorting. Also, the partial elasticity from the capitalized value of public services and retiree sorting may be inelastic. From a Tiebout sorting hypothesis perspective, these results imply a partial Tiebout sorting process with respect to retirees. Holding population, housing characteristics, and

taxes constant, retirees will move to where there are more public services. Retirees look for a surplus of benefits over costs.

In analyzing the first model's results, a few specification limitations were identified. First, complete house value capitalization from a community's cultural and physical amenities was not accounted for in the statistical model. Second, a Tiebout balancing of various property tax rates was not addressed. Third, a high level of statistical significance associated with one coefficient (on the population explanatory variable) resulted in a very high R-square result. An attempt to correct the first model for these concerns was attempted in the second econometric model.

The second econometric model respecified the first model in three ways. First, three additional explanatory variables were added in an attempt to control for amenity capitalization in housing values. Second, the consolidated property tax rate was used as the Tiebout tax/price variable replacing the three individual local property tax rate variables. Third, the population explanatory variable was dropped. Housing value capitalization from cultural and physical amenities were controlled by adding three explanatory variables characterizing a community's educational composition; it was assumed that an individual's educational attainment reflects the value placed on cultural and physical amenities. Using the consolidated property tax rate in place of the three individual property tax rates (city, county, and school district) allows for relaxing the Tiebout "full information" assumption and it allows for individuals to be rational economic agents by balancing the community's various property tax rates. By dropping the population explanatory variable it was expected that the R-square value

would fall since a highly correlated explanatory variable with the dependent variable was removed.

The results from the second model imply a Tiebout sorting process occurs with respect to retirees. Both the consolidated property tax rate and housing value affect retiree sorting. In this second model, the consolidated property tax rate becomes a significant coefficient explaining the dependent variable's variation about its mean; this was not the case with the first model. The difference between the first model's results and second model's results, with respect to the property tax partial elasticity, may be attributed to the influence of bonded debt property tax rates on retiree sorting.⁸² The estimated coefficient on the housing value variable increased in the second model after controlling for amenity capitalization. This was not expected. It was expected the estimated coefficient on the housing value variable would fall after controlling for amenity capitalization. This unexpected result suggests the three variables characterizing the community's educational attainment do not adequately control for amenity capitalization.

In analyzing the results of the second econometric model a few specification and methodology issues arose. First, the second model (as well as the first model) ignored the interdependent relationships between the various Tiebout sorting variables. In other words, a median voter process may simultaneously occur thereby implying specification error associated with endogeneity. Second, the property tax rate

⁸²Bonded debt property tax rates were not included as an explanatory variable in the first econometric model; however it was included in the second and third models.

variable may have been misinterpreted in the first two models. The property tax rate may not actually reflect the cost/price of local public services. The property tax rate may more accurately reflect the community's tax/spending bundle on local public services. Also, the Tiebout "shopping trip" may be described as balancing housing value and property tax rates; thereby revealing one's true preferred local public services tax/spending bundle.

To address the issues raised from the second econometric model a third econometric model was designed. To account for possible feedback influences in the Tiebout sorting variables (i.e., median voter process and property capitalization) the Tiebout sorting process was modeled as a simultaneous systems of equations. In this simultaneous system the Tiebout sorting variables (housing value, property tax rates, and the retirement population) are endogenous to the model's system. This endogeneity allows for property tax rates to be determined by the community's retirement population; thereby addressing feedback from a median voter process. This endogeneity also allows for property tax rates to affect housing values and retirees to affect housing values; thereby addressing feedback from housing value capitalization and retirees housing demand preferences.

The results from the third econometric model supports the Tiebout sorting hypothesis with respect to retirees. The structural coefficients on the housing value and property tax rate variables in the retirement population structural equation are both statistically significant at the 95% confidence level. Property taxes are negatively capitalized into housing values. The structural coefficient on the property tax rate variable in the housing value structural equation is

significant. Also, a community's retirement population positively effects property tax rates. A median voter process, with respect to retirees, is supported by the sample evidence in the model. The structural coefficient on the retirement population variable in the property tax rate equation is significant at the 95% level. A one percent increase in the retirement population results in .09 percent increase in a community consolidated property tax rate, on average.

These statistically significant structural coefficients suggest that a simultaneous systems model more accurately represents the Tiebout sorting process with respect to retirees in Oregon. An added benefit to the simultaneous systems model is the ability to evaluate equilibrium outcomes of the endogenous variable. The reduced form coefficients of the systems endogenous variables (retirement population, housing value, and property tax rate) can be interpreted as equilibrium outcomes of the dependent variables given a change in an exogenous variable (income, average house size, housing stock age, and a community's educational attainment). The reduced form equations are useful for policy analysis.

Caution should be used when using the results of the three econometric models in this thesis. When interpreting the results of each models parameter estimates, I phrased the results with respect to a community or city. The usefulness of these econometric models is not so much in their ability to forecast specific changes in retiree sorting from changes in local government taxes and spending; the models are useful in their ability to test hypotheses of economic relationships and theories.

Suggestions for Future Research and Work

This thesis attempted to answer two questions: 1) "What are the economic and fiscal impacts from retiree in-migration?", and 2) "Is there a Tiebout sorting process with respect to retirees in Oregon?" The prior question was answered through a review of previous empirical research on the fiscal impacts of retiree in-migration. The previous empirical work identifies similar suggestions for future research and work. During the process of conducting this empirical research process, several obstacles were encountered through the project's design and data collection phases that reflect the experience from the previous work.

The first, and most challenging obstacle, was the lack of local government financial data or its inaccessibility. The prior empirical research on this topic exclusively used county government level financial data. I attempted to improve the research on this topic by focusing on a smaller government unit - municipal government. My reasoning for this focus was guided by the belief that individuals choose a city/community, not a county, when making a residential location choice. Oregon's numerous municipal government financial data is not readily accessible for use in empirical research. Moreover, there are no consistent financial data definitions for city governments. One city government may place all of its public transportation financial transactions in the general fund; whereas another city government may account for its public transportation financial transactions through the general fund and a special fund category. This makes the cross comparison of city government budget data extremely difficult.

Standardizing city government budget data items (i.e., expenditures and revenues) is one improvement that will improve future research on this topic, as well as other local government fiscal impact analysis. The lack of, and inaccessibility, of such local government budget data resulted in designing a statistical model with proxy variables. The use of proxy variables is not uncommon in economic, and econometric, analysis. The three statistical models rely on three variables to proxy the Tiebout tax/spending sorting process: property tax rate, house value, and the retirement population. Different, and possibly more accurate, results would come from better data resembling the Tiebout tax/spending sorting process: program specific spending and category specific revenue.

The focus of this thesis was the fiscal impacts from retiree immigration and community sorting specific to Oregon's retirement age population. Similarly fiscal impacts and community sorting from the younger, non retirement age, population was not addressed. A comparison of the two population groups would provide additional insight for local economic development policy. For example, it would be interesting to know if non retirees effect property tax rates and at what level. A comparison of the various partial elasticities of the two population age groups would provide additional information to the policy maker. For example, the results in the third model's reduced form coefficients imply the retirement population increases as the community's housing stock age falls (i.e., through new housing construction), but what happens to the community's non retirement age population? Does it increase or decrease? This study is unable to answer questions of similar impact to the non retirement population.

The role cultural and physical amenities play in an individual's residential relocation decision is a topic warranting further research. The second econometric model attempted to account for a community's cultural and physical amenities. This attempt was unsuccessful given the difficulty with identifying quantifiable measures for cultural and physical amenities. The community's educational composition was used to proxy these amenities with the belief that differing educational attainments effect amenity valuation. Contingent valuation techniques and logistic regression may be better tools to adequately, and justly, address the amenity issue.

Finally, local government fiscal impacts from Oregon's recent property tax rate reduction initiative, Measure 5, were not addressed in the three econometric models. The data set used for the econometric models is pre-Measure 5. The extent in which Measure 5 effects local public services is not reflected in the data set. Measure 5 effects on the provision of local public services was not addressed since city governments were the least affected by the Measure 5 tax rate limitations. However, the Measure 5 tax rate shocks to school districts and county governments are reflected in the consolidated property tax rates. Given that the consolidated tax rate is used as an explanatory variable in the second and third econometric models, the estimated coefficients may differ if a data set is used reflecting post-Measure 5 demographic and fiscal equilibrium.

Clearly, more work can occur on this topical area. Before any further empirical research is conducted, improvements in data accessibility, consistency, and quality are highly recommend by this researcher. Conducting informative fiscal impact analysis of Oregon's

local governments requires a readily retrievable database of a community's socioeconomic and local government fiscal information. The lack of quality local government data has made previous researchers rely on county government data provided through the US Census. The quality of a specific research project is only as good as the data used in the research project.

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APPENDICIES

APPENDIX A: FISCAL PROFILE OF FOUR COASTAL CITIES WITH RETIREE IN-MIGRATION

The fiscal impacts from increased retiree in-migration in Oregon are not well understood. As part of this thesis research, a data analysis of four Oregon coastal cities was conducted. The data analysis covers four retirement oriented coastal communities and attempted to identify public sector fiscal trends. The coastal cities of Astoria, Cannon Beach, North Bend, and Brookings were selected. Local government revenue, expenditure, and population data covering the period from fiscal year (FY) 1985 through FY 1993 are presented and trends are discussed. This time period was selected because it covers both recessionary and expansionary economic activity for the state, and it covers the period of the late 1980's in which the state experienced its greatest increase in retiree in-migration.⁸³

The four cities in this case study section were specifically chosen by meeting two criteria: 1) demographic characteristics and geographic location, and 2) for their receipt of a "Certificate of Achievement for Excellence in Financial Reporting" awarded by the Government Finance Officers Association of the United States and Canada. The first criterion is self-evident as this thesis focuses on Oregon's coastal local governments. Two of the cities, Astoria and Cannon Beach, have an active tourism industry; whereas Brookings and North Bend have

⁸³Budgetary, or fiscal, data observations cover a fiscal year (FY) time period. Oregon's city governments' fiscal year begins July 1 and ends June 30. The demographic data come from two sources: US Census and The Center for Population Research and Census, Portland State University (PSU). The US Census is taken on April 1, and the PSU population estimate is for July 1. The population estimate from PSU parallels the city government's FY because the population estimates, when certified by the Secretary of State, are used in the allocation of certain state tax revenues to city governments.

recently experienced a marked increase in their retirement population. Thus, these four cities are fairly representative of the Oregon coast, geographically and demographically, and they are representative of the topic of interest. The second criterion provides consistent data definitions for comparing city government categorical expenditures and revenues. The "Certificate of Achievement for Excellence in Financial Reporting" is awarded to local government units and retirement systems whose comprehensive annual financial reports meet a standard in government accounting and financial reporting established by the Government Finance Officers Association of the United States and Canada. One of the standards set by this professional association is the maintenance of specific fiscal statistics and their publication in the local government's comprehensive annual financial report. The fiscal statistics cover the previous nine fiscal years and include: general governmental expenditures by function, general governmental revenues by source, property tax levies and collections, assessed and estimated actual value of taxable property, property tax rates for direct and overlapping governments, and net bonded debt per capita.

Each case study follows a similar format for analyzing relationships between retiree in-migrating and impacts on local government operations. First, each city's population is described in terms of persons age 65 and older (retirees), persons under 65 years of age (non-retirees), and in terms of retirement household income. Second, a brief description of each city's budget is presented. Individual fund categories and their purpose are described briefly. Third, the city's revenue growth is presented for two major revenue types: taxes and fees and charges. Fourth, the city's expenditure

growth is characterized for four expenditure categories: general government, public safety, parks and recreation, and debt service. Per capita dollar figures are used to allow for cross-city comparison of local government spending and revenue, as well as to assess changes in local government revenue effort.⁸⁴ Finally, an attempt to relate various patterns in local government fiscal patterns and retiree-in migration is conducted through partial correlation analysis.

The City of Astoria

The City of Astoria is Oregon's northern most coastal city. Located in Clatsop County, Astoria is a characteristic coastal tourism community. In 1989, 17% of the city's population was over the age of 65. This is a little higher than the share of the population over 65 for the entire state of Oregon (15%).⁸⁵ Astoria experienced tremendous population growth in the late 1980's, specifically from 1987 through 1989. Another insightful way of interpreting the city's population is through patterns of personal income. In 1989, \$6.5 million of Astoria total household income can be described as retirement income. This represents 5% of Astoria's total household income.⁸⁶ An additional 8% is Social Security income. Retirement and Social Security income's share

⁸⁴ Glasgow and Reeder used "revenue effort" in their data analysis of non-metro retirement county fiscal data. An increase in per capita revenue would suggest increased revenue effort.

⁸⁵ The population shares are based on Oregon Department of Revenue data of individuals filing income tax return claiming the federal income tax over 65 exemption.

⁸⁶ Astoria's total 1989 household income of \$120.2 million consists of wage and salary income (70%), nonfarm self-employment income (7%), farm self-employment income (0.09%), interest dividend or net rental income (8%), Social Security income (8%), public assistance income (0.8%), and retirement income (5%). Source: US 1990 Census.

of total income for Oregon is 11%. The 1990 Census data indicates Astoria's share of income characterized as retirement and Social Security income is greater than the State's figure. Per capita income was \$12,320, and the median household income in 1989 was \$24,325.

The city budget consists of a general fund and 20 special funds. The city's General Fund is the major fund in the city's budget with expenditures in excess of \$4 billion. Many city services are funded through the General Fund. These include the municipal court, police and fire protection, parks and recreation, as well as salaries and expenditures for the city council, city manager and city attorney. Local property taxes are the major revenue source for the General Fund. In FY '93, over half of the General Fund revenue came from local property taxes. Each special fund was developed for specific expenditure needs or to account for spending specific revenues. For example, the Capital Improvement Fund (Fund 105) was established "to account for monies designated for capital improvement appropriation. The primary revenue source is the sale of city-owned property."⁸⁷ The DARE Fund (Fund 181) "account(s) for monies received for the Drug Awareness Resistance and Education Program." ⁸⁸

During this period the city's per capita revenue from fees and charges increased by 209.1%. Comparing this to the increase in the city's per capita tax revenue during this period of 22.8%, it appears that fees and charges are becoming an increasingly important revenue source for the city. In FY 1985, fees and charges accounted for 2.69%

⁸⁷City of Astoria, Oregon Comprehensive Annual Financial Report For The Fiscal Year Ended June 30, 1993, p. 38.

⁸⁸Ibid., p. 38.

of total revenue; by FY 1993 this share was 6.44% of total revenue. The tax revenue share of total revenue remained fairly stable throughout this period at about 60%. Of all revenue sources for the city of Astoria, fees and charges have experienced the greatest growth in percentage terms.

The largest program expenditure for the city is public safety. Over the nine year period Astoria's per capita expenditure on public safety increased 44%. In FY 1985 the city spent \$156 per person on public safety; by FY 1993 Astoria was spending \$224 per person on public safety.⁸⁹ This has been a fairly steady increase during the nine year period.

An indicator of possible future tax liability the city's net bonded debt. Net bonded debt is the net debt owed by the city to repay past bond obligations. These bond obligations are general obligation bonds passed by the city residents, and may be repaid with future property taxes that are exempt from Measure 5 limits. General obligation bonds are often paid by charges, fees, other non property tax revenues. During the nine year period Astoria's per capita bonded debt decreased 89%. In FY 1985 the city's per capita bonded debt was \$168. By FY 1993 the city's per capita bonded debt dropped to \$18 per capita.

Astoria's nine year fiscal history can be summarized as follows. First, fees and charges have become increasingly important to the city's total revenue (as measured by increased revenue share). Taxes' share of total revenue remained fairly constant. The city's per capita total revenue increased 26% during this period. Second, the demand for public

⁸⁹Per capita figures on expenditures is a common method of evaluating demand for public goods and services.

goods and services has increased (as measured by per capita expenditure); total per capita expenditures increased 43%. Third, the city's per capita bonded debt fell 89%.

The City of Cannon Beach

The City of Cannon Beach is another Oregon northern coastal city. Located in Clatsop County, Cannon Beach may be characterized as a mixed coastal tourism and retirement oriented community. In 1989, 27% of the city's population was over the age of 65. This is greater than the share of the population over 65 for the entire state of Oregon (15%).⁹⁰ Cannon Beach experienced 5% population growth during the period of FY 1985 through FY 1983. In 1989, Cannon Beach's total household income was \$16.85 million. Six percent of this total household income can be described as retirement income, and an additional 10% is Social Security income. Cannon Beach's share of total income characterized as retirement and Social security income (16%) is over the State's share of 11%. Finally, per capita income was \$14,101 in 1989.⁹¹

The city budget consists of a general fund and seven special funds. The city's General Fund is the major fund in the city's budget with expenditures in excess of \$1.2 billion. Many city services are funded through the General Fund. These include the municipal court, police protection, parks and community service, as well as expenditures for executive operations. Local taxes and assessments are the major revenue source for the General Fund. In FY '93, over half of the

⁹⁰The population shares are based on Oregon Department of Revenue data of individuals filing income tax return claiming the federal income tax over 65 exemption.

⁹¹ Cannon Beach's 1989 income data comes from the 1990 US Census.

General Fund revenue came from local taxes. The seven special revenue "funds account for revenue derived from a specific tax or other earmarked revenue sources which are legally restricted to finance particular functions or activities."⁹² For example, the Lifesaving Fund "accounts for tax revenues received from [the] transient room tax, an expired serial levy and State of Oregon funds to support the lifeguard program."⁹³ The Transient Lodging Reserve Fund is " used to accumulate transient room tax funds that are determined to be in excess of current needs for financing future tourist related expenditures."⁹⁴

Cannon Beach's per capita total revenue has grown 164% during the nine year period covering FY 1985 through FY 1993. In FY 1985 per capita total revenue was \$508; by FY 1993 per capita total revenue was \$1,339. Property taxes have become a less important source of revenue for the city. In FY 1985 property taxes contributed 32% to the city's total general revenue; by FY 1993 local property taxes' share of total revenue was 22%. Cannon Beach experienced tremendous growth in several revenue categories. While per capita tax revenue grew 246% during this nine year period, per capita revenue from licenses, permits and franchise fees grew 101%.

Like Astoria, the largest program expenditure for the city is public safety. Over the nine year period Cannon Beach's per capita expenditure on public safety increased 171%. In FY 1985 the city spent \$154 per person on public safety; by FY 1993 Cannon Beach was spending \$418 per person on public safety. This has been a fairly steady

⁹²City of Cannon Beach, Oregon Annual Financial Report for the Year Ended June 30, 1993, p. 18.

⁹³Ibid., p. 18.

⁹⁴Ibid., p. 18.

increase during the nine year period. Parks and community services per capita expenditures also increased substantially (289%). In FY 1985 per capita expenditure on parks and community services was \$45; in FY 1993 this amount increased to \$174. Also during this nine year period per capita general government expenditures increased 193%.

An evaluation of the city's future tax liability (as measured by net bonded debt per capita) reveals that during the period Cannon Beach's per capita net bonded debt declined 100%. In FY 1985 the city's per capita bonded debt was \$489; by FY 1993 the city had no bonded debt.⁹⁵

Cannon Beach's nine year fiscal history can be summarized as follows. First, total revenue and several specific revenue categories increased significantly. Per capital total revenue increased 164%. Per capita total tax revenue increased 246% and per capita revenue from fees and charges increased 101%.⁹⁶ Second, the demand for public goods and services has increased (as measured by per capita expenditure); total per capita expenditures increased 23%. The demand for parks and community services increased the most in percentage terms (289%), and public safety demand increased 171%. Third, the city's per capita net bonded debt substantially declined from \$489 to \$0.

⁹⁵The \$2.5 million net bonded debt in FY 1993 does not include general obligation water and sewer bonds outstanding initiated in FY 1986.

⁹⁶The City of Cannon Beach is a newly incorporated city government entity. During time period of this data analysis, the city's "start-up" phase included much property annexation activity. Therefore accounting for the tremendous fiscal growth.

City of North Bend

The City of North Bend is located on Oregon's south central coast. Located in Coos County, North Bend can be characterized as a mixed coastal tourism and retirement oriented community. In 1989, 16% of the city's population was over the age of 65. This is similar to the share of the population over 65 for the entire state of Oregon (15%). The City of North Bend annual financial report identifies the growing importance of tourism in the city's economy:

The City lies at the south edge of the vast Oregon Dunes National Recreational Area, close to the Pacific shoreline where outdoor recreational activities draw tourists from within the state and from other states. The economy of the South Coast stems directly from the geography and natural resource base of the area. (Principal) industries in the area are lumber, fishing, agriculture, shipping, recreation and a growing tourist industry. (emphasis added) ... The recreational resources of the North Bend-Coos Bay area and Coos County include the Coos Bay estuary and ocean beaches, as well as numerous rivers, streams, mountains and forest. ... These natural resources have been enhanced by the development of user facilities and other improvements, including camping and picnic sites, trails, marinas, breakwaters, access roads, motel and hotels, golf courses, moorages and other tourist facilities. ... The presence of these natural resources and user facilities ... has resulted in the development of a growing tourist industry.⁹⁷

North Bend experienced substantial population growth during the period of FY 1985 through FY 1993. During the latter part of the 1980s the city experienced a decline in its population. From 1985 to 1986 the city's population fell from 9,135 to 8,770 which the Oregon Employment Division attribute to the loss of timber industry jobs in the region and the recession of the early 1980s. Since 1986 the city's population increased 12%. Another insightful way of interpreting the city's

⁹⁷City of North Bend, Oregon Comprehensive Annual Financial Report, Fiscal Year Ended June 30, 1993, p. 94.

population is through patterns in personal income. According to the 1990 US Census 14% of North Bend residents' personal income can be described as retirement and Social Security income.⁹⁸ This is above the State's share of 11%. Per capita income for the city was \$11,590.⁹⁹

The city budget consists of a general fund and 11 special funds. The city's General Fund is the major fund in the city's budget with expenditures in excess of \$2.3 million. Primary sources of revenues for the general fund come from property taxes, licenses, fees and permits, and intergovernmental revenue. Many city services are funded through the General Fund. These include the general government, police and fire protection, parks and recreational services, the community center, and street maintenance.¹⁰⁰ Local property taxes are the major revenue source for the General Fund. In FY '93, over half of the General Fund revenue came from local property taxes. Eleven special revenue funds are used to account for specific taxes and other revenues designated for specific programs or services. For example, the Footpath and Bicycle Fund accounts for the expense of "the portion of [the] state gas tax apportionment's which are restricted for footpath and bicycle routes."¹⁰¹ The Transient Room Tax Fund is used for "promoting and

⁹⁸ Total 1989 income is \$109.83 million. Social Security income is 9% of total income or \$10.31 million, and retirement income is 5% of total income or \$6 million.

⁹⁹ The source for 1989 income is the 1990 US Census.

¹⁰⁰ General government includes salaries and expenditures for the city administrator, finance, engineering, building, planning commission, municipal court, city attorney, city hall and grounds, and community promotion.

¹⁰¹ City of North Bend, Oregon Comprehensive Annual Financial Report, Fiscal Year Ended June 30, 1993. p. 33.

advertising the City and surrounding community;" the primary revenue source for this fund comes from the city's hotel and motel room tax.¹⁰²

North Bend's per capita total revenue has grown 74% during the nine year period covering FY 1985 through FY 1993. In FY 1985 per capita total revenue was \$231; by FY 1993 it was \$402. The growth in total general revenue cannot be attributed to one specific revenue source. Property taxes have steadily contributed roughly 40% of total general revenue. In FY 1985 property taxes contributed 43% to the city's total general revenue; by FY 1993 local property taxes' share of total revenue was 44%. Motel taxes' share of total revenue increased from 2% to 11%.

Like Astoria and Cannon Beach, the largest program expenditure for the city is public safety.¹⁰³ Over the nine year period North Bend's per capita expenditure on public safety increased 38%. In FY 1985 the city spent \$111 per person on public safety; by FY 1993 North Bend was spending \$153 per person on public safety. This has been a fairly steady increase during the nine year period with one period of reduced police spending during FY 1987. Parks spending fluctuated during the nine year period. In FY 1985 per capita expenditure on parks was \$14; by FY 1993 this amount was slightly lower \$13. During this period per capita general government expenditures increased 29%.

North Bend's per capita net bonded debt increased substantially. In FY 1985 the city's per capita bonded debt was \$47; by FY 1993 it was \$423 per capita. There are several ways of interpreting an increase in net bonded debt. One interpretation is current city residents are

¹⁰²Ibid., p. 33.

¹⁰³Public Safety includes both police and fire protection expenditures.

postponing payment of present public services demands until a future period. Another interpretation is that current residents are shifting the burden of current public service demands onto future generations. The increase in general obligation bond debt may be attributed to anticipated large capital projects, or perhaps bonded debt is just the cheapest way of borrowing money to fund capital projects that may be paid off by future revenues from water and sewerage charges.

North Bend's nine year fiscal history can be summarized as follows. First, total per capita general revenue and increased 74%. This increase is fairly evenly distributed among all general revenue sources. Second, the demand for public goods and services has increased (as measured by per capita expenditure); total per capita expenditures increased 59%. Public safety demand increased 38%. Third, the city's per capita bonded debt substantially increased 801%.

The City of Brookings

The City of Brookings is located along Oregon's south coast. Located in Curry County, Brookings may be characterized as a coastal retirement oriented community. In 1989, 30% of the city's population was over the age of 65. This is greater than the share of the population over 65 for the entire state of Oregon (15%).¹⁰⁴ Brookings experienced substantial population growth during the period of FY 1985 through FY 1993 of 46%. At the end of FY 1985, the city's population was 3,470; by the end of FY 1993 Brookings had 5,100 residents. Another

¹⁰⁴The share of the population for the City of Brookings and the State of Oregon are based on Oregon Department of Revenue data of individuals filing income tax return claiming the federal income tax over 65 exemption.

insightful way of assessing the city's population is through patterns in personal income. In 1989, 17% of Brookings residents' personal income can be described as retirement and Social Security income. Similar to the other three cities, this is above the State's share of 11%. The city's total household income was \$55.12 million, and per capita income was \$12,525.¹⁰⁵

The city budget consists of a general fund and 4 special funds. The city's General Fund is the major fund in the city's budget with expenditures in excess of \$1.5 million. Primary sources of revenues for the general fund come from taxes (property and non-property), licenses and permits, and charges for services. Intergovernmental revenue, fines and forfeitures and interest contribute smaller shares towards General Fund revenue. The city services funded through the General Fund include general government, public safety, and culture and recreation. Local taxes are the major revenue source for the General Fund. In FY '93, over half of the General Fund revenue came from local property taxes. Four special revenue funds are used to account for specific taxes and other revenues designated for specific programs or services. These funds include the Waste Water Fund, the Water Fund, the Street Fund, and the 911 Fund. The individual fund names are fairly self-explanatory. For example, the Waste Water Fund "accounts for operating the City's sewer system and treatment facility."¹⁰⁶ Revenue for this fund comes from charges for services to sewer users, permit fees to establish new sewer connections, and various system development charges. The Street

¹⁰⁵ The source for 1989 income data is the 1990 US Census.

¹⁰⁶ City of Brookings, Oregon Comprehensive Annual Financial Report, Fiscal Year Ended June 30, 1993.

Fund accounts for expenditures charged against the City's share of the State's special gasoline tax revenue. These expenditures are limited to street maintenance.

Brookings' per capita total general revenue has grown 86.2% during the nine year period covering FY 1985 through FY 1993. In FY 1985 per capita total revenue was \$479; by FY 1993 it was \$892. The growth in total general revenue cannot be attributed to tax growth. During the nine year period per capita tax revenue declined 5% while several other revenue categories increased. Per capita fees and charges for services increased 82%. The share of taxes contributing to general revenue has steadily declined throughout the nine year period. This revenue trend may suggest the greater reliance on fees, licenses and permits, and other revenue sources to finance city expenditures on public services.

Like Astoria, Cannon Beach, and North Bend the largest program expenditure for the city is public safety.¹⁰⁷ Over the nine year period Brookings' per capita expenditure on public safety increased 38%. In FY 1985 the city spent \$117 per person on public safety; by FY 1993 Brookings was spending \$161 per person on public safety. This has been a fairly steady increase during the nine year period with two periods of reduced police spending during FY 1988 and FY 1993. During this period per capita general government expenditures increased 107% from \$109 in FY 1985 to \$226 in FY 1993. Brookings' per capita bonded debt increased during the nine year period. In FY 1985 the city's per capita bonded debt was \$548; by FY 1993 it was \$1,182 per capita.

³⁹Expenditures on public works is roughly equivalent to public safety expenditures throughout the nine year period.

Brookings' nine year fiscal history can be summarized as follows. First, per capita total general revenue increased 86%. Tax revenue (property and non property) has become less important to the city's total revenue. The nine year revenue trend indicates the lessening importance of tax revenue, and the greater reliance on fees, licenses and permits, and other revenue sources to finance city expenditures on public services. Second, the demand for public goods and services increased (as measured by per capita expenditure); total per capita expenditures increased 95%. Public safety demand increased 38%, and the demand for general government services increased 107%. Third, the city's per capita net bonded debt more than doubled from \$548 to \$1,182.

Cross City Comparison and Analysis

The four cities in this case study were selected for their expected demographic characteristic as being retirement oriented. In other words, it was expected that their population share of elderly would be distinctive. Table 1 below describes Oregon's, and each city's, population in terms of 1989 retirement population and income as well as the FY 1985 to FY 1993 population growth.

<i>Table 1: Coastal OR Demographics 1989</i>	<i>Oregon</i>	<i>Astoria</i>	<i>Cannon Beach</i>	<i>North Bend</i>	<i>Brookings</i>
9 year population growth	15%	3%	5%	12%*	46%
Share of retirees in the city	15%	17%	27%	16%	30%
Social Security share of total household income	7%	8%	10%	9%	11%
Retirement share of total household income	4%	5%	6%	5%	6%

*Nine year population growth (FY 86 - FY 94). Retirees are individuals age 65 and over. Population growth source is PSU Center for Urban Studies and Population Research. Share of retirees in the city source is 1989 OR State Tax Returns. Social Security and retirement shares of total household income in 1989 source is the 1990 US Census.

In terms of retirement population and retirement income shares, each of the four coastal cities have larger shares compared to the State. The cities of Cannon Beach and Brookings have the greatest shares of retirees in their communities; nearly one-third of Brookings' population are retirees. Astoria and North Bend retirement population is very similar to the State's population share of retirees. Social Security and retirement household income shares tell a similar story. Cannon Beach and Brookings have the largest shares of Social Security and retirement income, and these shares are greater than the State's share. In terms of population growth, Brookings' population appears to have exploded in the nine year period.

<i>Table 2: Coastal OR Retirement Population Growth</i>	<i>Astoria</i>		<i>Cannon Beach</i>		<i>North Bend</i>		<i>Brookings</i>	
	65+	<65	65+	<65	+65	<65	65+	<65
1985	1021	4744	97	364	728	4245	981	2400
1987	976	4903	98	402	723	4536	1051	2676
1988	1052	5123	103	429	784	4530	1147	2828
1986	1090	6380	179	697	844	5412	1250	4188
1990	1087	5218	186	562	886	4562	1306	3035
1991	1101	5175	117	490	919	4534	1382	3161
1992	1067	5362	117	502	911	4556	1383	3143
1993	1075	5202	120	539	917	4535	1442	3229
Percent Change 1985-1993	5.3%	9.6%	23.7%	48.1%	25.9%	6.8%	31.9%	35.5%

Source: Unpublished data from the Oregon Department of Revenue; number of single and joint full year state income tax returns; data for 1996 N/A.

Intracensusal data on Oregon's city population characteristics are limited. PSU Center of Urban Studies and Population Research provides annual population estimates for all Oregon cities; however these estimates are not specified by age group, race, ethnicity, etc. This makes through-time analysis of age specific population growth, or migration, for Oregon cities difficult; hence a proxy is needed. State tax returns provide a useful proxy. Table 2 below shows an eight year time-series of the number of Oregon state tax returns for individuals

65+ years of age and individuals under 65 years of age, for each of the four coastal cities.¹⁰⁸

In terms of filed tax returns, North Bend had substantial growth in state tax returns filed by individuals and couples age 65 or older. Between 1985 and 1993, the number of state tax returns filed by this age group increased 26% compared to a 7% increase by the under 65 age group. The other three coastal cities had a greater increase in tax returns filed by the under 65 age group. Aggregating the four coastal cities' population groups together reveals the growth in filed tax returns by the 65 and older age group (25.7%) was greater than that of the under 65 age group (14.9%) for the nine year time period. Thus, assuming the four coastal cities are a representative sample of the coastal Oregon region, it appears the retirement age population may be growing faster than non retirement age population along the Oregon coast.

Using the number of filed state tax returns as a proxy for population does not provide a complete or accurate picture of population growth for a city. Tax returns only capture the presence of adults in the population, and do not reflect the number of children or births in the population. Moreover, tax return data only captures those adults who file tax returns. Given this specific time period, the tax return data most likely underestimates the true adult population. The economic recession, associated with the declining natural resource industries, along the Oregon coast during this period may have had an impact on tax return filing activity. New driver's license issues from the Oregon DMV is another potential proxy for describing a city's population growth;

¹⁰⁸Oregon tax return data for the 1986 tax year was not available.

however DMV data are currently not available. In fact, Portland State University's Center for Urban Studies and Population Research uses a number of variables to estimate Oregon's population. These variables include number of tax returns, number of births and deaths, etc. Given it's limitations, and placing it in perspective, state tax return data is still useful in describing the coastal city's population growth.

Table 3 shows fiscal growth among the four Oregon coastal cities during the nine year period covering FY '85 through FY '93.

Table 3: Fiscal Growth of Local Government	Astoria	Cannon Beach	North Bend	Brookings
Total Revenue	26.4%	163.6%	74.0%	86.2%
Taxes	22.8%	245.8%	89.4%	-4.9%
Fees/Charges	209.1%	101.2%	45.2%	81.8%
Revenue Burden	-9.5%	4.3%	8.3%	-46.2%
Total Expenditures	42.5%	22.5%	58.5%	95.4%
Gen. Govt.	29.7%	193.2%	28.6%	107.3%
Public Safety	43.6%	171.4%	37.8%	37.6%
Recreation/Parks	13.5%	288.8%	-7.1%	-30.6%
Net Bonded Debt	-89.3%	-100%	801.3%	115.7%

(All figures are percentage change in per capita dollars). Revenue effort is the share of local income going to local taxes and fees/charges or $\{(tax\ revenue + fees\ and\ charges) / AGI\}$.

Over the nine year period covering FY 1985 through FY 1993, five general fiscal patterns can be identified. First, per capita bonded debt more than doubled in two of the four coastal cities; also per capita bonded fell in the other two coastal cities. Second, per capita revenue from fees and charges grew in all four coastal cities. This growth ranged from 45.5% in North Bend to 209.1% in Astoria. Third, per capita tax revenue increased in three of the four cities. Fourth, per capita total revenue increased in all four coastal cities. This growth ranged from 26.4% in Astoria to 163.6% in Cannon Beach. Fifth, demand for local

public services increased. Per capita total expenditures grew in all four coastal cities. Per capita expenditures for public safety and general government grew in all four coastal cities; however per capita expenditures on parks and recreation declined in two of the four coastal cities.

The growth in per capita local government revenues and per capita local government expenditures correspond with the findings of Glasgow and Reeder ('90 and '92). Glasgow and Reeder analyzed county government fiscal data for metro and non-metro retirement and non-retirement counties in the US between 1977 and 1982. While they found taxes and operating fees were lower in non-metro retirement counties, these counties also raised their taxes and operating fees to meet increased demands for local public services (increased revenue effort). The fiscal data for the four coastal Oregon cities shows increased demand for local public services (as measured by increased per capita expenditures) and increased revenue effort by local governments (as measured by increased per capita revenues).

Glasgow and Reeder also found increases in per capita income in non-metro retirement counties. In the four coastal cities per capita income (as measured by per capita adjusted gross income) increased in all four cities. Each city showed increased per capita income greater than 40%. This increase in per capita income parallels the findings of the Glasgow and Reeder study. The average per capita income for all four cities, over the nine year period was \$15,556.

Revenue burden measures the city's residents' income contribution to support local government operations, or to pay for local public goods and services. Revenue burden is the share of local income going to

local taxes and other revenues. In other words, revenue burden is a measure of a local government's home economic impact on the communities' residents. Glasgow and Reeder use "revenue burden" in their data analysis of non-metro retirement counties. Revenue burden is defined here as $(\$taxes + \$fees + \$license\ and\ permits + \$\ special\ assessments / adjusted\ gross\ income)$. Glasgow and Reeder report lower revenue burden in non-metro retirement counties. Although comparison "nonretirement metro" data was not collected for this case study, a brief analysis of revenue burden for the four coastal cities may provide some interesting insights. During the nine year period revenue burden increased in two of the four coastal cities. In North Bend revenue burden increased 8%, and in Cannon Beach revenue burden increased 27%. The other two coastal cities showed declines in revenue burden over the nine year period. Astoria showed a 9% decline in revenue burden and Brookings showed a 46% decline. Among the four coastal cities during the nine year time period revenue burden averaged 3%, ranging from 0.7% to 9.4%.

Thus far, the coastal city fiscal data provides the following summary fiscal information for the nine year period covering FY 1985 through FY 1993: 1) local government revenue effort increased in all four cities through increases in both taxes (property and non property) and fees and charges, 2) the demand for local public services increased - most noticeably for public safety and general government, 3) per capita bonded debt increased substantially in two of the four coastal cities, and 4) revenue burden increased in two of the four coastal cities. From the demographic data presented thus far, population growth for the population over age 65 grew faster than the population under the age 65. Each coastal city had a greater elderly population share

compared to the state's elderly population share in FY 1989. Also, per capita income grew greater than 40% in all four coastal cities. We have not previously evaluated the relationships between retiree (or elderly) population growth in these coastal cities and fiscal growth. Partial correlation analysis can be used to evaluate this relationship.

Partial correlation analysis measures the strength of the linear relationship between two variables, adjusting for linear effects of other variable(s). Put another way, partial correlation coefficients provide a numeric measure of the linear relationship between variable pairs while controlling for shared linear relationships from another variable(s) (or control variable). Partial correlation coefficients were constructed for variable pairs consisting of population age groups and various local government fiscal characteristics while controlling for the linear effects population has on either variable in the variable pair. Population was chosen as a control variable due to possible economies or diseconomies of scale. Ladd pointed out that there is no clear economic theory to help predict population growth's effects on the provision of local public services.¹⁰⁹ Population growth may provide an opportunity for local government to experience economies of scale. However providing additional public services may become more difficult with growth; thereby increasing the cost of providing additional public services to meet increased demand. Using population as a control variable extracts linear effects, or the shared variability, population has on the various fiscal variables in the partial correlation

¹⁰⁹ Ladd's work is summarized in the literature review; section two.

coefficients. Controlling for shared variability provides a better picture of the linear relationship between the variable pairs.

Partial correlation coefficients are given for the following variable pairs: Retirees and Consolidated Property Tax Rate, Retirees and Per Capita Bonded Debt, Retirees and Per Capita Total Expenditures, Retirees and Per Capita Total Revenue, Retirees and Per Capita Tax Revenue, Retirees and Per Capita Fees and Charges Revenue, Retirees and Per Capita Parks and Recreation Expenditure, Retirees and Per Capita Public Safety Expenditure, as well as Retirees and Per Capita General Government Expenditure. The retirees variable is the city's population 65 years of age and older. Partial correlation coefficients were also constructed for non-retirees and the same fiscal variables listed above. The non-retirees variable is the city's population under 65 years of age. Both the retirees and non-retirees variables are proxied by the number of Oregon state income tax returns. Table 4 provides the partial correlation coefficients with P-values.

Table 4: Partial Correlation Analysis controlling for population	Retirees	Non-retirees
	Consolidated Property Tax Rate	-.831 p=.000
Per Capita Bonded Debt	.825 p=.000	.653 p=.000
Revenue Burden	-.849 p=.000	-.813 p=.000
Per Capita Total Expenditure	.466 p=.014	.354 p=.070
Per Capita Total Revenue	.212 p=.252	.143 p=.444
Per Capita Tax Revenue	-.665 p=.000	-.584 p=.001
Per Capita Fee & Chgs Revenue	-.702 p=.000	-.696 p=.000
Per Capita Parks & Rec Exp	-.437 p=.023	-.322 p=.101
Per Capita Public Safety Exp	-.464 p=.015	-.408 p=.034
Per Capita General Govt Exp	-.244 p=.220	-.237 p=.234

n=28 and 25 degrees of freedom

Before interpreting the results in Table 7, one important point must be clarified. The correlation coefficient only provides a measure of the linear relationship between two independent variables; causation can not be inferred from correlation. The closer the value of the correlation coefficient is to one the greater the correlation, or the greater the linear relationship between the two variables. The sign on the correlation coefficient indicates the direction of the linear relationship. A positive sign implies larger values of the first variable correspond with larger values of the second variable in the pair. A negative sign implies larger values of the first variable correspond with smaller values of the second variable. For example, the partial correlation coefficient between retirees and per capita bonded debt is .825; the positive sign suggests that higher populations of retirees correspond with higher per capita bonded debt. Since this value is fairly close to one, the two variables can be said to be fairly well correlated.¹¹⁰

The p-value, or observed significance level, for a partial correlation coefficient shows the extent to which the partial correlation coefficient disagrees with a zero null hypothesis; thus the reader can decide whether a zero null hypothesis is rejected. In other words, the p-value gives the probability that the calculated correlation coefficient rejects the null hypothesis. For example, the p-value on the partial correlation coefficient between retirees and per capita expenditure is .014. Testing a null hypothesis that the estimated

¹¹⁰ Correlations greater than .7 or .8 are generally accepted values to identify variable pairs as "correlated."

partial correlation coefficient is zero ($H_0=0$) is rejected if a 95% confidence level is selected ($\alpha=.05$); because .014 is less than .05. If a 99% confidence level ($\alpha=.01$) is selected, then the null hypothesis would not be rejected because .01 is not less than .014. The lower the p-value, the lower the probability that the zero null hypothesis is not rejected.

All partial correlation coefficients with the retirees and non-retirees variables are statistically significant from zero, at the 95% confidence level, with the exceptions of the partial correlation coefficients on per capita total revenue and per capita general government expenditure. In this correlation analysis a partial correlation greater than .70, in absolute value, is interpreted as a good correlated relationship. The partial correlation analysis will focus on the correlations between retirees and the various fiscal variables. The correlations between non-retirees and the various fiscal variables are slightly lower in magnitude and are similar in direction to the retiree partial correlations.

The retiree population is negatively correlated with property tax rates, revenue burden, per capita tax revenue, per capita fees and charges revenue, and all three per capita expenditure categories (parks and recreation, public safety, and general government). The partial correlation between retirees and consolidated tax rate (-.831) is negative and statistically significant; moreover this negative correlation is fairly strong. Lower tax rates correspond with larger retiree populations. The correlation between consolidated tax rates and retirees is a little stronger than the correlation between consolidated tax rates and non-retirees. The negative correlation between retirees

and revenue burden (-.849) is significant and fairly strong; lower revenue burdens correspond with larger retiree populations. The partial correlations between retirees and the three expenditure categories are negative suggesting lower per capita expenditures correspond with larger retiree populations; however the correlations are low. Moreover, the partial correlation between retirees and per capita general government expenditure is insignificant at the 95% confidence level.

Retirees are positively correlated with per capita bonded debt and per capita total expenditure. The partial correlation between retirees and per capita bonded debt (.825) is strong and statistically significant; higher levels of per capita bonded debt correspond with larger retiree populations. The partial correlations between retirees and per capita total expenditure (.466) is fairly low.

Summary and Conclusions of the Case Study

The second question posed in this thesis research project is, "What are the fiscal impacts to Oregon's coastal local governments from retiree in-migration?" A case study methodology was chosen to answer this question. Whether retiree in-migration (population growth) results in a net fiscal benefit to Oregon's coastal local governments can not be answered in a clear-cut yes or no response. There appears to be both positive outcomes and negative consequences. The case study results of four coastal Oregon cities can be summarized as follows:

1. Retiree population growth outpaced non-retiree population growth.

The entire population of the four coastal cities shows the 65 and older population increased 25.7% whereas the under 65 population increased 14.9%.

2. Per capita income grew. Each city experienced per capita income growth greater than 40%. This finding parallels the findings of the Glasgow and Reeder data analysis of metro and non-metro retirement counties.
3. Coastal local governments showed increased revenue effort. Per capita total revenue increased in all four cities. This finding corresponds with the findings of the Glasgow and Reeder study.
4. The demand for local public services increased. Per capita total expenditures increased in all four cities. The demand for general government services and public safety increased in all four cities; however the demand for parks and recreation services increased in only two of the four cities. This finding also parallels the Glasgow and Reeder data analysis.
5. Smaller levels of revenue burden corresponded with larger populations of retirees. Revenue burden is the share of a community's income going to local taxes and fees. A partial correlation analysis, controlling for population, shows larger retiree populations correspond with a smaller share of income going to local taxes and fees.
6. Higher levels of per capita bonded debt corresponded with larger populations of retirees. Per capita bonded debt is a comparative measure of a community's debt financing operations. It also provides insight to a community's future, or long run, fiscal responsibilities.
7. Higher property tax rates corresponded with smaller populations of retirees. The property tax rate can be a proxy for the price of providing local public services. A partial correlation analysis,

controlling for population, shows higher prices of local public services (proxied by the property tax rate) correspond with smaller retiree populations.

The correlated relationships described in items five through seven are similar (i.e., same direction) with the non-retiree population; however the correlated relationships are of lower magnitude with the non-retiree population.

The literature review section explored the private economic and public sector fiscal benefits and consequences from retiree population growth. This case study section provided a description of the fiscal impacts retiree population growth may place on Oregon's coastal local governments. Although a net fiscal benefit or negative consequence can not be determined, strong and statistically significant relationships between retiree population growth and various public sector fiscal operations are shown to exist in this case study.

The strong negative correlations between retirees and tax rates and revenue burden may explain some preference for using local fiscal policy to stimulate retiree in-migration. Proponents of retiree attraction development strategies may be tempted to use these negative correlations to support their policy outcomes. However, correlation does not mean causation. Although higher retiree populations correspond with lower tax rates and lower revenue burdens the prior does not cause the latter, and vice versa. In other words, the negative correlations do not suggest lower tax rates cause retiree population growth nor can one imply retiree population growth causes lower revenue burden. The direction or reason of causation can not be interpreted from a correlation coefficient. Likewise, one may be tempted to use the strong

positive partial correlations to explain fiscal consequences from retiree attraction development strategies. The strong positive correlation does not imply retiree population growth results in increased per capita bonded debt or vice versa. Also, one cannot imply increased public spending causes retiree population growth.

APPENDIX B: LOG-LOG TRANSFORMATION ELASTICITY PROOF

The following proof demonstrates the estimated coefficients of a regression model specified as:

$$R = \beta_0 C^{\beta_1} O^{\beta_2} S^{\beta_3} H^{\beta_4} A^{\beta_5} B^{\beta_6} I^{\beta_7} P^{\beta_8}$$

can be interpreted as partial elasticities of the independent variable on the dependent variable. Taking the partial derivative $\partial R/\partial C$ we get:

$$\partial R/\partial C = \beta_0 C^{\beta_1-1} O^{\beta_2} S^{\beta_3} H^{\beta_4} A^{\beta_5} B^{\beta_6} I^{\beta_7} P^{\beta_8}$$

$$\partial R/\partial C = (\beta_0 C^{\beta_1} O^{\beta_2} S^{\beta_3} H^{\beta_4} A^{\beta_5} B^{\beta_6} I^{\beta_7} P^{\beta_8})/C$$

$$\partial R/\partial C = (\beta_1 R)/C$$

The partial elasticity ϵ_{R-C} is:

$$\partial R/\partial C (C/R) = (\beta_1 R/C) (C/R)$$

Simplifying we get:

$$\epsilon_{R-C} = \beta_1$$

Therefore β_1 is the partial elasticity between R and C. A partial elasticity is the percent change in the dependent variable (R) resulting from a percent change in one of the independent, or explanatory, variables (C). From the above example, the partial elasticity is

elastic when $\epsilon_{R-C} > 1$, is of unitary elasticity when $\epsilon_{R-C} = 1$, and is inelastic when $\epsilon_{R-C} < 1$.

APPENDIX C: DROPPING POPULATION AS AN EXPLANATORY VARIABLE IN MODEL II

The two tables below provide a comparison of the second model with the population variable (P) included and excluded as an explanatory variable. The first table is a correlation matrix of all variables. The second table compares estimated coefficients, standard errors, t-statistics, and P-values of the model with and without the P variable.

Dropping the P variable from the model results in a lower R-square (0.57 vs. 0.88) and more efficient estimates on the explanatory variables of interest (T and H) as shown through higher t-statistics. Dropping the P variable results in the property tax rate point estimate to be significantly different from zero at the 95% confidence level.

Is population (P) a "relevant" variable? If P is a "relevant" variable then bias created by its omission is relatively small given P's low correlation with the other explanatory variables. Answering this question is an example of the "bias-efficiency" trade-off in regression analysis. All regression models contain some level of bias because the researcher does not truly know all the relevant variables. Theory guides the researcher in identifying relevant variables. Sometimes, to improve a model's efficiency unbiasedness must be sacrificed.

Correlation Matrix, Descriptive Statistics and Model II Results

	R	T	H	A	B	I	E1	E2	E3	P
R	1.00									
T	0.06	1.00								
H	0.56	-0.30	1.00							
A	-0.29	0.13	-0.55	1.00						
B	-0.46	-0.10	-0.09	0.23	1.00					
I	0.21	0.12	0.51	-0.22	0.24	1.00				
E1	-0.29	0.11	-0.54	0.12	-0.22	-0.59	1.00			
E2	-0.29	-0.05	-0.27	0.17	0.18	-0.08	-0.03	1.00		
E3	0.40	-0.07	0.60	-0.16	0.06	0.55	-0.79	-0.34	1.00	
P	0.91	0.12	0.49	-0.32	-0.43	0.30	-0.30	-0.32	0.48	1.00

Model Comparison

Retirement Population

	Without P	With P
R Square	.57	.88
Adjusted R Square	.55	.87

	Coeff.	Coeff.	SE	SE	t-Stat	t-Stat	P-value	P-value
	W-out P	With P	W-out P	With P	W-out P	With P	W-out P	With P
Inter (β_0)	-8.54	-4.14	5.55	2.98	-1.54	-1.40	.12	.16
T (β_1)	1.12	.34	.33	.18	3.44	1.93	.00	.05
H (β_2)	2.29	1.38	.37	.20	6.26	6.88	.00	.00
A (β_3)	.28	.42	.26	.14	1.08	2.96	.28	.00
B (β_4)	-5.34	-.79	.74	.45	-7.18	-1.77	.00	.08
I (β_5)	-.69	-1.06	.44	.24	-1.57	-4.43	.11	.00
E1 (β_6)	.34	.29	.33	.18	1.02	1.63	.31	.11
E2 (β_7)	.38	.94	.76	.41	.51	2.30	.61	.02
E3 (β_8)	1.16	.33	.31	.17	3.67	1.92	.00	.06
P (β_9)	N/A	.73	N/A	.03	N/A	22.28	N/A	.00