Jobs, Natural Amenities, Distance, Population, or Services: What Drives Age-Specific Migration for Small Oregon Communities?

By

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AN ABSTRACT OF THE ESSAY OF

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Declining population is a major concern for rural communities. In many places, out-migration has led to a loss of key services. This essay investigates the role of services, as well as labor markets, natural amenities, distance to urban areas, and community size, in determining net migration rates for small Oregon communities for the 1990-2000 and 2000-2010 time periods. Estimates of age-specific migration rates for Oregon incorporated places show markedly different patterns for small communities, with such places experiencing severe outmigration among 20-to-24 year-olds, but adding population in older age groups. Regression analysis of net migration in Oregon communities with 1289 people or fewer shows that natural amenities, particularly low rainfall and proximity to open water, are primary drivers of community-specific migration rates. The effects of labor markets and distance to urban centers are found to wane, particularly for working-age migrants, in the 2000-2010 period, with the size of a community becoming a more important determinant of its net migration rate. Access to services, such as grocery stores, however, is found to significantly boost net migration rates and to mitigate the tendency for very small places to suffer net outmigration.

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Introduction

Loss of population in rural American communities has become a major policy concern over the past half century. While rural America as a whole has gained population over the past fifty years, many rural places have experienced sustained outmigration. These losses have taken a severe toll on individual towns, which face the loss of schools, key businesses, jobs, and social institutions. As young people move away, many communities are asking what effects these losses will have on their long-term viability, and whether job losses in key industries have doomed them to long term decline. The implications are enormous for the $40 million spent on rural development each year, with both Kilkenny (2010) and Partridge and Rickman (2008) asking whether such spending should be diverted to avoid wasting money on areas that are in irreversible decline.

This study focuses on net migration in small incorporated communities in Oregon, where just under a quarter of the state's 240 incorporated places lost population between 2000 and 2010, even as the state population increased by 12%. Twenty-one of these declining communities lost over 10% of their population, and nine lost more than 25%.

While population losses have been most common in small communities, many small places have also experienced large population gains, sometimes reversing equally sharp losses. This essay seeks to inform policy by answering a seemingly simple question: what factors determine net migration rates for rural Oregon communities?

Background

Decline and even disappearance of rural American communities was frequent during frontier times. Rural areas were generally settled for their use for agriculture, or for the extraction or transportation of natural resources such as timber, coal, or precious metals. Many town sites were abandoned almost as quickly as they were settled, often because of failure to secure needed infrastructure, such as railroad connections, or because of greater growth in competing towns (Berry 1967; Hudson 1985). Oregon was not immune from this pattern. McArthur and McArthur's (2003) *Oregon Geographic Names* is littered with town sites that failed to attract residents and quickly disappeared.

Many towns, of course, survived this churning process. Towns that survived provided needed services to those who worked in local industries. Some diversified their economies and grew into large urban centers, and others remained small and primarily oriented around the purposes for which they were originally settled.

Many of these smaller towns have come under pressure as agriculture and the extractive industries have shed labor, leading to questions about the futures of communities whose economic reason for existence may no longer be a viable foundation for a community. At the same time, however, new opportunities have arisen, as urban residents have moved to rural areas seeking amenities such as open space and pleasant landscapes (McGranahan 1999; Wardwell 1980).

This section investigates the long-term population trends affecting rural America. The subsequent section reviews findings on what factors explain shifts in these trends over time, and then investigates what factors explain the wide differences in population growth rates across rural areas.

Historical Context

Rural populations in the United States held steady for most of the twentieth century around 50 million, with high birthrates compensating for the fact that, from the 1930s through the 1960s, millions more people left rural areas than moved to them (Lichter and Brown 2011; Johnson 2006). The 1940s, 1950s, and early 1960s were marked by particularly high outmigration from rural areas, with over half of all counties classed as nonmetropolitan[1] in 1974 losing population in the 1960s (Johnson and Purdy 1980).

The 1970s, however, produced a striking reversal of the long-standing trend of rural outmigration, with net migration rates in nonmetropolitan counties exceeding those in metropolitan America for the first time in at least a century (Johnson and Cromartie 2006). In the first five years of the decade, nonmetropolitan counties gained 3.5 million people, or 40% of the population gains of the previous 50 years (Johnson and Purdy 1980). Though growth at the fringes of large cities played a role in this reversal, counties in isolated areas, including counties that had suffered decades of decline, also experienced rapid population growth (Fuguitt, Brown, and Beale 1989; Johnson and Purdy 1980).

Just as rapidly as this nonmetropolitan population growth emerged, however, the 1980s brought a return of net outmigration from rural areas, with over half of all

[1] Nonmetropolitan counties are those that are not included in Metropolitan Statistical Areas as defined by the U.S. Office of Management and Budget. Metropolitan counties are generally those that have a city of over 50,000, or that have 25% of their workers commuting to a metropolitan county. Because these definitions change after each U.S. Census, growth rates of nonmetropolitan counties found in the studies cited here do not necessarily refer to exact same set of counties.

nonmetropolitan counties losing population during the decade (Johnson 1993). Losses were driven by a new round of farm consolidation, and declines in other key rural industries, including manufacturing (Fulton, Fuguitt, and Gibson 1997). The early 1990s ushered in the return of strong nonmetropolitan growth, which moderated in the ensuing years, producing a decade where nonmetropolitan counties, as whole, returned to net inmigration, but at a more moderate pace than in the 1970s (Johnson and Cromartie 2006). Growth slowed further from 2000 to 2009, with nonmetropolitan counties as a whole adding only a third as many people as in the 1990s (Johnson and Lichter 2012).

Explaining Rural Population Change

Migration and Natural Increase

One way to look for explanations for the shifting rural population trends over the past 60 years is to break population change into its two components: natural increase and net migration. The more basic, and stable, of the two is natural increase, defined as the difference between the number of births and the number of deaths in a given area during a given time period. The second and more dynamic driver of population is net migration, which consists of the number of people moving into a given area in a given period minus the number of people who move away (McGranahan, Cromartie, and Wojan 2010). Historically, high fertility rates in rural areas produced rates of natural increase that mitigated the effects of negative net migration rates (Frey and Johnson 1998; Johnson and Lichter 2012; Wardwell 1977).

While rates of natural increase tend to be relatively steady over time, migration rates can fluctuate considerably, as demonstrated by the up and down rural-urban migration trends observed over the last four decades of the twentieth century (McGranahan, et al. 2010; Johnson, Nucci, and Long 2005). Amid the fluctuations in nonmetropolitan net migration rates over time and across space, one stable characteristic has been their age-selective nature (Johnson and Fuguitt 2000). Generally speaking, nonmetropolitan counties lose large numbers of people between the ages of 20 and 29, as youth leave rural communities in search of urban jobs or lifestyles. To the extent that these losses are replaced, it is by inmigration from children and older age cohorts, and particularly from people over fifty-years old (Fuguitt, et al. 1989; Johnson and Cromartie 2006; Johnson and Fuguitt 2000). Although the 1970s and 1990s saw a slight influx of families with children to non-metropolitan America, nonmetropolitan counties still had net losses of nearly 20% of their 20- to- 24-year-old populations in those decades, following 40% losses in the 1950s and 1960s (Johnson and Cromartie 2006).

Periods or areas that show stronger nonmetropolitan growth are not marked by a different migration pattern, but by more moderate losses of young people and higher gains among older age cohorts (Johnson and Fuguitt 2000). One way of framing the task for places that wish to reverse outmigration, then, is to say that they must accomplish some combination of lowering the number of young adults who leave, increasing the number young outmigrants who return to raise families, and increasing the number of seniors who move to the community.

The importance of the first two groups that rural communities must retain or attract—young adults and young families—is magnified when one considers the effect of age-selective migration on natural increase. Overall migration trends have tended to rob non-metropolitan counties of young adults of child-bearing age and to replace them (to the extent that they were replaced), with seniors with high mortality rates (Johnson 2011). This process, coupled with lower fertility rates, has resulted in an increasing number of nonmetropolitan areas with too few births to cancel out deaths (Johnson 2011).

This phenomenon, known as natural decrease, first appeared in isolated instances amid the economic deprivation and resultant low birth rates of the Great Depression, and reappeared at the end of the baby boom. Natural decrease has been heavily concentrated in rural areas, first appearing in pockets on the Great Plains, and in the western Corn Belt, eastern and central Texas, and the hill country of Missouri and Arkansas. The phenomenon has since spread to parts of Appalachia, interior New York and Pennsylvania, portions of the South, and affected several counties in Oregon (Johnson 2011). Twenty-nine percent of nonmetropolitan counties reported more deaths than births during the 1990s, and 36% experienced natural decrease between 2000 and 2009 (Johnson 2011; Johnson and Lichter 2012). Though non-metropolitan birth rates have declined in recent decades, the main cause of natural decline is not declining fertility but population age imbalances brought about by years of age-selective migration (Johnson 2011; Johnson and Cromartie 2006).

The prevalence of non-metropolitan natural decrease even in the rebound decade of the 1990s illustrates a related shift in nonmetropolitan population gains from being fueled by natural increase to relying on inmigration. As noted above, nonmetropolitan America historically gained population through high rates of natural increase that compensated for negative net migration rates. In the 1990s, however, increasingly positive net migration, instead, compensated for a rate of natural increase that fell by over a third (Johnson and Cromartie 2006). The population gains of the 1970s and 1990s, then, were, in this sense, quite different, with natural increase accounting for 46% of the population gains of the 1970s, but just a third of those experienced in the 1990s (Johnson and Cromartie 2006).

Although natural increase returned to prominence in nonmetropolitan population change in the first decade of the 2000s, its greater importance was caused by declining overall migration (Johnson and Lichter 2012). Given that migration rates are more dynamic than natural increase rates, (Johnson, et al., 2005; McGranahan, et al. 2010) and the fact that natural increase is strongly influenced by previous migration patterns, the future of nonmetropolitan American populations will be driven largely by migration (Johnson and Cromartie 2006; Johnson 2003).

A deeper investigation, then, is necessary into what specific factors drive migration, and population change, in rural areas. We will start by considering the factors driving large swings in aggregate metropolitan and nonmetropolitan net migration rates over the past several decades, and proceed to consider what factors cause differences in net migration and population change between rural locations.

Explaining Aggregate Rural-Urban Migration

There are two complementary explanations for the swings in nonmetropolitan population trends over the past 60 years. Johnson and Cromartie (2006) and Frey and Johnson (1998) note the connection between these shifts and the relative performance of metropolitan and nonmetropolitan economies. The growth of the 1970s, in this line of thought, results from competition for urban jobs among the baby boom generation forcing many people to find work in smaller places (Johnson and Cromartie 2006). Strong performances in the rural America's agricultural, extractive, manufacturing, and services sectors (Fuguitt, et al., 1989), and the movement of manufacturing from Rust Belt cities to lower-cost rural locations (Falk and Lobao 2003) also contributed to migration towards nonmetropolitan areas.

Similarly, Johnson and Cromartie (2006) note that 1980s outmigration from nonmetropolitan counties reflected a farm crisis and a national recession that was longer and deeper in rural areas than in urban ones. The rebound in the early 1990s, conversely, was aided by a "white collar recession" in the early part of decade that disproportionately affected urban labor markets, and therefore discouraged outmigration from nonmetropolitan counties (Johnson 2003). The tailing off of nonmetropolitan growth in the latter part of the decade, similarly, reflects a response to economic growth driven by the urban-centered technology sector (Johnson and Cromartie 2006).

Underlying these shifting macroeconomic trends, however, is a separate shift in living preferences toward smaller, less urbanized locations. This explanation of migration patterns, broadly labeled as deconcentration, sees these changes as part of a break throughout the developed world from a previous trend toward urbanization. In this view, migration toward nonmetropolitan areas reflects the fact that certain factors in the size of metropolitan areas, such as congestion and high property costs, created negative consequences for their residents and diseconomies for businesses (Wardwell 1980, 1977). At the same time, transportation and technology improvements, increased disposable income, and an increase in urban amenities in rural areas, allowed people and firms to act on their preferences for less urban locations (Frey and Johnson 1998; Long and Nucci 1997; Wardwell 1980, 1977).

A key characteristic of this population deconcentration, and of nonmetropolitan population growth in general, is that it has been selective, with some rural areas experiencing particularly rapid growth, and others facing long-term decline (Johnson 2003; Johnson and Cromartie 2006; Johnson, et al., 2005). Both recently and historically, areas such as the Great Plains, the Corn Belt, and the Mississippi Delta, have been concentrations of nonmetropolitan population decline, while large nonmetropolitan population gains have appeared in the Mountain West, Upper Great Lakes, the Ozarks, parts of the South, and in the Northeast (Beale 1978; McGranahan, et al., 2010). These broad geographic categories themselves, however, mask further selectivity, with wide variation in population growth rates present even within areas such as the Great Plains (Rathge and Highman 1998; White 2008).

This selective deconcentration, marked by differential patterns of population change in America's rural areas, leads us back to a central question: what separates those rural communities and areas that have experienced strong population growth from those that have declined?

Explaining Place-Specific Rural Population Change

Population research in the United States and Canada has identified a wide range of factors that explains differences in population growth or net migration in rural areas. The most important of these can be placed in five categories: labor markets, proximity to urban centers, natural amenities, population size, and access to services.

Labor Market Factors

As noted above, Johnson and Cromartie (2006) and Frey and Johnson (1998) find that, historically, aggregate population flows between metropolitan and nonmetropolitan America have been driven by their relative economic performances. Ferguson, Ali, Olfert, and Partridge (2007) find that economic indicators also predict differences in population change between census consolidated subdivisions in rural Canada. Partridge and Rickman (2003) find that, while employment does respond to population growth, the tendency of people to follow jobs is stronger. New bursts of job creation, rather intuitively, attract in-migrants (Johnson and Beale 2002), while high employment rates increase net migration, particularly in difficult economic conditions (Chi and Marcouiller 2011; McGranahan 2008). Partridge, Rickman, Olfert, and Ali (2012), however, find that migration responses to employment decreased sharply in the first years of the twenty-first century.

The types of jobs in rural areas are also strong predictors of migration and population change. Frey and Johnson (1998) and Johnson and Cromartie (2006) both note that counties with heavy dependence on agriculture or mining are particularly likely to decline. White (2008) finds that farm dependence, since 1930, has had a negative effect on county population change on the Great Plains, and Rathge and Highman (1998) note that Great Plains counties suffering continuous population decline from 1950 to 1996 tended to have high percentage of farm employment, a relationship also identified by Albrecht (1993). McGranahan and Beale (2002), however, argue that population losses in farm-dependent counties are caused not by the high concentration of agriculture but by the lack of other employment opportunities.

Distance from Urban Centers

Proximity to urban areas has also shown a strong influence on nonmetropolitan population growth, with nonmetropolitan population gains often concentrated at the edges of large metropolitan areas. Fuguitt, et al., (1989) see sprawl outside of metropolitan areas as a main cause of nonmetropolitan population gains in the 1970s, while Millward (2004) finds that 1990s population growth in Nova Scotia was almost entirely limited to commuter zones of large towns. Johnson (2003) found that, during the 1990s, nonmetropolitan counties that were adjacent to metropolitan areas grew more quickly than those that were not. Johnson and Cromartie (2006) found a similar pattern in the 1980s, 1990s, and the first years of the 2000s.

Just as proximity to metropolitan areas tends to increase nonmetropolitan population growth, remoteness from such centers has been a strong predictor of loss. In studying counties nationwide, McGranahan and Beale (2002) find isolation from urban centers to work alongside low population density and lack of amenities in predicting population losses. Frey and Johnson (1998) note that nonmetropolitan counties that were not adjacent to metropolitan areas were particularly likely to suffer outmigration in the 1980s, and that those with strong commuting ties were particularly likely to grow in the early 1990s. Renkow and Hoover (2000) find that rural population growth in North Carolina was strongly associated with out-commuting, while McGranahan, et al., (2010) find that lack of commuting opportunities was a key characteristic for the surprisingly numerous low-poverty nonmetropolitan counties that suffered severe outmigration between 1988 and 2008. Partridge, Rickman, Ali, and Olfert (2007) also found that nonmetropolitan counties that were an average distance from a metropolitan area lost 2.6 percentage points of population growth compared to those that were adjacent to a metropolitan area. Johnson and Lichter (2012) show that isolation has continued to dampen population growth in the twenty-first century, as nonmetropolitan counties that were not adjacent to metropolitan areas suffered net outmigration while adjacent counties posted gains.

Natural Amenities

When population growth has occurred in rural areas that are remote from urban centers, it has generally been concentrated in places that draw migrants with natural amenities such as attractive scenery, pleasant weather, recreational opportunities, or access to water (McGranahan and Beale 2002). As noted by Garkovich (1989), nonmetropolitan population gains between 1940 and 1970 were concentrated in high-amenity areas such as Florida, the Pacific Coast, the Southwest, the Lower Great Lakes, and coastal areas of the Northeast. Nonmetropolitan counties with high rankings on the natural amenities index developed by McGranahan (1999) grew by 120% between 1970 and 1996, compared to just 1% growth for counties with low scores.

More recent studies have corroborated these findings, with Johnson and Cromartie (2006) showing that, between 1980 and 2003, high-amenity nonmetropolitan counties experienced faster growth than low-amenity counties, which were more likely to decline. McGranahan and Beale (2002), similarly, found that lack of natural amenities were one of three main factors predicting population loss in the 1990s. McGranahan (2008) documented the effects of specific amenities, finding that forest land cover and open water raise rural county population growth rates, while high percentages of farmland tend to lower growth rates.

Amenity-based migration has the ability to not only attract new residents, but also to create new jobs, improve local services and entertainment options, and increase land values and tax revenue (Reeder and Brown 2005). Nonmetropolitan counties have seen population and economic gains based around attracting residents and visitors for outdoor recreation, or attracting retirees, whose departure from dependence on labor markets can free them to act on longstanding preferences for amenities and smaller places (Frey and Johnson 1998; Johnson and Beale 2002; Reeder and Brown 2005).

Population Size

Some research has shown that places with low starting populations face obstacles to population growth. In the 1950s, 1960s, and 1970s, incorporated places with fewer than 500 people were more likely than any other category to lose population (Beale 1978; Fuguitt, et al., 1989). More recent research on Nova Scotia suggests that remote and thinly populated areas are most vulnerable to severe depopulation, even in the absence of economic decline (Millward 2004). Chen, Etuk, and Weber (2012) further find two population thresholds, with communities below each threshold facing progressively lower growth trajectories. Kilkenny (2010) asks whether a process of spatial rationalization is in progress, as departures from rural places lead to higher tax burdens on those who remain.

Studies on county-level population change have similarly found that county population or population density are positively associated with future population growth. McGranahan and Beale (2002), for example, find that low county population density is a strong indicator of population decline. These findings are corroborated by the research of Albrecht (1993), who found that the average population of Great Plains counties that continuously lost population from 1950 to 1990 was only half the average of those counties that did not experience consistent decline.

Access to Services

One often-offered but little-studied explanation for the tendency of sparsely populated, geographically-isolated areas to lose population is that they lack key services. Both McGranahan, et al., (2010) and Kilkenny (2010) note that outmigration may raise tax burdens and costs for services, as a smaller population base is left to pay the same fixed costs for service provision. Some non-academic literature (e.g. Cohen 2001; Hansen 2003; Kristof 2002) has hypothesized that the loss of the key businesses as people leave rural places, prompts continued population decline. In academic literature, this point of view is also offered by Von Reichert (2006) and illustrated in case-study form by Albrecht (2000). Ferguson, et al., (2007) test the effects of access to a number of services in Canada and find negative effects of distance to hospitals and police stations. McGranahan and Beale (2002) also suspect that lack of access to retail services explains why remote, low-density counties decline despite the preference of many people to live in smaller places.

Fears of population loss due to lack of services are particularly salient given Stabler and Olfert's (2002) finding that small communities in Saskatchewan are losing their ability to support retail businesses. If lack of services is associated with population decline, this finding constitutes a serious problem for rural communities.

Modeling Population Change

A number of recent papers have used regression analysis to examine the relative importance of the factors identified above on rural population change. Several have sought to better understand the effects of distance on rural population growth. To avoid endogeneity, most of these analyses use independent variable levels at the beginning of the study period to predict subsequent population change or migration. These recent papers provide not only key findings regarding population change, but also guidance for modeling such changes in rural areas.

One example is the research of Partridge, et al. (2011), which models county-level population growth from 1990 to 2007 as a function of economic, geographic, demographic, amenity, and state-fixed effects variables. Economic variables include wages, median rent, employment-to-population ratio, and measures of the industry mix in a county. To model proximity to urban areas, the authors take the distance to the nearest micropolitan area (a county containing a city of at least 10,000 people), and then the additional distance needed to reach successively larger urban centers. Natural amenities are measured using McGranahan's (1999) natural amenity index, in addition to dummy variables for proximity to the Atlantic Ocean, the Pacific Ocean, or the Great Lakes. In comparing effects between the 1990-2000 and 2000-2007 periods, the authors found strong and consistent effects of distance on population growth. After 2000, amenity affects became smaller and employment effects on migration disappeared.

Ferguson, et al., (2007) use data on Canadian census consolidated subdivisions to disentangle the effects of economic factors, natural and man-made amenities, population agglomeration, demography, region, and human capital, on population change. Although the focus of the analysis, which was to weigh effects of entire sets of variables on both urban and rural population change, is not applicable here, many of the variables used to model population change are instructive.

Economic variables include employment rate, income, variables measuring industry-mix, including the percentage of workers employed in agriculture and extractive industries, along with their space-weighted counterparts. Amenity variables include a dummy variable for open water, Great Lake, or ocean access, the percent area covered in forest, the standard deviation of elevation within the census consolidated subdivision, and weather variables, such as average annual precipitation. Human-made amenities and disamenities, such crime rates and distances to services such as hospitals, physicians, police stations, schools, and universities, are also included. Population agglomeration is operationalized through starting population, population density, and distance to metropolitan areas.

Ferguson, et al., (2007) then use dozens of regressions to test how each set of variables impacts R-squared values for regressions predicting both overall population change and age-specific migration for both rural and urban areas. They find that the economic variables have the largest effects, followed by variables for population agglomeration and amenities. The positive effects of economic diversity and negative effects of agricultural dependence are consistent across rural age categories. The most important amenity variables are found to be disamenities, such as crime and distance to police stations. Youth and young adults are also found to be drawn to rural areas with high surrounding populations and proximity to urban centers.

While Ferguson, et al., (2007) analyze census consolidated subdivisions in Canada, the research of Chen, et al., (2012) also gives rare guidance in the study of migration dynamics for rural communities in the United States. Applying the statistical threshold estimation technique developed by Hansen (2000) to Oregon's communities of fewer than 20,000 people, Chen, et al., (2012) show that two population thresholds exist for Oregon communities. Each of the two thresholds—one at 5355 people, and the other at 1289 people—introduces lower net migration trajectories, and considerably different growth dynamics. Not only do communities at or below the lower threshold grow more slowly than larger places, but they also show considerably different growth dynamics. While Chen, et al., (2012) find that the larger communities (those with more than 5355 people but fewer than 20,000 people) show growth consistent with migration toward economic opportunity, net migration rates for small communities (those with fewer than 1290 people) show no sensitivity to unemployment rates during the 1990s, and actually have a negative relationship with wage income. Unlike large communities, small communities also display positive migration effects for population size, and positive effects for distance to a city of 20,000, suggesting that small communities may actually benefit from isolation.

Because including communities with different growth dynamics in the same regression could cause competing effects to cancel each other out, the analysis portion of this paper will focus on communities with fewer than 1290 people, hereafter referred to as 'small communities.' In 1990, this category included 120 places, or just under half of the 241 incorporated communities in Oregon. Population growth during the decade dropped the number of small communities to 107 by 2000, or 45% of the total.[2] The following section explains the technique for estimating migration in such places, and then compares overall migration trends in small places with those found in larger ones.

Migration Trends in Oregon Communities

Calculating Migration Rates

Determining the causes of differences in overall and age-specific net migration rates between small Oregon communities first requires the calculation of such rates for each community. Because the United States Census does not directly measure net migration, migration rates are generally taken as the residual once population increase is subtracted from population change (Murdock, Kelley, Jordan, Pecotte, and Luedke 2006). Given that:

Population Change = Natural Increase + Net Migration

It follows that:

$$\text{Net Migration Rate}_{i(t,t+10)} = (\text{Population}_{i(t+10)} - \text{Population}_{it} - \text{Natural Increase}_{i(t,t+10)}) / \text{Population}_{it}$$

where i denotes an Oregon community, and t denotes 1990 or 2000, and $(t,t+10)$ denotes the decade between year t and year $t+10$.

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[2] Because the city of Hammond disincorporated in 1991, there were only 240 incorporated communities in Oregon in 2000.

Age specific net migration rates can be calculated by taking the number people in a community in a given age-cohort at the start of a decade. Subtracting the number of people who die during the subsequent decade gives us the number of people (or ‘expected population’) who, absent any migration, would be in the cohort, aged ten years, at the end decade. Subtracting this ‘expected population’ from the number of people actually in the ten-years-older cohort at the end of the decade provides the number of net migrants for that cohort:

$$\text{Net Migrants}_{ia(t,t+10)} = \text{Population}_{ia(t+10)} - \text{Expected Population}_{ia(t+10)}$$

where *a* denotes a five-year age cohort (e.g., age 10 to age 14, age 15 to age 19, etc.). It is important to note that the age cohort refers to the age of its individuals at the end of the decade in question.

Dividing the number of net migrants in a cohort by the starting population (which was ten years younger at the beginning of the decade) turns this into a rate:

$$\text{Age-Specific Net Migration Rate}_{ia(t,t+10)} = \text{Net Migrants}_{ia(t,t+10)} \;/\; \text{Population}_{i(a-10)t}$$

Because the State of Oregon does not publish age-specific death and fertility statistics for small communities, survival rates and expected populations for small communities must be calculated using county-level statistics. This paper makes use of tabulations of county-level data for the 1990s (Voss, McNiven, Hammer, Johnson, and Fuguitt 2004) and 2000s (Winkler, Johnson, Cheng, Voss, and White 2013). Data were obtained from the University of Wisconsin’s Applied Population Laboratory, and from the University of Michigan’s Inter-university Consortium for Political and Social Research.

Both Voss, et al., (2005) and Winkler, et al., (2013) used annual county-level death data to calculate 'expected populations,' or the number of people who would be expected to survive to the end of a decade, for five-year age cohorts. County-level age-cohort survival rates are inferred by dividing the end-of-decade expected population for a given age group by the number of people in the ten-years-younger age group at the beginning of the decade:

$$\text{Survival Rate}_{ca(t,t+10)} = \text{Expected Population}_{ca(t+10)} / \text{Population}_{c(a-10)t}$$

where *c* denotes a county.

Community-specific expected populations are obtained by applying the county survival rate for a cohort to the base population for each community in the county:

$$\text{Expected Population}_{ia(t+10)} = \text{Population}_{i(a-10)t} * \text{Survival Rate}_{ca(t,t+10)}$$

where *c* denotes the county in which community *i* is located.

The difference between the actual cohort population at the end of the decade and the expected cohort population is the estimated number of net migrants during the decade in question, and dividing this number by the population that was aged ten years younger at the beginning of the decade turns this into an age-specific migration rate:

$$\text{Age-Specific Migration Rate}_{ia(t,t+10)} = (\text{Population}_{i(a)(t+10)} - \text{Expected Population}_{ia(t,t+10)}) / \text{Population}_{i(a-10)t}$$

Because there is no base population for age groups that were not born at the time of the prior U.S. Census, the equation above yields age-specific migration rates only for cohorts aged 10 to 14 and older at the end of a decade. This necessitates projections of births to residents of each community in order to calculate an all-inclusive migration rate. The University of Wisconsin data compiled by Voss, et al., (2005) and Winkler, et al.,

(2013) contains numbers of births for each Oregon county in the first five years and second five years of each the decade. These numbers are then used to calculate county-level fertility rates for women between the ages of 15 to 44. To account for changes in the number of women of child-bearing age throughout the decade, the total decade change in the number of women between ages 15 and 44 is calculated:

$$\text{Childbearing-Age Women Change}_{c(t,t+10)} = \text{Childbearing-Age Women}_{c(t+10)} - \text{Childbearing-Age Women}_{ct}$$

Assuming that this change was uniform over time allows the estimation of average numbers of childbearing-age women in both halves of the decade:

$$\text{Childbearing-Age Women}_{c(t,t+5)} = \text{Childbearing-Age Women}_{ct} + (\text{Childbearing-Age Women Change}_{c(t,t+10)}*.25)$$

$$\text{Childbearing-Age Women}_{c(t+6,t+10)} = \text{Childbearing-Age Women}_{ct} + (\text{Childbearing-Age Women Change}_{c(t,t+10)}*.75)$$

The average numbers of women of childbearing age for both the first and second half of decade are then used calculate county-level birth rates for each period:

$$\text{Birth rate}_{c(t,t+5)} = \text{Births}_{c(t,t+5)} / \text{Childbearing-Age Women}_{c(t,t+5)}$$

$$\text{Birth rate}_{c(t+6,t+10)} = \text{Births}_{c(t+6,t+10)} / \text{Childbearing-Age Women}_{c(t+6,t+10)}$$

Community-level numbers of women of childbearing age for each half of the decade are calculated using the same procedure used at the county-level. These numbers are then multiplied by the county-level birth rates for each part of the decade to calculate estimated births for each community:

$$\text{Births}_{i(t,t+5)} = \text{Birth rate}_{c(t,t+5)} * \text{Childbearing Age Women}_{i(t,t+5)}$$

$$\text{Births}_{i(t+6,t+10)} = \text{Birth rate}_{c(t+6,t+10)} * \text{Childbearing Age Women}_{i(t+6,t+10)}$$

County-level survival rates for births during the study decades are calculated by dividing expected populations from Voss, et al., (2005) and Winkler, et al., (2013) for age cohorts 0 to 4 and 5 to 9 by the numbers of births from the second half and first half of the decade, respectively:

$$\text{Survival Rate}_{c(\text{age 0 to 4})(t,t+10)} = \text{Expected Population}_{c(\text{age 0 to 4})(t+10)} / \text{Births}_{c(t+6,t+10)}$$

$$\text{Survival Rate}_{c(\text{age 5 to 9})(t,t+10)} = \text{Expected Population}_{c(\text{age 5 to 9})(t+10)} / \text{Births}_{c(t,t+5)}$$

Migration rates for children under the age of 10 at the end of the decade can then be calculated using the procedure for the other age cohorts, with estimated births substituted for the base population:

$$\text{Expected Population}_{i(\text{age 5 to 9})(t+10)} = \text{Births}_{i(t,t+5)} * \text{Survival Rate}_{c(\text{age 5 to 9})(t,t+10)}$$
$$\text{Expected Population}_{i(\text{age 0 to 4})(t+10)} = \text{Births}_{i(t+6,t+10)} * \text{Survival Rate}_{c(\text{age 0 to 4})(t,t+10)}$$

$$\text{Age-Specific Migration Rate}_{i(\text{age 5 to 9})(t,t+10)} = (\text{Population}_{i(\text{age 5 to 9}))(t+10)} - \text{Expected Population}_{i(\text{age 5 to 9})(t,t+10)}) / \text{Births}_{i(t,t+5)}$$

$$\text{Age-Specific Migration Rate}_{i(\text{age 0 to 4})(t,t+10)} = (\text{Population}_{i(\text{age 0 to 4}))(t+10)} - \text{Expected Population}_{i(\text{age 0 to 4})(t,t+10)}) / \text{Births}_{i(t+6,t+10)}$$

Summing migration all age cohorts then allows the calculation of an aggregate migration rate:

$$\text{Net Migration Rate}_{i(t,t+10)} = (\sum \text{Net Migrants}_{ia(t,t+10)}) / \text{Population}_{it}$$

Summing migration across all age groups also allows the decomposition of population change into migration and natural increase:

$$\text{Natural Increase Rate}_{i(t,t+10)} = (\text{Population}_{i(t,t+10)} - (\sum \text{Migration}_{ia(t,t+10)})) / \text{Population}_{it}$$

Because the migration and natural increase numbers derived above are estimates, the numbers for individual communities should be interpreted with some caution. A key assumption in these estimates is that age-specific death rates, as well as fertility rates for women of child-bearing age, vary across, but not within, Oregon's counties. While this assumption ignores some inevitable variation within counties, there is little reason to believe that there would be systematic differences in, for example, mortality rates for 20- to 24-year-olds *within a given county*. However, random events, such as the death of multiple young people from a community in an automobile accident, could have large effects on migration estimates for small communities. If the errors on the individual estimates, however, are not systematic, their effect would be to bias regression coefficients toward zero.

One place for concern about systematic error is in the migration estimates for the oldest age cohorts. Self-selection may cause seniors with worse health, and therefore higher mortality rates, to concentrate in nursing homes and assisted care facilities, while healthier seniors remain in their home communities. If such self-selection does take place *within a county*, these estimates would underestimate the mortality rate in communities with high concentrations of high-mortality seniors, and thereby artificially lowering that community's migration rates for the oldest age cohorts. Given the dearth of health services in most small rural communities, it is unlikely that such self-selection takes place within the regression universe of communities with fewer than 1290 people. It should be noted, however, that if seniors living in such communities are healthier than their counterparts in other parts of the county, it would artificially raise their predicted migration rates.

Trends in Migration and Natural Increase

The potential for error in particular communities notwithstanding, the migration estimates provide a useful general view of population trends in communities of various sizes. A comparison of net migration and natural increase rates, seen in Figures 1 and 2, show the primacy of net migration in driving overall population change for both small communities (shown in Column 4) and for all Oregon communities (shown in Column 1).

Several other trends are readily observable from these figures. The first is that both migration and natural increase were markedly lower for each community cohort in the 2000-2010 period than in the previous decade. The second is that the communities focused on in this study—those with fewer than 1290 people—have lower migration and natural increase rates than the full set of the state's communities. Places with fewer than 500 people, a subset of the communities in this study that will be referred to as 'very small communities,' have the smallest net migration and natural increase rates of all. The data also show that small communities got a larger percentage of their population gains in the 1990s from migration than the full set of communities (82% vs. 77%), and that this dependence on migration increased to 91% (vs. 78% for all communities) in the subsequent decade. This dependence on migration for population increases further justifies this paper's focus on migration as the prime driver of population change in rural communities.

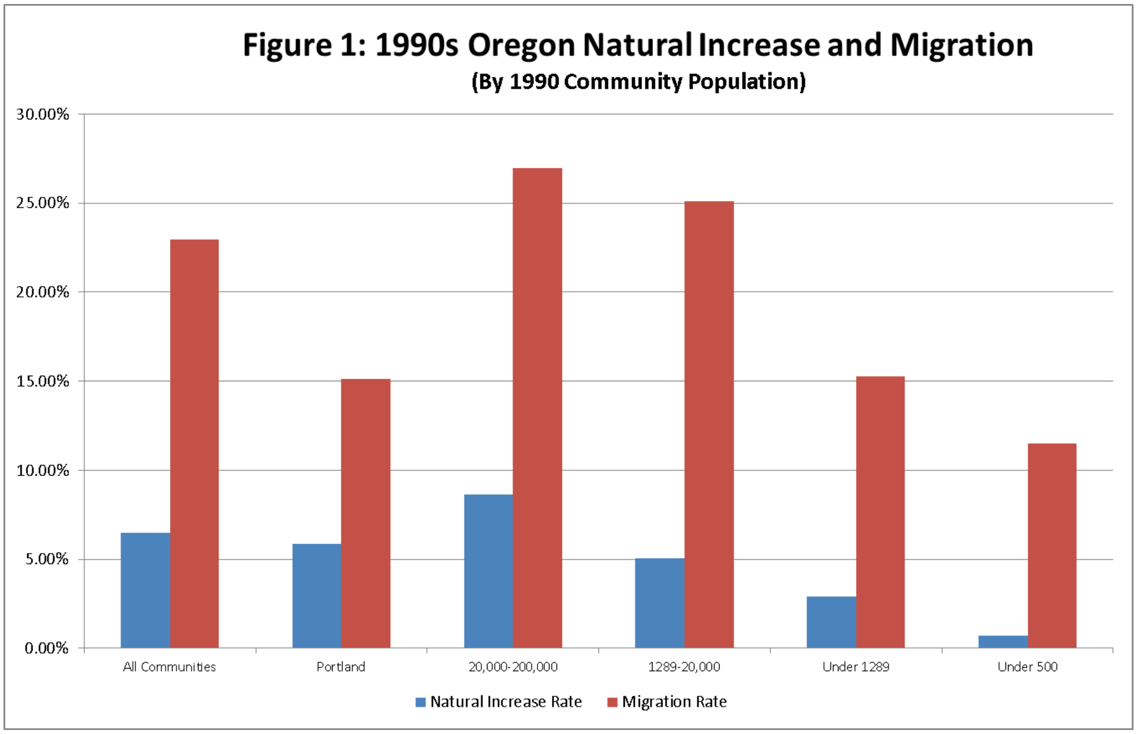


Figure 1: 1990s Oregon Natural Increase and Migration
(By 1990 Community Population)
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
All Communities
Portland
20,000-200,000
1289-20,000
Under 1289
Under 500
Natural Increase Rate
Migration Rate

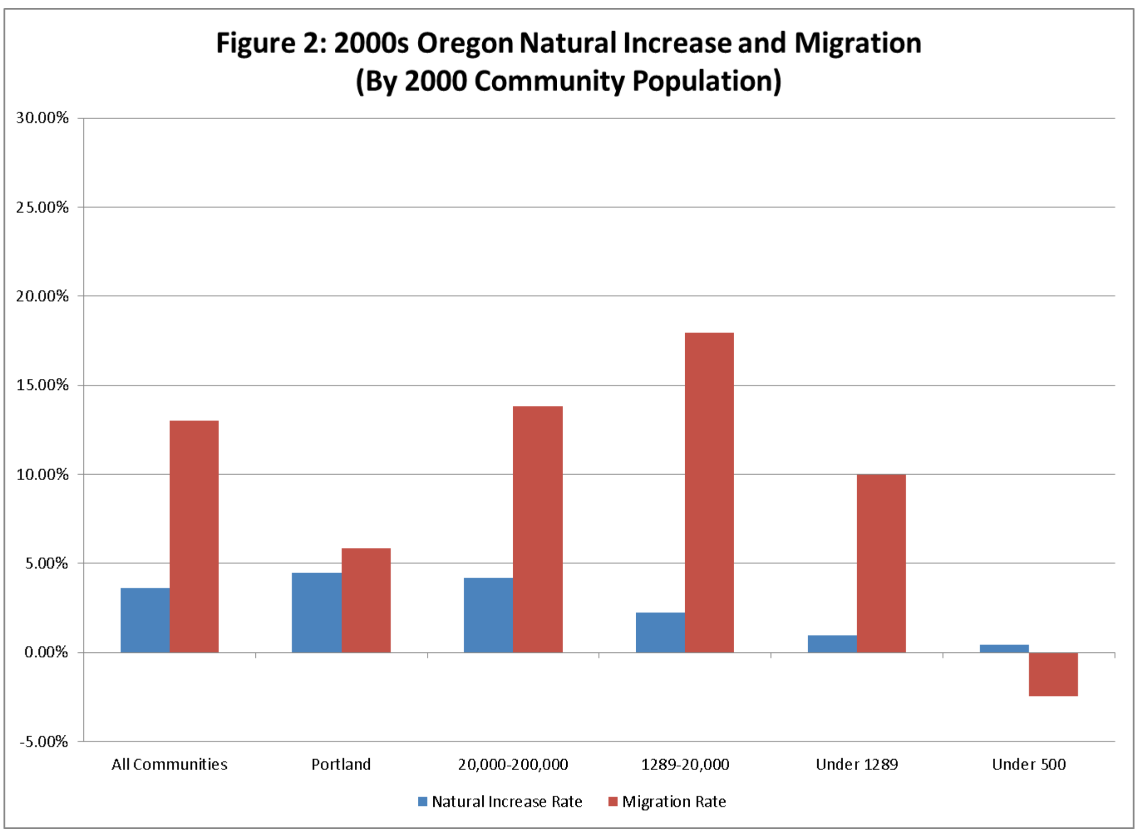
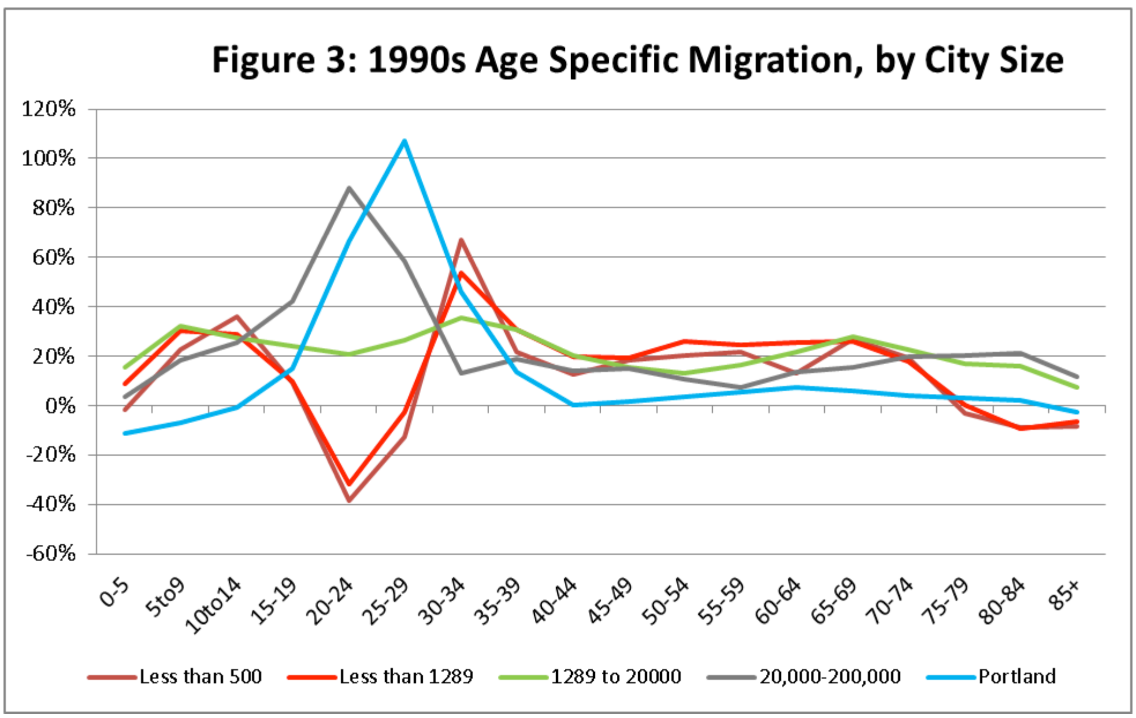


Figure 2: 2000s Oregon Natural Increase and Migration
(By 2000 Community Population)
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
All Communities
Portland
20,000-200,000
1289-20,000
Under 1289
Under 500
Natural Increase Rate
Migration Rate

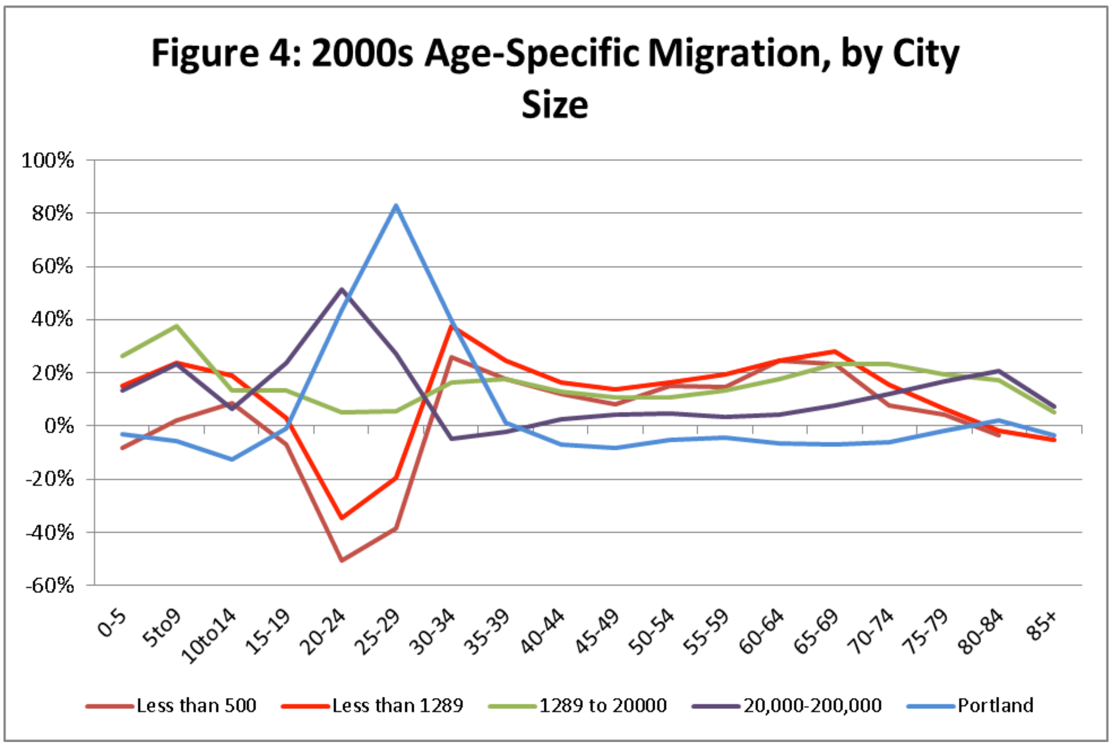
Age-Specific Trends in Migration

Further analysis of migration trends in Oregon communities, presented in Figures 3 and 4, shows striking differences across age-groups and city sizes. Figure 3 shows that, during the 1990s, small and very small places suffered mass outmigration of people in their twenties, but regained population through inmigration of working-age adults, and particularly those in their early thirties.[3] Although it is tempting to assume that the spike in early-thirties migration rates represents the return of young people who left the community, the identity and origins of those migrating into rural communities cannot be determined from the U.S. Census data.



[3] It is important to note that higher percentage gains among people in their 30s than losses of people in their 20s do not necessarily indicate a net population gain. If there was a similar trend of outmigration of 20-24 year-olds in the previous decade, this would leave a small base population in that cohort at the end of the decade, magnifying the percent gain from subsequent inmigration. For example, consider a community with 10 people aged 10 to 14 in 1990. If that community had 40% outmigration in that cohort during the decade, it would leave six 20- to 24-year-olds in 2000. The return of all four outmigrants in the subsequent decade would then constitute 67% inmigration in the 2000-2010 period.

Migration trends in the 2000-2010 period, depicted in Figure 4, below, show a similar pattern with a few key differences. Although the general trend of outmigration of young adults and inmigration of those in their early thirties persists for small communities, the spike in the latter group is much smaller, and inmigration among working-age adults is somewhat lower. The subset of very small communities, which was quite similar to small communities as a whole in the 1990s, diverges considerably, with much greater losses of young adults, and smaller gains among children and working-age adults.



In addition to illuminating age-specific migration trends, comparing these figures with known rural migration patters serves as a useful validity check on the migration estimates. The general pattern shown in these graphs, with large losses in rural communities among young people, and some gains in older age cohorts is strikingly similar to the national county-level findings of Johnson and Fuguitt (2000) and Johnson and Cromartie (2006). The preservation of the general age-specific pattern amidst the shift from a high-migration decade (the 1990s) to a decade of more moderate rural net migration (2000-2010) is also in keeping with the literature, suggesting that these migration estimates are an accurate approximation of the migration trends that are shaping rural communities.

Although these aggregate trends illustrate the differences between small rural communities and their larger counterparts, they cannot explain the wide differences in net migration rates among Oregon's small communities. To investigate such differences, we turn to a regression analysis of aggregate and age-specific migration trends in small Oregon communities.

Regression Data and Methods

This analysis draws on the research described in Section III to specify total migration and age-specific migration, as follows:

Community Net Migration = f(E,D,A,P,S)

where *E* indicates economic, and particularly labor market effects; *D* indicates distance to urban centers; *A* indicates natural amenities, *P* indicates starting population, and *S* indicates access to services.

Ordinary least squares regression is used to isolate the effects of the five factors above on overall and age-specific net migration rates in small incorporated Oregon places. Though migration in the United States is generally studied at the county level, places are the unit of analysis here because county-level population rates may disguise wide differences within counties. Because this paper is concerned with the threat of outmigration to the existence of small rural communities, and because the research of Chen, et al., (2012) shows that different growth dynamics in large communities could cancel out effects that are unique to small places, only communities with populations at or below the lowest threshold (1289 people) identified by Chen, et al. (2012) are included in the regression analysis.

Dependent Variables

This analysis uses five dependent variables for the 1990-2000 time period, and five for the 2000-2010 time period. For each decade, the first dependent variable is the total net migration rate for each community. Subsequent regressions investigate what factors attract specific age cohorts, with each cohort labeled by its members' ages *at the end of the study decade*. The first of these, labeled 'young adults' consists of individuals between the ages of 20 and 24. As shown above, small communities tend to have very high outmigration rates in this cohort, and these regressions will explain what factors are associated with communities that better retain their young adults. The second, referred to as 'working-age adults,' includes those between the ages of 25 and 59. These adults are in their prime working years, and are expected to be most sensitive to economic variables. The third group, referred to as 'younger seniors,' is those between the ages of 60 and 74. As individuals in or nearing their retirement years, this group is expected to have their separation from the labor market allow them to be most concerned with natural amenities. Finally, 'older seniors' are those aged 75 and over. To the extent that they migrate, they are expected to be affected by access to the hospitals and health services.

Descriptive statistics for the dependent variables can be found in Table 1, below.

Table 1: Summary Statistics, Dependent Variables, Communities Included in Decade Regressions

Variable	Mean	Standard Deviation	Min	Max
1990-2000				
Overall Migration Rate	15.039	25.898	-52.732	121.099
Migration Rate, Age 20 to 24	-26.165	49.389	-99.147	200.853
Migration Rate, Age 25 to 59	27.457	45.759	-46.272	265.702
Migration Rate, Age 60 to 74	21.656	33.521	-61.978	145.044
Migration Rate, Age 75 and Over	2.234	26.688	-45.298	115.943
2000-2010				
Overall Migration Rate	5.692	24.109	-53.478	112.031
Migration Rate, Age 20 to 24	-40.459	36.650	-99.038	200.963
Migration Rate, Age 25 to 59	11.662	27.342	-51.177	127.535
Migration Rate, Age 60 to 74	20.871	22.762	-20.688	118.135
Migration Rate, Age 75 and Over	.955	21.577	-57.874	70.531

The four age cohorts used as dependent variables, of course, differ in size and therefore have unequal effects on overall net migration rates. To understand the relative sizes of the cohorts and their influence on total net migration, Table 2 shows the average size of each cohort at the beginning of each study decade, and the average net migration (in people, rather than percentage-points) for each cohort, as well as the percent of the total that each cohort provides. While one would expect that, as the largest age category, working-age adults would exert the largest influence community net migration, Table 2 shows that migration for that cohort is even more important than its numbers would indicate. Despite accounting for only 46% and 45% of the average small community population in 1990 and 2000, respectively, those who were between the ages of 25 and 59 at the end of each accounted for 67% of net migration within each decade. Given that working-age adults are also responsible, as parents, for most migration in the under-19 cohort, it is clear that they are the most important component of net migration rates for small Oregon communities.

Table 2: Average Starting Population and Net Migrants, by Age Cohort, Communities Included in Decade Regressions

Variable	Starting Population*	Percent of Total Starting Population	Net Migrants	Percent of Total Net Migrants
1990-2000				
Total	573	100%	88	100%
Age 20 to 24	47	8%	-15	-17%
Age 25 to 59	262	46%	59	67%
Age 60 to 74	81	14%	18	21%
Age 75 and Over	95	17%	0	0%
Age 19 and Under	88	15%	26	30%
2000-2010				
Total	586	100%	57	100%
Age 20 to 24	48	8%	-19	-33%
Age 25 to 59	263	45%	38	67%
Age 60 to 74	103	18%	24	41%
Age 75 and Over	95	16%	2	4%
Age 19 and Younger	77	13%	12	21%
*Starting population totals are based on the cohort members' age at the end of the decade. In other words, the starting population for the Age 20 to 24 cohort indicates the number of people between the ages of 10 and 14 at the beginning of the decade.				

Explanatory Variables

Three variables from the 1990 and 2000 U.S. Censuses are used to model the effects of *labor markets* on the dependent variables. The first is the civilian unemployment rate at the beginning of the study period, which is expected to negatively impact population change. Because employment in extractive industries is associated with lower population growth, and because the downturn in Oregon's forestry industry is thought to have adversely affected many communities in the 1990s and early 2000s, the percentage of a community's civilian workers employed in agriculture, forestry, fishing, hunting, or mining at the beginning of the decade is included. Changes in classification systems between 1990 and 2000 necessitated the use of crosswalks outlined by the U.S. Census Bureau (2003) in creating measures that were comparable across decades.

The third labor market variable in this analysis follows a number of authors (e.g., Ferguson, et al. 2007; Partridge, et al., 2007) in using a spatial weights matrix to incorporate job market characteristics in nearby areas. For each community in each decade, all other communities within a 100-mile radius are given a weight equal to the inverse of their squared distance to the community. The weights are standardized to sum to one, and the resulting matrix is then used to create a variable that sums of the product of each neighboring community's number of employed civilian workers and its inverse distance to the community in question. Summing these values creates a variable that represents the size of the nearby labor market that residents of a community can access, with the weights ensuring that more proximate employment opportunities are given more weight than those that are farther away. Because people are thought to migrate towards economic opportunity, this variable is expected to have a positive effect on migration.

Proximity to urban areas is incorporated through a distance from a community to the nearest place with at least 20,000 people, and to the nearest place with at least 150,000 people. Each decade's distance variables were calculated separately in ArcGIS, using 1990 and 2000 U.S. Census population data and shapefiles for Oregon and the surrounding states of California, Idaho, Nevada, and Washington. An additional variable, interstate access, is equal to one if a community is within 5 miles of an interstate highway, and equal to zero otherwise. Greater distances to urban places are expected to lower net migration rates, while interstate access, by lowering the cost of distance, is expected to have a positive effect on net migration.

Natural amenity variables were also calculated in ArcGIS to quantify the amount of variation in elevation, normal annual precipitation, and the percentage of forest, farmland, and open water, in a 20-mile radius around each community. Though the amenity variables are taken from data published during or after the study period, concerns about endogeneity are slight. Elevation data, which is taken from U.S. Geological Survey (USGS) 2005 Digital Elevation Models, is virtually unchanged over time, and the 2005 standard deviation in elevation can reasonably be used as a proxy for the elevation variation in 1990 or 2000. The precipitation variable for both the 1990-2000 and 2000-2010 time periods is the average annual precipitation for the community between 1970 and 2000, obtained from Oregon State University's PRISM Climate Group. The land cover variables for the 1990-2000 and 2000-2010 periods are respectively drawn from the USGS's 1992 and 2001 National Land Cover Databases. Each dataset was created from data that were largely collected in the years before publication, meaning that any land cover changes due to changes in population were likely extremely slight. Based on the findings of McGranahan (1999; 2008), elevation variation, forest cover, and open water are expected to be landscape amenities, increasing net migration, while farmland is expected to be a disamenity, and carry negative effects on net migration rates.

C*ommunity size*, defined as each community's population at the beginning of the study period, is incorporated to test whether smaller communities grow more slowly than larger ones.

Access to services is modeled by binary variables indicating the presence or absence of a service in each community. For select services, the distance to the nearest incorporated place with that service is also included. The 1989-1990 and 1999-2000 edition of the *Oregon Business Directory* were used to document the presence or absence four sets of services in each community: grocery stores or general stores; eating or drinking establishments; doctor's offices or health clinics; and hospitals. *Oregon School Directories* were used to document the presence or absence of high schools in a community.

The grocery stores category includes all businesses in Standard Industrial Classification (SIC) 5411, which includes grocery stores, supermarkets, convenience food stores, food markets, and sellers of frozen foods. Because many general stores in rural areas also sell food, businesses in SIC 5399, General Merchandise, are also included. To account for the prevalence of food sold by stores like Wal-Mart and Fred Meyer, the department store classification, 5311, is also included. It is worth noting that the breadth of the categories included in the grocery variable, which includes convenience stores, means that communities listed as having grocery stores are not necessarily located in close proximity to a full-service supermarket.

The other presence of services variables are more straightforward. Communities that have a business in either SIC 5812 (eating places) or 5813 (which includes bars, nightclubs, and other drinking establishments) are coded as "1" for the eating and drinking establishments variable. The hospitals variable is drawn from SIC 8062, which includes "General Medical and Surgical Hospitals." The doctors classification included all businesses in SIC 8011, which includes a wide range of medical services, including primary care physicians and clinics. Access to three essential services—grocery stores, doctors, and hospitals—is additionally measured with a variable indicating the distance to the nearest incorporated community that has such a service. Because only one small community had a hospital in 1990, and none had a hospital in 2000, access to hospitals is modeled only through the distance to the nearest place with a hospital.

Finally, two variables are incorporated as controls. The first is the natural log of each community's median rent, which is introduced to control for housing costs. This variable is particularly important in the context of natural amenities, which may, over time, become priced into housing costs. The second control is the natural log of each community's median income, which is introduced to control for the potential earnings a person might gain from moving to a community. The earnings variable is expected to have a positive effect on net migration, while the effect of the median rent variable is expected to be negative.

As noted above, this analysis is limited to incorporated places with 1289 or fewer residents at the beginning of the decade in question. Of the 241 incorporated places in Oregon in 1990, 119 had populations of 1289 or fewer. Five of these must be excluded from the 1990s regressions. Hammond is dropped because it disincorporated during the decade, while Greenhorn is not included because it did not have any residents in 1990. Three others—Granite (population eight), Lonerock (population eleven), and Shaniko (population 26)—are excluded due to lack of median rent data. Spray (population 149) is also excluded from the young adult regression because its lack of a cohort base

Table 3: Summary Statistics, 1990s Variables, 1990s Regressions Communities

Variable	Source	Expected Sign	Mean	Standard Deviation	Min	Max
Population, 1990	U.S. Census	+	573.175	338.015	34	1289
Distance to the Nearest Community of 150,000 People, Miles	Author calculation	-	109.708	70.284	0	318.051
Distance to the Nearest Community of 20,000 People, Miles	Author calculation	-	41.647	30.436	0	115.86
Highway Access (=1 if the distance to nearest interstate highway is 5 miles or less)	Author calculation	+	.289	.456	0	1
Civilian Unemployment Rate, 1990	U.S. Census	-	8.789	5.189	0	30.864
Percent of workers employed in agriculture, fishing, forestry, or mining, 1990	U.S. Census	-	8.141	6.523	0	31.565
Space weighted employment in communities within 100 miles	U.S. Census/Author calculation	+	3235.66	2033.94	529.252	13282.52
Percent of land within a 20-mile radius classified as "open water"	U.S. Geological Survey (USGS) /Author calculation	+	6.291	14.503	.018	55.126
Percent of land within a 20-mile radius classified as forest	USGS/Author calculation	+	43.792	24.493	.049	91.750
Percent of land within a 20-mile radius classified as farmland	USGS/Author calculation	-	21.534	19.977	.169	64.166
Average annual precipitation, 1970-2000, Millimeters	PRISM Climate Group, Oregon State University	-	94.110	65.588	21.534	279.466
Standard deviation of elevation in a 20-mile radius, feet	USGS/Author Calculation	+	230.728	85.308	74.192	450.379
Natural log of median rent, 1990	U.S. Census	-	5.805	.215	5.215	6.431
Natural log of median household income, 1990	U.S. Census	+	10.010	.230	9.402	10.971
Grocery Store (=1 if a community has a business in SIC 5411, 5311, or 5399, 1990)	Oregon Business Directory	+	.816	.389	0	1
High School (=1 if a community has a high school, 1990)	Oregon School Directory	+	.509	.502	0	1
Doctor_90 (=1 if a community had a business in SIC 8011, 1990)	Oregon Business Directory	+	.289	.456	0	1
EatDrink_90 (=1 if a community had a business in SIC 5812 or 5813, 1990)	Oregon Business Directory	+	.781	.416	0	1
GrocDist90 (Distance to the nearest Oregon incorporated place for which grocery_90=1, Miles)	Author calculation	-	.802	3.398	0	24.443
DoctDist90 (Distance to the nearest Oregon incorporated place for which doctor_90=1, Miles)	Author calculation	-	6.263	8.595	0	35.019
HospDist90 (Distance to the nearest Oregon incorporated place for which hospital_90=1, Miles)	Author calculation	-	13.430	12.641	0	60.870

Table 4: Summary Statistics, 2000s Variables, 2000s Regressions Communities

Variable	Source	Expected Sign	Mean	Standard Deviation	Min	Max
Population, 2000	U.S. Census	+	585.893	347.142	59	1286
Distance to the Nearest Community of 150,000 People, Miles	U.S. Census/Author calculation	-	97.788	53.767	0	209.574
Distance to the Nearest Community of 20,000 People, Miles	U.S. Census/Author calculation	-	41.731	30.837	0	115.692
Highway Access (=1 if the distance to nearest interstate highway is 5 miles or less)	Author calculation	+	.262	.442	0	1
Civilian Unemployment Rate, 2000	U.S. Census	-	8.356	5.630	0	33.096
Percent of workers employed in agriculture, fishing, forestry, or mining, 2000	U.S. Census	-	7.714	6.161	0	29.126
Space weighted employment in communities within 100 miles, 2000	U.S. Census/Author calculation	+	4236.213	2915.779	586.338	19587.19
Percent of land within a 20-mile radius classified as “open water”, 2001	U.S. Geological Survey (USGS)/Author calculation	+	6.137	14.419	.014	55.186
Percent of land within a 20-mile radius classified as forest, 2001	USGS/Author calculation	+	36.540	21.942	.009	83.728
Percent of land within a 20-mile radius classified as farmland, 2001	USGS/Author calculation	-	18.922	19.008	.062	63.626
Average annual precipitation, 1970-2000, Millimeters	PRISM Climate Group, Oregon State University	-	92.035	67.179	23.550	279.466
Standard deviation of elevation in a 20-mile radius, feet	USGS/Author Calculation	+	235.976	85.580	74.192	450.379
Natural log of median rent, 2000	U.S. Census	-	6.240	.245	5.677	7.180
Natural log of median household income, 2000	U.S. Census	+	10.412	.250	9.753	11.350
Grocery Store (=1 if a community has a business in SIC 5411, 5311, or 5399, 2000)	Oregon Business Directory	+	.786	.412	0	1
High School (=1 if a community has a high school, 2000)	Oregon School Directory	+	.524	.502	0	1
Doctor_2000 (=1 if a community had a business in SIC 8011, 2000)	Oregon Business Directory	+	.272	.447	0	1
EatDrink_2000 (=1 if a community had a business in SIC 5812 or 5813, 2000)	Oregon Business Directory	+	.777	.418	0	1
GrocDist2000 (Distance to the nearest Oregon incorporated place for which grocery_2000=1, Miles)	Author calculation	-	1.365	5.897	0	51.683
DoctDist2000 (Distance to the nearest Oregon incorporated place for which doctor_2000=1, Miles)	Author calculation	-	6.477	8.495	0	35.019
HospDist2000 (Distance to the nearest Oregon incorporated place for which hospital_2000=1, Miles)	Author calculation	-	14.555	11.795	0	70.765

population (those who were between 10 and 14 years old in 1990) preclude the calculation of a migration rate for that cohort.

Between 1990 and 2000, eleven communities included in the 1990s regressions grew to have more than 1290 people[4], leaving 107 communities with a population of 1289 or fewer. For the same reasons as above, Greenhorn, Granite, Lonerock, and Shaniko are dropped from the 2000-2010 regressions, leaving 103 communities. Two communities that incorporated during the decade (LaPine and Damascus) are also excluded from the sample, as they did not have populations of 1289 of fewer, and were not incorporated, at the start of the study period.

Descriptive statistics for the explanatory variables for the 1990-2000 regressions (114 communities) and for the 2000-2010 regressions (103 communities) are displayed in Tables 3 and 4, above.

Results

Overall Migration

Before testing effects of the set of services variables, a base model was specified, using the labor market, distance, natural amenity, and population size variables described above. Results of regressions of overall are shown in Tables 5 and 6, below.

The 1990s overall net migration base regression, shown in Column 1 of Table 5, shows the importance of both distance to urban centers and natural amenities in driving migration in small Oregon communities. Other things equal, a 10-mile increase in the distance of a community from the nearest city of 150,000 is found to reduce migration by

[4] These communities are, with 1990 populations in parentheses: Carlton (1289), Brownsville (1281), Cannon Beach (1221) Canyonville (1219), Amity (1175), Cave Junction (1126), Columbia City (1003), Gervais (992), North Plains (972), Durham (748), and Irrigon (737).

Table 5: Total Migration, Small Oregon Communities, 1990-2000

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**15.04**	**15.04**	**15.04**	**15.04**	**15.04**	**15.04**	**15.04**	**15.04**	**15.04**	**15.04**
pop_90	-0.008	-0.007	-0.008	-0.007	-0.007	-0.006	-0.008	-0.011	-0.011	-0.012
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.008)	(0.009)	(0.008)	(0.009)
dist_150k_90	-0.151**	-0.155**	-0.152**	-0.153**	-0.149**	-0.153**	-0.155**	-0.162**	-0.152**	-0.160**
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.066)	(0.064)	(0.065)	(0.063)	(0.066)
Dist_20k	-0.275*	-0.259*	-0.277*	-0.268*	-0.272*	-0.255	-0.258*	-0.256*	-0.268*	-0.249
	(0.153)	(0.155)	(0.154)	(0.154)	(0.154)	(0.159)	(0.156)	(0.155)	(0.150)	(0.158)
interstate_access	9.347	8.653	9.267	9.236	9.192	8.622	9.281	9.169	8.271	8.229
	(6.280)	(6.374)	(6.332)	(6.308)	(6.321)	(6.514)	(6.301)	(6.294)	(6.183)	(6.242)
unemploy90	-0.325	-0.323	-0.327	-0.329	-0.333	-0.329	-0.302	-0.302	-0.298	-0.276
	(0.502)	(0.503)	(0.505)	(0.504)	(0.505)	(0.512)	(0.505)	(0.504)	(0.493)	(0.500)
agforestshare_90	0.180	0.223	0.196	0.219	0.182	0.220	0.230	0.192	0.394	0.414
	(0.457)	(0.462)	(0.472)	(0.465)	(0.459)	(0.480)	(0.466)	(0.458)	(0.459)	(0.468)
sw_employ90	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
openwater_90	1.057***	1.060***	1.040**	1.039***	1.026**	1.039**	1.134***	1.070***	0.802**	0.874*
	(0.399)	(0.400)	(0.417)	(0.402)	(0.409)	(0.433)	(0.420)	(0.400)	(0.409)	(0.450)
forest_90	0.288	0.296	0.285	0.271	0.280	0.287	0.347	0.290	0.119	0.169
	(0.205)	(0.206)	(0.207)	(0.209)	(0.207)	(0.218)	(0.228)	(0.206)	(0.216)	(0.253)
farmland_90	0.199	0.207	0.192	0.186	0.186	0.197	0.256	0.191	-0.034	0.015
	(0.267)	(0.268)	(0.271)	(0.269)	(0.270)	(0.280)	(0.285)	(0.268)	(0.283)	(0.314)
Annual Precipitation	-0.278***	-0.279***	-0.276***	-0.273***	-0.273***	-0.274***	-0.293***	-0.289***	-0.249***	-0.266**
	(0.096)	(0.096)	(0.098)	(0.097)	(0.098)	(0.101)	(0.100)	(0.097)	(0.095)	(0.104)
ElevationSD	0.005	0.007	0.004	0.005	0.005	0.006	0.007	0.003	0.001	0.001
	(0.038)	(0.038)	(0.039)	(0.038)	(0.039)	(0.040)	(0.039)	(0.039)	(0.038)	(0.038)
ln_medianrent_90	13.214	13.627	12.936	12.972	13.729	14.063	12.561	9.673	4.362	2.940
	(16.341)	(16.394)	(16.522)	(16.411)	(16.470)	(16.844)	(16.430)	(16.944)	(16.545)	(17.108)
ln_medianhhinc_90	-31.033**	-33.552**	-31.053**	-32.805**	-31.665**	-34.071**	-30.469**	-31.567**	-35.448***	-35.026***
	(13.372)	(13.881)	(13.439)	(13.885)	(13.536)	(14.301)	(13.448)	(13.411)	(13.280)	(13.472)
grocery_90		-5.082				-4.544				
		(7.262)				(9.813)				
hs90			-0.821			0.363				
			(5.352)			(5.804)				
eatdrink_90				-3.378		-0.584				
				(6.775)		(9.323)				
doctor_90					-2.251	-1.743				
					(6.012)	(6.144)				
GrocDist90							0.480			0.289
							(0.800)			(0.848)
DoctDist90								-0.301		-0.146
								(0.372)		(0.403)
HospDist90									-0.604**	-0.557*
									(0.277)	(0.300)
_cons	289.199**	314.027**	291.910**	310.786**	292.568**	316.539**	281.683**	320.331**	404.115***	405.785***
	(139.756)	(144.539)	(141.559)	(146.821)	(140.655)	(149.253)	(140.767)	(145.181)	(146.947)	(151.130)
Number of observations	114	114	114	114	114	114	114	114	114	114
R2	0.222	0.226	0.222	0.224	0.223	0.227	0.225	0.227	0.258	0.259
Adjusted R2	0.112	0.107	0.103	0.105	0.104	0.080	0.106	0.109	0.144	0.128

note: *** p<0.01, ** p<0.05, * p<0.1

1.5 percentage points. The effect of distance to a city of 20,000 is less significant but considerably larger, with an extra ten miles of distance carrying a net migration penalty of 2.7 percentage points.

The findings regarding natural amenities are also as expected, and strongly significant The large amount of precipitation occurring in many parts of Oregon is found to lower net migration, with an extra ten centimeters of average annual precipitation in the 1970 to 2000 period associated with a 2.7 percentage-point decrease in net migration. Communities with large amounts of open water within a twenty-mile radius are, other things equal, found to grow much more quickly than other places, with an extra percentage point of nearby land classified as open water associated with just over a one percentage point increase in net migration. This implies that, were it not for the high precipitation, isolation from urban centers, and other conditions afflicting coastal communities, they would have migration rates as many as 50 percentage points higher than those that lack access to open water.

One surprising finding in the 1990s full migration model is that higher median incomes produce lower levels of net migration, even when median rent is held constant. Although the potential to earn higher income would generally be expected to increase net migration rates, this finding mirrors that of Chen, et al. (2012) who found that, for communities with fewer than 1290 people, median wages had a negative effect on overall migration. There are several potential explanations for this finding. Partridge and Rickman (2008) note that moving costs, which are more difficult for low-income households to afford, psychic costs of moving, and the local, informal nature of low-skilled job markets, may discourage out-migration from low-income areas. The increasing importance of commuting means that the median income in a given community does not necessarily reflect the income that a person might earn by moving to a community and commuting elsewhere. This distinction is particularly important for communities that are subject to suburbanization, which may entail migrants who work white-collar jobs in urban areas moving into communities with relatively low median incomes that reflect predominant employment in lower-paying traditional rural industries. This finding may also represent a willingness on the part of residents to accept lower wages in exchange for certain benefits they see in living in a small town.

The successive introduction of the services variables to the 1990s regressions shows both the robustness of the results in the base model, and also the significant effect of distance to hospitals on net migration. Residents of many rural communities have long drives to reach hospitals or health clinics, with the most isolated communities in 1990 located 60 miles from the nearest community with such services in the 1990s. These results show that an extra 10 miles of distance to the nearest community with a hospital or health clinic was associated with a six percentage-point drop in a community's net migration rate. This result diminishes slightly in magnitude and significance when the distance to other services was incorporated.

The most noticeable difference in the results for the 2000-2010 decade (Table 6, below) is the significant relationship between a community's starting population and its net migration rate. Larger communities are found to exhibit higher migration rates, with a community with an additional 100 people at the beginning of the decade expected to grow, other factors held equal, at rate 1.5 percentage points higher. Taken along with the overall trend of outmigration and natural decrease in Oregon's smallest communities, this finding, which corroborates that of Chen, et al. (2012), is of serious concern to small rural communities. Somewhat more encouraging is the marginally significant effect of unemployment on migration, suggesting that job-focused economic development does have potential to counteract trends toward population decline.

As the effects of size and unemployment increase in the 2000-2010 period, the effects of natural amenities and distance diminish. Average annual precipitation remains negatively significant, but both the level of significance and the magnitude of the beta-coefficient are smaller than in the previous decade. The same is true for open water, which has gone from being strongly significant to being marginally so.

Variation in elevation, found to encourage migration in a national county-level study by McGranahan (1999), here emerges as a factor that lowers net migration for small Oregon communities. One potential explanation for this unexpected finding is that elevation variation has different effects on migration for larger units of analysis (such as counties) spread across large areas (such as the contiguous United States) than for small units of analysis (such as communities) within a single state. The scope of the study is important in that elevation variation has generally been used to explain differences across the entire United States, with elevation variation found to explain why counties in the Mountain West, for example, have grown much more quickly than those on the Great Plains. Differences in elevation within a rather mountainous state and for geographically small units of analysis, however, could be conceivably be negative if small differences between places with high levels of elevation variation are unimportant to migrants, and potentially outweighed by factors, like inferior roads and longer driving times, that are not controlled for here. Large units of observation, such as counties, also have the luxury

Table 6: Total Migration, Small Oregon Communities, 2000-2010

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Net Migration Rate	**5.69**	**5.69**	**5.69**	**5.69**	**5.69**	**5.69**	**5.69**	**5.69**	**5.69**	**5.69**
Pop2000	0.015**	0.011	0.014*	0.010	0.015*	0.011	0.015**	0.016*	0.014*	0.013
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.007)	(0.009)	(0.008)	(0.009)
Dist150k00	-0.135*	-0.117	-0.133*	-0.121	-0.135*	-0.118	-0.143*	-0.136*	-0.133*	-0.141*
	(0.076)	(0.076)	(0.076)	(0.075)	(0.076)	(0.077)	(0.075)	(0.076)	(0.076)	(0.076)
Dist20k_00	-0.174	-0.197	-0.167	-0.210	-0.174	-0.225	-0.258*	-0.176	-0.196	-0.261*
	(0.143)	(0.143)	(0.146)	(0.143)	(0.144)	(0.148)	(0.149)	(0.145)	(0.149)	(0.152)
interstate_access	-8.071	-9.043	-7.876	-7.944	-8.035	-8.762	-9.649	-8.129	-8.030	-9.567
	(5.917)	(5.892)	(5.975)	(5.830)	(5.973)	(6.046)	(5.898)	(5.966)	(5.939)	(5.970)
unemploy2000	-0.897*	-0.852*	-0.905*	-0.937*	-0.896*	-0.893*	-0.973**	-0.911*	-0.891*	-0.926*
	(0.487)	(0.484)	(0.491)	(0.481)	(0.490)	(0.492)	(0.483)	(0.502)	(0.489)	(0.498)
agforestshare_2000	-0.610	-0.727	-0.655	-0.755*	-0.611	-0.721	-0.468	-0.618	-0.537	-0.423
	(0.451)	(0.453)	(0.473)	(0.451)	(0.454)	(0.472)	(0.452)	(0.458)	(0.469)	(0.475)
sw_employ2000	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
openwater_2000	0.609*	0.517	0.639*	0.660*	0.615	0.557	0.439	0.612*	0.538	0.411
	(0.364)	(0.365)	(0.377)	(0.360)	(0.378)	(0.402)	(0.371)	(0.367)	(0.384)	(0.389)
forest_2000	0.339	0.275	0.348	0.352	0.341	0.302	0.171	0.344	0.277	0.136
	(0.221)	(0.222)	(0.224)	(0.218)	(0.225)	(0.234)	(0.236)	(0.226)	(0.245)	(0.260)
farmland_2000	0.196	0.119	0.208	0.212	0.199	0.151	-0.015	0.201	0.113	-0.053
	(0.231)	(0.234)	(0.235)	(0.228)	(0.237)	(0.250)	(0.255)	(0.235)	(0.270)	(0.287)
Annual Precipitation	-0.221**	-0.209**	-0.223**	-0.242***	-0.222**	-0.230**	-0.201**	-0.223**	-0.207**	-0.194**
	(0.090)	(0.090)	(0.091)	(0.090)	(0.092)	(0.094)	(0.090)	(0.091)	(0.094)	(0.094)
ElevationSD	-0.095**	-0.097***	-0.093**	-0.092**	-0.095**	-0.095**	-0.099***	-0.095**	-0.094**	-0.098***
	(0.037)	(0.037)	(0.038)	(0.037)	(0.038)	(0.038)	(0.037)	(0.038)	(0.038)	(0.037)
ln_medianrent_2000	14.828	18.952	14.360	19.641	14.799	21.505	11.162	15.122	12.859	9.718
	(15.764)	(15.820)	(15.904)	(15.736)	(15.859)	(16.249)	(15.674)	(16.001)	(16.157)	(16.314)
ln_medianhhinc_2000	-20.941	-18.795	-20.206	-18.892	-20.891	-19.261	-20.083	-21.157	-22.391	-19.259
	(14.427)	(14.353)	(14.662)	(14.256)	(14.527)	(14.603)	(14.238)	(14.597)	(14.680)	(14.771)
Grocery_2000		9.836				5.142				
		(6.025)				(8.266)				
hs2000			1.748			-2.563				
			(5.171)			(5.684)				
EatDrink_2000				11.594*		9.242				
				(6.076)		(8.155)				
Doctor_2000					0.389	0.014				
					(5.592)	(5.618)				
grocdist2000							-0.823*			-0.892*
							(0.443)			(0.497)
doctdist2000								0.048		-0.178
								(0.359)		(0.376)
hospdist2000									-0.181	-0.005
									(0.301)	(0.315)
_cons	187.240	136.963	180.583	130.573	186.791	125.530	218.551	187.296	221.498	221.988
	(135.860)	(138.071)	(137.962)	(137.121)	(136.787)	(140.179)	(135.069)	(136.625)	(147.795)	(146.765)
Number of observations	103	103	103	103	103	103	103	103	103	103
R2	0.305	0.325	0.306	0.333	0.305	0.336	0.331	0.305	0.307	0.333
Adjusted R2	0.194	0.209	0.186	0.217	0.185	0.194	0.216	0.185	0.188	0.199
note: *** p<0.01, ** p<0.05, * p<0.1										

of potentially having high overall elevation variation with large portions of flat land that is suitable residential development and growth. If such land is not available within mountainous rural communities, high variation in elevation could lower migration rates.

Incorporation of the service variables in the 2000-2010 regressions shows marginally significant effects for eating and drinking establishments and for the distance to grocery stores. The magnitude of the eating and drinking location effect is quite large, with an eating or drinking establishment found to add over 11 percentage points to a community's net migration rate. While communities that have grocery stores show no significant differences with those that do not, an extra ten miles to reach a place with such a store is associated with loss of between eight and nine points off a community's net migration rate.

While the incorporation of services variables has little effect on the results for unemployment, precipitation, or elevation variation, it does diminish the significance of the open water variable, and, more interestingly, often takes away the significance from the starting community size variable. The population of a community in 2000 has a positive and statistically significant effect on overall migration in the base model, but the significance of this effect diminishes or disappears in all eight of the services models. For example, 2000 population is significant only at the .10 level if whether a community has an eating or drinking establishment is controlled for, and is insignificant when the distance for a grocery store is controlled for. A community's population is, of course, a major determinant of its ability to support key services, and these findings suggest that part of the effect that low population has on limiting migration is explained by the lack of access to services in such areas.

Age-Specific Migration

The factors influencing overall net migration, not surprisingly, are somewhat different from those affecting migration rates for specific age groups. Because young and working-age adults are particularly important to a community's long-term ability to maintain its population, and because different community assets may be particularly attractive to different groups, Tables 7 through 14 display regression results for four age cohorts: young adults, or those aged 20 to 24; working-age adults, or those between 25 and 59; younger seniors, or those aged 60 to 74; and older seniors, defined as those that are age 75 or older. All age groups refer to ages at the end of the decade in question.

Young Adults

Young adults are shown (Table 7) to be quite sensitive to natural amenities, and particularly to local land cover. In the 1990s, larger percentages of nearby open water and forest increased communities' ability to retain their youth. Farmland, found by McGranahan (2008) to be a disamenity, is also associated with higher net migration in this age group. Communities with higher median rent, not surprisingly, experience higher outmigration.

The incorporation of service variables shows that the presence of a grocery store in a community is associated with better retention of young adults, while places that are distant from hospitals see greater outmigration. All else equal, a community with no grocery or convenience store will have a young adult migration rate over 27 points lower

Table 7: Young Adult Migration, Small Oregon Communities, 1990-2000

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**-26.17**	**-26.17**	**-26.17**	**-26.17**	**-26.17**	**-26.17**	**-26.17**	**-26.17**	**-26.17**	**-26.17**
pop_90	-0.017	-0.026	-0.016	-0.024	-0.013	-0.019	-0.018	-0.017	-0.023	-0.021
	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)	(0.019)	(0.017)	(0.018)	(0.016)	(0.017)
dist_150k_90	-0.142	-0.125	-0.142	-0.134	-0.136	-0.114	-0.135	-0.143	-0.142	-0.100
	(0.128)	(0.127)	(0.129)	(0.128)	(0.129)	(0.129)	(0.129)	(0.132)	(0.125)	(0.130)
Dist_20k	-0.454	-0.545*	-0.459	-0.489	-0.446	-0.568*	-0.489	-0.451	-0.439	-0.559*
	(0.303)	(0.303)	(0.306)	(0.304)	(0.305)	(0.309)	(0.310)	(0.308)	(0.297)	(0.309)
interstate_access	4.953	8.750	4.779	5.471	4.550	7.892	5.065	4.924	2.729	2.933
	(12.461)	(12.436)	(12.564)	(12.444)	(12.539)	(12.644)	(12.504)	(12.532)	(12.229)	(12.235)
unemploy90	-1.418	-1.430	-1.423	-1.396	-1.441	-1.485	-1.462	-1.415	-1.362	-1.503
	(0.995)	(0.981)	(1.001)	(0.994)	(1.000)	(0.993)	(1.001)	(1.002)	(0.974)	(0.980)
agforestshare_90	0.389	0.151	0.427	0.203	0.395	0.288	0.289	0.391	0.842	0.687
	(0.906)	(0.901)	(0.937)	(0.918)	(0.910)	(0.932)	(0.924)	(0.911)	(0.908)	(0.918)
sw_employ90	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.005	-0.004	-0.004	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
openwater_90	1.924**	1.912**	1.884**	2.011**	1.845**	1.617*	1.774**	1.926**	1.385*	0.901
	(0.791)	(0.780)	(0.827)	(0.793)	(0.811)	(0.840)	(0.833)	(0.796)	(0.808)	(0.882)
forest_90	0.958**	0.913**	0.951**	1.034**	0.938**	0.852**	0.843*	0.958**	0.602	0.259
	(0.408)	(0.402)	(0.411)	(0.412)	(0.411)	(0.423)	(0.453)	(0.410)	(0.427)	(0.497)
farmland_90	1.065**	1.022*	1.051*	1.124**	1.034*	0.910*	0.951*	1.064**	0.577	0.235
	(0.530)	(0.523)	(0.538)	(0.531)	(0.536)	(0.543)	(0.565)	(0.533)	(0.559)	(0.615)
Annual Precipitation	-0.378**	-0.374**	-0.373*	-0.402**	-0.365*	-0.334*	-0.349*	-0.380*	-0.316*	-0.210
	(0.191)	(0.188)	(0.194)	(0.192)	(0.194)	(0.196)	(0.198)	(0.194)	(0.189)	(0.204)
ElevationSD	-0.033	-0.041	-0.035	-0.030	-0.035	-0.055	-0.037	-0.033	-0.042	-0.046
	(0.076)	(0.075)	(0.078)	(0.076)	(0.077)	(0.078)	(0.077)	(0.077)	(0.075)	(0.075)
ln_medianrent_90	-72.496**	-74.682**	-73.049**	-71.352**	-71.341**	-75.662**	-71.451**	-73.080**	-90.569***	-83.488**
	(33.179)	(32.727)	(33.498)	(33.127)	(33.398)	(33.367)	(33.336)	(34.451)	(33.383)	(34.151)
ln_medianhhinc_90	-6.940	6.830	-6.966	1.336	-8.578	6.713	-8.106	-7.028	-16.074	-19.389
	(26.585)	(27.133)	(26.718)	(27.443)	(26.910)	(27.826)	(26.747)	(26.753)	(26.307)	(26.458)
grocery_90		27.753**				31.472*				
		(14.158)				(19.032)				
hs90			-1.834			-8.392				
			(10.628)			(11.276)				
eatdrink_90				15.768		1.222				
				(13.356)		(18.083)				
doctor_90					-5.693	-8.640				
					(11.927)	(11.926)				
GrocDist90							-0.939			-2.116
							(1.588)			(1.663)
DoctDist90								-0.050		0.741
								(0.740)		(0.790)
HospDist90									-1.269**	-1.545***
									(0.547)	(0.587)
_cons	496.335*	360.080	501.758*	395.380	506.255*	373.866	513.215*	501.460*	732.844**	746.243**
	(285.272)	(289.685)	(288.412)	(297.265)	(287.156)	(297.360)	(287.643)	(296.624)	(297.144)	(302.972)
Number of observations	113	113	113	113	113	113	113	113	113	113
R2	0.160	0.192	0.160	0.172	0.162	0.201	0.163	0.160	0.204	0.220
Adjusted R2	0.040	0.067	0.030	0.044	0.032	0.049	0.034	0.030	0.081	0.080
note: *** p<0.01, ** p<0.05, * p<0.1										

Table 8: Young Adult Migration, Small Oregon Communities, 2000-2010

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**-40.46**	**-40.46**	**-40.46**	**-40.46**	**-40.46**	**-40.46**	**-40.46**	**-40.46**	**-40.46**	**-40.46**
Pop2000	0.011	-0.000	0.015	0.001	0.012	0.005	0.010	0.015	0.009	0.012
	(0.013)	(0.013)	(0.014)	(0.013)	(0.014)	(0.015)	(0.013)	(0.014)	(0.014)	(0.015)
Dist150k00	-0.162	-0.116	-0.170	-0.135	-0.162	-0.124	-0.169	-0.168	-0.160	-0.171
	(0.127)	(0.125)	(0.128)	(0.125)	(0.128)	(0.124)	(0.128)	(0.128)	(0.128)	(0.130)
Dist20k_00	0.322	0.265	0.296	0.251	0.322	0.141	0.252	0.313	0.303	0.252
	(0.242)	(0.236)	(0.245)	(0.238)	(0.243)	(0.240)	(0.254)	(0.243)	(0.251)	(0.260)
interstate_access	5.576	3.068	4.896	5.833	5.505	1.235	4.244	5.186	5.613	4.208
	(9.967)	(9.718)	(10.043)	(9.731)	(10.063)	(9.774)	(10.081)	(10.034)	(10.019)	(10.215)
unemploy2000	-0.791	-0.675	-0.761	-0.874	-0.793	-0.636	-0.856	-0.889	-0.786	-0.898
	(0.821)	(0.798)	(0.825)	(0.802)	(0.826)	(0.796)	(0.825)	(0.844)	(0.825)	(0.851)
agforestshare_2000	-1.302*	-1.606**	-1.145	-1.597**	-1.299*	-1.304*	-1.183	-1.361*	-1.238	-1.214
	(0.760)	(0.747)	(0.795)	(0.753)	(0.765)	(0.762)	(0.772)	(0.771)	(0.791)	(0.813)
sw_employ2000	-0.000	0.000	-0.000	0.000	-0.000	-0.001	-0.000	-0.000	-0.000	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
openwater_2000	0.934	0.697	0.827	1.036*	0.921	0.447	0.790	0.956	0.870	0.806
	(0.614)	(0.603)	(0.634)	(0.601)	(0.637)	(0.650)	(0.634)	(0.618)	(0.648)	(0.666)
forest_2000	0.755**	0.591	0.722*	0.781**	0.750**	0.513	0.613	0.790**	0.699*	0.637
	(0.372)	(0.367)	(0.376)	(0.364)	(0.379)	(0.378)	(0.404)	(0.379)	(0.413)	(0.444)
farmland_2000	0.877**	0.679*	0.835**	0.910**	0.870**	0.578	0.699	0.908**	0.802*	0.721
	(0.389)	(0.385)	(0.395)	(0.380)	(0.399)	(0.404)	(0.435)	(0.395)	(0.456)	(0.491)
Annual Precipitation	-0.146	-0.115	-0.142	-0.188	-0.144	-0.130	-0.128	-0.155	-0.133	-0.132
	(0.152)	(0.148)	(0.153)	(0.150)	(0.155)	(0.152)	(0.154)	(0.154)	(0.158)	(0.161)
ElevationSD	-0.015	-0.020	-0.019	-0.008	-0.015	-0.030	-0.018	-0.017	-0.014	-0.019
	(0.063)	(0.061)	(0.063)	(0.061)	(0.063)	(0.061)	(0.063)	(0.063)	(0.063)	(0.064)
ln_medianrent_2000	-19.330	-8.685	-17.698	-9.602	-19.273	2.068	-22.427	-17.353	-21.092	-21.390
	(26.555)	(26.093)	(26.734)	(26.263)	(26.716)	(26.265)	(26.793)	(26.913)	(27.259)	(27.911)
ln_medianhhinc_2000	-23.743	-18.203	-26.305	-19.601	-23.841	-23.518	-23.019	-25.202	-25.040	-24.134
	(24.304)	(23.674)	(24.646)	(23.793)	(24.472)	(23.605)	(24.339)	(24.551)	(24.766)	(25.271)
Grocery_2000		25.396**				24.871*				
		(9.938)				(13.362)				
hs2000			-6.097			-18.560**				
			(8.692)			(9.188)				
EatDrink_2000				23.436**		14.511				
				(10.141)		(13.182)				
Doctor_2000					-0.760	0.260				
					(9.420)	(9.081)				
grocdist2000							-0.695			-0.612
							(0.758)			(0.850)
doctdist2000								0.326		0.170
								(0.604)		(0.644)
hospdist2000									-0.162	-0.034
									(0.509)	(0.539)
_cons	305.821	176.012	329.040	191.271	306.696	178.153	332.263	306.197	336.468	335.626
	(228.866)	(227.733)	(231.905)	(228.854)	(230.425)	(226.590)	(230.881)	(229.795)	(249.341)	(251.101)
Number of observations	103	103	103	103	103	103	103	103	103	103
R2	0.146	0.206	0.151	0.195	0.146	0.250	0.154	0.149	0.147	0.155
Adjusted R2	0.010	0.069	0.004	0.057	-0.001	0.089	0.008	0.002	0.000	-0.014
note: *** p<0.01, ** p<0.05, * p<0.1										

than a community that has such a store. The incorporation of other service variables increases the magnitude of the effect, but, likely due to multicollinearity, reduces its significance. An additional ten miles of distance to a place with a hospital, meanwhile, lowers young adult migration rates by more than 12 percentage points, and grows in both magnitude and significance when other distance variables are included. While the significance of the other variables is robust to the inclusion of presence of service variables, the preferences for land cover amenities shown by young adults largely disappear when distances to hospitals are controlled for.

In the 2000s, (Table 8, above) the influence of water, rent, and distance lose significance, and the effects of forest and farm land cover diminish but remain significant. In contrast to the 1990s, when the share of the population employed in agriculture, forestry, and mining had a no significant effect on young adult migration, the 2000s do show a slight negative effect. This finding, however, is not robust to the inclusion of distances to services.

The 2000s young adult results reinforce the importance of grocery stores in retaining young people. The magnitude of this effect—just over 25 percentage-points of net migration—is similar to that shown in the 1990s, and virtually unchanged by the inclusion of other variables denoting the presence of services. The inclusion of other service variables yields a large and negative coefficient for the presence of a high school. Since most young adults do not have school age children, high schools are not a service that they would be likely to require, but it is difficult to see why high schools promote outmigration unless children from such communities were more likely to go on to college. While this finding serves as a cautionary note about the multicollinearity introduced by incorporating several services in one regression, it would seem to rule out high schools having a positive role in retaining young people by promoting attachment to the community. The other service variables, and particularly the distances to services, also tend to compromise the significance of the land cover and agriculture, forestry, and mining employment variables that best explain migration in the base model.

Working-Age Adults

Working-age adults, meanwhile, show much more clear cut responses to job opportunities in the 1990s (Table 9) than do young adults. A one-point increase in a community's unemployment rate decreases net migration in this age cohort by just less than 1.7 percentage points. Working-age adults, however, are also sensitive to long distances to cities of 150,000 people, and to the starting population of a community. Increasing the distance to a city of 150,000 people by ten miles lowers migration rates in the 1990s by nearly 2.8 percentage points, suggesting that an additional ten miles of distance would more than cancel out a 1.5 point improvement in a place's unemployment rate. Working-age adults are unique among groups in that the size of a community has a significant and negative relationship with net migration. This finding, combined with the negative effect of distance to centers of 150,000, suggests that in 1990s, middle aged adults valued both small places, but also the access to urban amenities or job opportunities provided by proximity to large urban centers like Portland.

The 1990s service regressions, quite strangely, show lower net migration rates in communities that have eating and drinking establishments, and in those that are located close to a grocery store. It is possible that these results reflect a general preference for smaller communities.

Table 9: Working-Age Adult Migration, Small Oregon Communities, 1990-2000

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**27.46**	**27.46**	**27.46**	**27.46**	**27.46**	**27.46**	**27.46**	**27.46**	**27.46**	**27.46**
pop_90	-0.034**	-0.028*	-0.031**	-0.023	-0.027*	-0.018	-0.030**	-0.033**	-0.037***	-0.034**
	(0.014)	(0.015)	(0.014)	(0.015)	(0.016)	(0.016)	(0.014)	(0.015)	(0.014)	(0.015)
dist_150k_90	-0.279**	-0.290***	-0.281***	-0.289***	-0.269**	-0.281***	-0.307***	-0.274**	-0.280***	-0.312***
	(0.109)	(0.108)	(0.109)	(0.107)	(0.109)	(0.109)	(0.106)	(0.111)	(0.108)	(0.110)
Dist_20k	-0.184	-0.126	-0.205	-0.134	-0.169	-0.129	-0.052	-0.192	-0.176	-0.043
	(0.260)	(0.262)	(0.261)	(0.257)	(0.261)	(0.265)	(0.256)	(0.264)	(0.259)	(0.264)
interstate_access	16.702	14.290	15.885	15.963	16.046	15.065	16.208	16.781	15.493	15.365
	(10.669)	(10.742)	(10.713)	(10.518)	(10.699)	(10.845)	(10.332)	(10.728)	(10.648)	(10.416)
unemploy90	-1.681**	-1.674**	-1.704**	-1.713**	-1.718**	-1.744**	-1.514*	-1.691**	-1.651*	-1.490*
	(0.853)	(0.848)	(0.854)	(0.841)	(0.854)	(0.852)	(0.828)	(0.858)	(0.849)	(0.835)
agforestshare_90	-0.093	0.058	0.079	0.172	-0.082	0.209	0.285	-0.098	0.148	0.432
	(0.776)	(0.779)	(0.798)	(0.776)	(0.776)	(0.799)	(0.764)	(0.780)	(0.790)	(0.781)
sw_employ90	-0.005	-0.005	-0.005	-0.005	-0.005	-0.006	-0.003	-0.005	-0.004	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
openwater_90	0.889	0.896	0.710	0.764	0.756	0.627	1.468**	0.883	0.602	1.269*
	(0.678)	(0.674)	(0.705)	(0.671)	(0.693)	(0.721)	(0.689)	(0.682)	(0.704)	(0.751)
forest_90	0.222	0.250	0.192	0.112	0.188	0.094	0.666*	0.220	0.032	0.530
	(0.349)	(0.347)	(0.350)	(0.348)	(0.351)	(0.362)	(0.374)	(0.350)	(0.372)	(0.423)
farmland_90	-0.246	-0.218	-0.309	-0.331	-0.297	-0.375	0.190	-0.242	-0.507	0.003
	(0.454)	(0.452)	(0.459)	(0.449)	(0.457)	(0.466)	(0.467)	(0.456)	(0.487)	(0.524)
Annual Precipitation	-0.276*	-0.278*	-0.255	-0.242	-0.253	-0.223	-0.390**	-0.271	-0.243	-0.370**
	(0.163)	(0.162)	(0.165)	(0.162)	(0.165)	(0.168)	(0.163)	(0.166)	(0.164)	(0.173)
ElevationSD	-0.029	-0.024	-0.040	-0.034	-0.032	-0.038	-0.014	-0.028	-0.034	-0.019
	(0.065)	(0.065)	(0.066)	(0.064)	(0.065)	(0.066)	(0.063)	(0.066)	(0.065)	(0.064)
ln_medianrent_90	57.704**	59.140**	54.869**	56.093**	59.883**	57.415**	52.791*	59.263**	47.756*	44.864
	(27.764)	(27.632)	(27.952)	(27.367)	(27.879)	(28.042)	(26.940)	(28.877)	(28.492)	(28.546)
ln_medianhhinc_90	-85.563***	-94.310***	-85.765***	-97.395***	-88.234***	-98.945***	-81.316***	-85.328***	-90.523***	-84.905***
	(22.719)	(23.396)	(22.736)	(23.155)	(22.912)	(23.807)	(22.050)	(22.857)	(22.869)	(22.479)
grocery_90		-17.655				-1.832				
		(12.240)				(16.336)				
hs90			-8.389			-2.273				
			(9.055)			(9.662)				
eatdrink_90				-22.556**		-19.629				
				(11.298)		(15.521)				
doctor_90					-9.524	-7.571				
					(10.177)	(10.228)				
GrocDist90							3.616***			3.486**
							(1.311)			(1.415)
DoctDist90								0.133		-0.148
								(0.634)		(0.673)
HospDist90									-0.678	-0.434
									(0.477)	(0.500)
_cons	655.067***	741.316***	682.777***	799.232***	669.322***	808.311***	598.478***	641.363***	784.211***	698.441***
	(237.448)	(243.614)	(239.493)	(244.838)	(238.085)	(248.472)	(230.811)	(247.433)	(253.051)	(252.174)
Number of observations	114	114	114	114	114	114	114	114	114	114
R2	0.281	0.296	0.287	0.309	0.287	0.313	0.332	0.281	0.295	0.340
Adjusted R2	0.179	0.188	0.178	0.203	0.178	0.183	0.230	0.171	0.187	0.223
note: *** p<0.01, ** p<0.05, * p<0.1										

In the 2000s middle age adult regressions (Table 10), the effects of employment, and community size that were found in the 1990s largely dissipate in favor of natural amenities. The effect of distance to a city of 150,000 maintains its significance but is diminished in magnitude. In the 2000-2010 period, an extra percentage point of open

Table 10: Working-Age Adult Migration, Small Oregon Communities, 2000-2010

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**11.66**	**11.66**	**11.66**	**11.66**	**11.66**	**11.66**	**11.66**	**11.66**	**11.66**	**11.66**
Pop2000	0.007	0.004	0.008	0.002	0.006	0.003	0.007	0.005	0.006	0.003
	(0.009)	(0.009)	(0.010)	(0.009)	(0.010)	(0.011)	(0.009)	(0.010)	(0.009)	(0.010)
Dist150k00	-0.178**	-0.165*	-0.179**	-0.164*	-0.179**	-0.168*	-0.187**	-0.175**	-0.177**	-0.182**
	(0.088)	(0.089)	(0.089)	(0.087)	(0.089)	(0.089)	(0.088)	(0.089)	(0.089)	(0.088)
Dist20k_00	-0.124	-0.141	-0.129	-0.162	-0.124	-0.193	-0.208	-0.120	-0.136	-0.206
	(0.167)	(0.168)	(0.170)	(0.167)	(0.168)	(0.173)	(0.174)	(0.168)	(0.173)	(0.177)
interstate_access	-2.593	-3.337	-2.705	-2.458	-2.411	-3.033	-4.171	-2.399	-2.571	-4.103
	(6.893)	(6.923)	(6.964)	(6.815)	(6.955)	(7.059)	(6.906)	(6.944)	(6.930)	(6.961)
unemploy2000	-0.830	-0.796	-0.825	-0.873	-0.826	-0.840	-0.906	-0.781	-0.827	-0.803
	(0.568)	(0.568)	(0.572)	(0.562)	(0.571)	(0.575)	(0.565)	(0.584)	(0.571)	(0.580)
agforestshare_2000	-0.674	-0.763	-0.648	-0.829	-0.681	-0.726	-0.532	-0.645	-0.635	-0.460
	(0.526)	(0.532)	(0.551)	(0.527)	(0.529)	(0.551)	(0.529)	(0.533)	(0.547)	(0.554)
sw_employ2000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
openwater_2000	0.979**	0.909**	0.962**	1.033**	1.012**	0.959**	0.810*	0.968**	0.941**	0.776*
	(0.425)	(0.429)	(0.440)	(0.421)	(0.440)	(0.469)	(0.434)	(0.428)	(0.448)	(0.454)
forest_2000	0.331	0.282	0.325	0.344	0.343	0.318	0.162	0.313	0.297	0.108
	(0.257)	(0.261)	(0.261)	(0.255)	(0.262)	(0.273)	(0.276)	(0.263)	(0.286)	(0.303)
farmland_2000	0.268	0.210	0.262	0.286	0.285	0.253	0.057	0.253	0.224	0.008
	(0.269)	(0.274)	(0.274)	(0.266)	(0.276)	(0.292)	(0.298)	(0.273)	(0.315)	(0.335)
Annual Precipitation	-0.223**	-0.214**	-0.222**	-0.245**	-0.227**	-0.246**	-0.202*	-0.219**	-0.215**	-0.194*
	(0.105)	(0.106)	(0.106)	(0.105)	(0.107)	(0.110)	(0.105)	(0.106)	(0.110)	(0.110)
ElevationSD	-0.059	-0.061	-0.060	-0.056	-0.059	-0.060	-0.064	-0.058	-0.059	-0.063
	(0.044)	(0.043)	(0.044)	(0.043)	(0.044)	(0.044)	(0.043)	(0.044)	(0.044)	(0.044)
ln_medianrent_2000	18.671	21.826	18.939	23.796	18.523	26.181	15.003	17.683	17.610	12.583
	(18.365)	(18.589)	(18.537)	(18.395)	(18.467)	(18.969)	(18.355)	(18.627)	(18.854)	(19.021)
ln_medianhhinc_2000	-38.029**	-36.386**	-38.450**	-35.847**	-37.778**	-37.395**	-37.171**	-37.300**	-38.810**	-34.247**
	(16.807)	(16.866)	(17.090)	(16.665)	(16.916)	(17.048)	(16.673)	(16.992)	(17.129)	(17.222)
Grocery_2000		7.527				1.483				
		(7.080)				(9.650)				
hs2000			-1.003			-5.447				
			(6.027)			(6.636)				
EatDrink_2000				12.347*		13.408				
				(7.103)		(9.520)				
Doctor_2000					1.956	1.785				
					(6.512)	(6.559)				
grocdist2000							-0.823			-1.039*
							(0.519)			(0.579)
doctdist2000								-0.163		-0.422
								(0.418)		(0.439)
hospdist2000									-0.098	0.101
									(0.352)	(0.367)
_cons	337.758**	299.285*	341.577**	277.409*	335.503**	283.330*	369.079**	337.569**	356.211**	357.651**
	(158.274)	(162.244)	(160.802)	(160.291)	(159.275)	(163.646)	(158.168)	(159.043)	(172.458)	(171.120)
Number of observations	103	103	103	103	103	103	103	103	103	103
R2	0.266	0.276	0.266	0.291	0.267	0.297	0.287	0.268	0.267	0.295
Adjusted R2	0.150	0.151	0.140	0.169	0.141	0.146	0.164	0.141	0.141	0.154
note: *** p<0.01, ** p<0.05, * p<0.1										

water in the surrounding area adds nearly an entire percentage point to working-age adult migration rates, suggesting that, if all else where equal there would be very large differences between migration rates on the Oregon Coast and those for the rest of the state. The high precipitation experienced by much of the Coast, however, counteracts this, with an extra ten centimeters of annual precipitation decreasing growth rates by 2.2 percentage points.

Introducing the service variables shows the robustness of these findings. It also reveals a reversal of the unexpected negative effect of eating and drinking establishments in the 1990s, with the presence of such places associated with a marginally-significant 12 percentage-point increase in working-age adult net migration during the 2000-2010 period.

Younger Seniors

Retirees are expected to differ from young and working-age adults in that their departure from labor markets allows them to act on preferences for natural amenities and more rural locations. The base regression for 60-to-74 year-old 1990s migration (Table 11, Column 1) supports this hypothesis, as younger seniors are found to favor areas with large amounts of open water, and to show some preference for places with greater topographical variation.

Incorporating the service variables shows that younger seniors are also influenced by local services, such as grocery stores and eating and drinking establishments. Though these two services do not show significant effects when they are in the same regression, the importance of grocery stories is underlined by the negative effect of distance to grocery stores on younger senior migration. These distances, in fact, erase the significance of open water, suggesting that a main attraction of younger seniors to small coastal and open water communities is superior access to such services. This does not, however, mean that open water is unimportant to these communities, as they may owe their base-period access to services to the help that amenity-seeking visitors provide in supporting such establishments.

Younger senior migration preferences in the 2000-2010 period differ considerably from the previous decade. Other things equal, the age cohort had higher net migration rates in places that were close to communities of 20,000 people, with an extra ten miles of distance to such a place lowering younger senior net migration by three percentage points. This finding, combined with the negative association of net migration with interstate access, suggests that, while commuting access to major cities was not a concern for younger seniors, they did seek proximity to some level of urban amenities.

The importance of natural amenities continues between 2000 and 2010, although the amenities driving the migration are different. Large amounts of surrounding farmland are found to lower net migration rates for younger seniors, but the effect of elevation variation reverses itself and becomes negative.

Unlike the 1990-2000 period, the first decade of twenty-first century shows a continuing of the working-age adults' tendency for higher net migration rates in lower-income communities. The 2000-2010 regressions also differ from the 1990s results in that they not do show any significant influence of services on younger senior migration.

Table 11: Younger Senior Migration, Small Oregon Communities, 1990-2000

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**21.66**	**21.66**	**21.66**	**21.66**	**21.66**	**21.66**	**21.66**	**21.66**	**21.66**	**21.66**
pop_90	-0.003	-0.009	-0.002	-0.011	-0.002	-0.007	-0.006	-0.004	-0.002	-0.004
	(0.011)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.011)	(0.012)	(0.011)	(0.012)
dist_150k_90	0.030	0.041	0.029	0.037	0.032	0.046	0.050	0.026	0.030	0.060
	(0.087)	(0.086)	(0.087)	(0.086)	(0.088)	(0.087)	(0.085)	(0.089)	(0.087)	(0.089)
Dist_20k	-0.053	-0.112	-0.061	-0.087	-0.050	-0.142	-0.145	-0.046	-0.055	-0.165
	(0.208)	(0.208)	(0.209)	(0.207)	(0.209)	(0.211)	(0.207)	(0.211)	(0.209)	(0.213)
interstate_access	6.486	8.950	6.169	7.002	6.360	7.617	6.832	6.422	6.789	6.917
	(8.527)	(8.527)	(8.591)	(8.447)	(8.587)	(8.623)	(8.331)	(8.574)	(8.589)	(8.436)
unemploy90	0.792	0.785	0.783	0.814	0.785	0.764	0.675	0.800	0.784	0.652
	(0.682)	(0.673)	(0.685)	(0.675)	(0.686)	(0.678)	(0.668)	(0.686)	(0.685)	(0.676)
agforestshare_90	-0.278	-0.433	-0.211	-0.463	-0.276	-0.341	-0.543	-0.274	-0.338	-0.553
	(0.620)	(0.618)	(0.640)	(0.623)	(0.623)	(0.635)	(0.616)	(0.623)	(0.637)	(0.632)
sw_employ90	0.002	0.002	0.002	0.003	0.002	0.002	0.001	0.002	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
openwater_90	1.113**	1.105**	1.043*	1.200**	1.087*	0.922	0.708	1.117**	1.185**	0.655
	(0.542)	(0.535)	(0.565)	(0.539)	(0.556)	(0.573)	(0.556)	(0.545)	(0.568)	(0.609)
forest_90	-0.040	-0.070	-0.052	0.036	-0.047	-0.053	-0.352	-0.039	0.007	-0.385
	(0.279)	(0.276)	(0.281)	(0.279)	(0.282)	(0.288)	(0.302)	(0.280)	(0.300)	(0.343)
farmland_90	0.055	0.027	0.031	0.115	0.046	-0.012	-0.249	0.053	0.121	-0.278
	(0.363)	(0.359)	(0.368)	(0.361)	(0.367)	(0.371)	(0.377)	(0.365)	(0.393)	(0.424)
Annual Precipitation	-0.126	-0.124	-0.118	-0.150	-0.122	-0.110	-0.047	-0.130	-0.134	-0.031
	(0.130)	(0.129)	(0.132)	(0.130)	(0.133)	(0.133)	(0.132)	(0.132)	(0.132)	(0.140)
ElevationSD	0.102**	0.097*	0.098*	0.105**	0.101*	0.087*	0.091*	0.101*	0.103**	0.093*
	(0.052)	(0.051)	(0.053)	(0.052)	(0.052)	(0.053)	(0.051)	(0.052)	(0.052)	(0.052)
ln_medianrent_90	-1.057	-2.523	-2.157	0.067	-0.637	-3.614	2.382	-2.330	1.435	4.754
	(22.189)	(21.935)	(22.414)	(21.978)	(22.375)	(22.296)	(21.725)	(23.079)	(22.982)	(23.121)
ln_medianhhinc_90	-19.861	-10.925	-19.940	-11.610	-20.376	-8.081	-22.834	-20.053	-18.619	-22.908
	(18.157)	(18.572)	(18.232)	(18.595)	(18.388)	(18.929)	(17.782)	(18.267)	(18.447)	(18.206)
grocery_90		18.036*				13.973				
		(9.716)				(12.989)				
hs90			-3.257			-9.248				
			(7.261)			(7.682)				
eatdrink_90				15.730*		11.713				
				(9.073)		(12.341)				
doctor_90					-1.834	-3.791				
					(8.167)	(8.132)				
GrocDist90							-2.531**			-2.686**
							(1.057)			(1.146)
DoctDist90								-0.108		0.237
								(0.507)		(0.545)
HospDist90									0.170	-0.043
									(0.384)	(0.405)
_cons	195.699	107.590	206.456	95.164	198.444	88.797	235.302	206.896	163.353	221.349
	(189.770)	(193.384)	(192.044)	(196.624)	(191.079)	(197.559)	(186.129)	(197.749)	(204.117)	(204.244)
Number of observations	114	114	114	114	114	114	114	114	114	114
R2	0.144	0.173	0.145	0.169	0.144	0.191	0.191	0.144	0.145	0.193
Adjusted R2	0.023	0.046	0.015	0.042	0.013	0.038	0.067	0.013	0.015	0.050
note: *** p<0.01, ** p<0.05, * p<0.1										

Table 12: Younger Senior Migration, Small Oregon Communities, 2000-2010

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**20.87**	**20.87**	**20.87**	**20.87**	**20.87**	**20.87**	**20.87**	**20.87**	**20.87**	**20.87**
Pop2000	0.004	0.000	0.006	0.002	0.005	0.003	0.004	0.007	0.004	0.005
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)	(0.009)	(0.008)	(0.009)
Dist150k00	-0.098	-0.082	-0.102	-0.091	-0.098	-0.085	-0.105	-0.102	-0.098	-0.108
	(0.076)	(0.076)	(0.077)	(0.076)	(0.076)	(0.077)	(0.076)	(0.077)	(0.077)	(0.077)
Dist20k_00	-0.301**	-0.321**	-0.313**	-0.319**	-0.301**	-0.360**	-0.368**	-0.307**	-0.303**	-0.358**
	(0.144)	(0.144)	(0.147)	(0.145)	(0.145)	(0.149)	(0.150)	(0.145)	(0.150)	(0.154)
interstate_access	-12.746**	-13.626**	-13.057**	-12.680**	-12.872**	-14.692**	-14.013**	-13.012**	-12.741**	-14.169**
	(5.945)	(5.937)	(5.997)	(5.948)	(6.000)	(6.088)	(5.968)	(5.981)	(5.979)	(6.043)
unemploy2000	-0.253	-0.213	-0.239	-0.274	-0.256	-0.173	-0.315	-0.320	-0.253	-0.337
	(0.490)	(0.487)	(0.492)	(0.490)	(0.492)	(0.496)	(0.488)	(0.503)	(0.493)	(0.504)
agforestshare_2000	-0.343	-0.449	-0.271	-0.417	-0.337	-0.314	-0.229	-0.382	-0.335	-0.281
	(0.453)	(0.456)	(0.474)	(0.460)	(0.456)	(0.475)	(0.457)	(0.459)	(0.472)	(0.481)
sw_employ2000	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
openwater_2000	0.353	0.270	0.304	0.379	0.330	0.120	0.216	0.368	0.345	0.261
	(0.366)	(0.368)	(0.379)	(0.367)	(0.380)	(0.405)	(0.375)	(0.368)	(0.387)	(0.394)
forest_2000	0.000	-0.057	-0.015	0.007	-0.008	-0.113	-0.135	0.024	-0.007	-0.095
	(0.222)	(0.224)	(0.225)	(0.222)	(0.226)	(0.236)	(0.239)	(0.226)	(0.246)	(0.263)
farmland_2000	-0.442*	-0.511**	-0.461*	-0.434*	-0.454*	-0.582**	-0.612**	-0.420*	-0.451*	-0.559*
	(0.232)	(0.235)	(0.236)	(0.232)	(0.238)	(0.252)	(0.258)	(0.235)	(0.272)	(0.290)
Annual Precipitation	-0.142	-0.131	-0.140	-0.152*	-0.138	-0.124	-0.125	-0.147	-0.140	-0.135
	(0.091)	(0.091)	(0.091)	(0.092)	(0.092)	(0.094)	(0.091)	(0.092)	(0.095)	(0.095)
ElevationSD	-0.073*	-0.075**	-0.075**	-0.071*	-0.074*	-0.081**	-0.076**	-0.074**	-0.073*	-0.078**
	(0.038)	(0.037)	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)	(0.038)	(0.038)	(0.038)
ln_medianrent_2000	16.765	20.501	17.512	19.225	16.867	23.965	13.819	18.115	16.548	15.303
	(15.839)	(15.940)	(15.964)	(16.054)	(15.930)	(16.360)	(15.861)	(16.044)	(16.268)	(16.513)
ln_medianhhinc_2000	-27.328*	-25.383*	-28.501*	-26.280*	-27.501*	-27.615*	-26.639*	-28.324*	-27.487*	-25.849*
	(14.496)	(14.462)	(14.717)	(14.544)	(14.592)	(14.703)	(14.408)	(14.636)	(14.780)	(14.951)
Grocery_2000		8.914				11.365				
		(6.071)				(8.323)				
hs2000			-2.793			-6.897				
			(5.190)			(5.723)				
EatDrink_2000				5.927		1.286				
				(6.199)		(8.211)				
Doctor_2000					-1.349	-0.747				
					(5.617)	(5.657)				
grocdist2000							-0.661			-0.696
							(0.449)			(0.503)
doctdist2000								0.223		0.051
								(0.360)		(0.381)
hospdist2000									-0.020	0.123
									(0.304)	(0.319)
_cons	274.594**	229.032*	285.230**	245.623*	276.148**	237.350*	299.747**	274.851**	278.359*	277.975*
	(136.507)	(139.124)	(138.480)	(139.894)	(137.396)	(141.141)	(136.678)	(136.989)	(148.802)	(148.558)
Number of observations	103	103	103	103	103	103	103	103	103	103
R2	0.212	0.231	0.215	0.221	0.213	0.245	0.232	0.216	0.212	0.233
Adjusted R2	0.087	0.099	0.080	0.086	0.077	0.084	0.099	0.081	0.077	0.080
note: *** p<0.01, ** p<0.05, * p<0.1										

The service variables do, however show the robustness of the results concerning interstate access and distance to communities of 20,000 people.

Older Seniors

In contrast to younger seniors, older seniors are expected to show preferences for larger places with better access to health services. The 1990s base migration model, however, yields no statistically significant results. Incorporating the service variables does show evidence that older seniors migrate away from places that are distant from hospitals, with an extra ten miles to the nearest community with a hospital associated with a seven percentage-point drop in the cohort's net migration rate. The service regressions also show lower net migration rates for places that *have* eating and drinking establishments. The latter finding is quite puzzling, and suggests that, in this case, eating and drinking establishments are associated with some other, uncontrolled for, factor. The 2000-2010 regressions, meanwhile, contain several results consistent with health-related migration. Older seniors in the 2000-2010 period show a statistically significant preference for places with larger populations, suggesting outmigration from the smallest rural communities. The oldest age cohort also shows a strong aversion to mountainous terrain, which may make living and transportation more difficult. The age cohort, however, is found to strongly prefer places with less rainfall, a preference that was both more significant and larger than that shown by younger seniors.

The significance of unemployment rates in determining older senior migration is quite puzzling, since such individuals should be largely freed from labor market constraints. One possible explanation is that older senior move toward communities with assisted living and senior health care infrastructure, and that this infrastructure is associated with

Table 13: Older Senior Migration, Small Oregon Communities, 1990-2000

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**2.23**	**2.23**	**2.23**	**2.23**	**2.23**	**2.23**	**2.23**	**2.23**	**2.23**	**2.23**
pop_90	0.006	0.010	0.008	0.014	0.007	0.014	0.007	0.003	0.003	0.001
	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.009)	(0.010)	(0.009)	(0.010)
dist_150k_90	-0.048	-0.056	-0.049	-0.055	-0.047	-0.056	-0.055	-0.063	-0.049	-0.066
	(0.072)	(0.072)	(0.072)	(0.071)	(0.073)	(0.072)	(0.072)	(0.073)	(0.070)	(0.074)
Dist_20k	-0.140	-0.099	-0.156	-0.105	-0.138	-0.108	-0.107	-0.114	-0.132	-0.086
	(0.172)	(0.173)	(0.173)	(0.170)	(0.173)	(0.176)	(0.175)	(0.174)	(0.169)	(0.177)
interstate_access	-2.556	-4.291	-3.166	-3.075	-2.639	-3.523	-2.681	-2.798	-3.815	-3.908
	(7.064)	(7.099)	(7.085)	(6.947)	(7.114)	(7.180)	(7.063)	(7.070)	(6.942)	(6.983)
unemploy90	-0.527	-0.521	-0.543	-0.549	-0.531	-0.549	-0.484	-0.496	-0.495	-0.441
	(0.565)	(0.561)	(0.565)	(0.555)	(0.568)	(0.564)	(0.566)	(0.566)	(0.553)	(0.560)
agforestshare_90	-0.042	0.067	0.086	0.144	-0.041	0.179	0.053	-0.026	0.209	0.265
	(0.514)	(0.515)	(0.528)	(0.512)	(0.516)	(0.529)	(0.522)	(0.514)	(0.515)	(0.524)
sw_employ90	-0.001	-0.001	-0.002	-0.002	-0.001	-0.002	-0.001	-0.001	-0.001	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
openwater_90	0.061	0.067	-0.072	-0.026	0.045	-0.051	0.208	0.078	-0.237	-0.052
	(0.449)	(0.445)	(0.466)	(0.443)	(0.461)	(0.477)	(0.471)	(0.449)	(0.459)	(0.504)
forest_90	-0.101	-0.080	-0.123	-0.178	-0.105	-0.168	0.012	-0.097	-0.298	-0.168
	(0.231)	(0.230)	(0.232)	(0.230)	(0.233)	(0.240)	(0.256)	(0.231)	(0.242)	(0.284)
farmland_90	-0.279	-0.259	-0.326	-0.338	-0.285	-0.339	-0.168	-0.290	-0.551*	-0.421
	(0.300)	(0.299)	(0.304)	(0.297)	(0.304)	(0.309)	(0.319)	(0.301)	(0.318)	(0.351)
Annual Precipitation	-0.110	-0.112	-0.094	-0.086	-0.107	-0.086	-0.139	-0.125	-0.076	-0.117
	(0.108)	(0.107)	(0.109)	(0.107)	(0.110)	(0.111)	(0.112)	(0.109)	(0.107)	(0.116)
ElevationSD	0.016	0.020	0.008	0.013	0.015	0.011	0.020	0.012	0.011	0.012
	(0.043)	(0.043)	(0.044)	(0.042)	(0.043)	(0.044)	(0.043)	(0.043)	(0.042)	(0.043)
ln_medianrent_90	-18.468	-17.436	-20.583	-19.598	-18.194	-19.975	-19.713	-23.285	-28.827	-31.865*
	(18.382)	(18.259)	(18.485)	(18.074)	(18.537)	(18.566)	(18.418)	(19.030)	(18.574)	(19.138)
ln_medianhhinc_90	13.243	6.952	13.092	4.946	12.906	4.988	14.319	12.517	8.077	9.268
	(15.042)	(15.460)	(15.035)	(15.293)	(15.235)	(15.762)	(15.075)	(15.063)	(14.909)	(15.070)
grocery_90		-12.698				-2.560				
		(8.088)				(10.816)				
hs90			-6.259			-2.044				
			(5.988)			(6.397)				
eatdrink_90				-15.817**		-13.382				
				(7.462)		(10.276)				
doctor_90					-1.200	0.296				
					(6.767)	(6.771)				
GrocDist90							0.916			0.793
							(0.896)			(0.949)
DoctDist90								-0.410		-0.303
								(0.418)		(0.451)
HospDist90									-0.706**	-0.598*
									(0.311)	(0.335)
_cons	10.528	72.560	31.200	111.621	12.324	114.875	-3.808	52.872	144.997	143.138
	(157.209)	(160.983)	(158.376)	(161.700)	(158.308)	(164.508)	(157.798)	(163.058)	(164.968)	(169.058)
Number of observations	114	114	114	114	114	114	114	114	114	114
R2	0.073	0.096	0.083	0.114	0.073	0.115	0.083	0.082	0.119	0.127
Adjusted R2	-0.058	-0.043	-0.057	-0.022	-0.069	-0.052	-0.058	-0.059	-0.015	-0.027
note: *** p<0.01, ** p<0.05, * p<0.1										

Table 14: Older Senior Migration, Small Oregon Communities, 2000-2010

	Base	Grocery	HS	Eat/Drink	Doctor	All Service	GrocDist	DoctDist	HospDist	All Dist.
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Average Net Migration Rate	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**
Pop2000	0.016**	0.014*	0.019**	0.016**	0.011	0.011	0.016**	0.010	0.017**	0.010
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)
Dist150k00	-0.117*	-0.109	-0.122*	-0.115*	-0.121*	-0.117*	-0.117*	-0.107	-0.118*	-0.110
	(0.069)	(0.070)	(0.070)	(0.070)	(0.069)	(0.070)	(0.070)	(0.069)	(0.070)	(0.070)
Dist20k_00	0.051	0.040	0.033	0.045	0.051	0.004	0.055	0.066	0.061	0.056
	(0.132)	(0.133)	(0.134)	(0.134)	(0.131)	(0.135)	(0.139)	(0.131)	(0.137)	(0.140)
interstate_access	-4.965	-5.408	-5.406	-4.947	-4.247	-5.904	-4.875	-4.286	-4.984	-4.736
	(5.438)	(5.477)	(5.473)	(5.467)	(5.419)	(5.523)	(5.526)	(5.389)	(5.467)	(5.494)
unemploy2000	-1.108**	-1.087**	-1.088**	-1.113**	-1.094**	-1.007**	-1.103**	-0.938**	-1.110**	-0.947**
	(0.448)	(0.450)	(0.449)	(0.451)	(0.445)	(0.450)	(0.452)	(0.453)	(0.450)	(0.458)
agforestshare_2000	-0.230	-0.283	-0.127	-0.251	-0.260	-0.154	-0.238	-0.128	-0.263	-0.120
	(0.415)	(0.421)	(0.433)	(0.423)	(0.412)	(0.431)	(0.423)	(0.414)	(0.431)	(0.437)
sw_employ2000	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
openwater_2000	0.164	0.123	0.095	0.172	0.292	0.085	0.174	0.125	0.196	0.114
	(0.335)	(0.340)	(0.345)	(0.338)	(0.343)	(0.367)	(0.347)	(0.332)	(0.354)	(0.358)
forest_2000	0.285	0.256	0.264	0.287	0.332	0.237	0.294	0.224	0.313	0.205
	(0.203)	(0.207)	(0.205)	(0.204)	(0.204)	(0.214)	(0.221)	(0.204)	(0.225)	(0.239)
farmland_2000	-0.056	-0.091	-0.083	-0.053	0.009	-0.107	-0.044	-0.111	-0.018	-0.129
	(0.212)	(0.217)	(0.215)	(0.214)	(0.215)	(0.229)	(0.239)	(0.212)	(0.249)	(0.264)
Annual Precipitation	-0.206**	-0.201**	-0.203**	-0.209**	-0.223***	-0.206**	-0.207**	-0.192**	-0.213**	-0.193**
	(0.083)	(0.084)	(0.083)	(0.084)	(0.083)	(0.086)	(0.084)	(0.083)	(0.086)	(0.087)
ElevationSD	-0.115***	-0.116***	-0.118***	-0.114***	-0.112***	-0.120***	-0.114***	-0.111***	-0.115***	-0.113***
	(0.034)	(0.034)	(0.035)	(0.035)	(0.034)	(0.035)	(0.035)	(0.034)	(0.035)	(0.034)
ln_medianrent_2000	22.522	24.402*	23.581	23.215	21.943	26.835*	22.731	19.081	23.418	18.837
	(14.488)	(14.707)	(14.569)	(14.755)	(14.388)	(14.842)	(14.687)	(14.456)	(14.873)	(15.012)
ln_medianhhinc_2000	-7.752	-6.773	-9.414	-7.457	-6.767	-8.160	-7.801	-5.213	-7.092	-3.730
	(13.260)	(13.343)	(13.431)	(13.367)	(13.180)	(13.339)	(13.342)	(13.188)	(13.513)	(13.592)
Grocery_2000		4.485				9.028				
		(5.601)				(7.551)				
hs2000			-3.956			-7.464				
			(4.737)			(5.192)				
EatDrink_2000				1.669		-1.971				
				(5.697)		(7.449)				
Doctor_2000					7.675	8.622*				
					(5.074)	(5.132)				
grocdist2000							0.047			-0.259
							(0.415)			(0.457)
doctdist2000								-0.567*		-0.628*
								(0.324)		(0.346)
hospdist2000									0.082	0.118
									(0.278)	(0.290)
_cons	-2.087	-25.013	12.978	-10.245	-10.932	-20.109	-3.875	-2.743	-17.673	-15.200
	(124.867)	(128.355)	(126.376)	(128.572)	(124.100)	(128.043)	(126.564)	(123.432)	(136.048)	(135.056)
Number of observations	103	103	103	103	103	103	103	103	103	103
R2	0.267	0.272	0.272	0.267	0.285	0.309	0.267	0.292	0.267	0.295
Adjusted R2	0.150	0.146	0.147	0.141	0.162	0.161	0.140	0.169	0.141	0.154
note: *** p<0.01, ** p<0.05, * p<0.1										

lower base period unemployment rates. Another is that they tend to move in with children or other family members who are employed.

The inclusion of services provides some evidence that access to doctor's offices was a driver of older senior migration in the 2000-2010 period. The distance to the nearest community with a doctor's office is significant at the .10 level when it is added to the base model on its own and with the other distance-to-service variables. The coefficients show that an extra ten miles to the nearest community with a doctor's office is associated with a roughly six percentage-point reduction in the older senior migration rate. As was found with the overall migration regression for 2000-2010, the incorporation of the services variables often takes away the significance of the starting population variable, suggesting that the tendency for places with low populations to decline is, at least in part, due to lack of access to services in such places.

Model Fit

One concern about the results presented here is the rather modest success of the models at predicting variation in migration rates, particularly for specific age cohorts. Measures of model fit, such as R^2 and adjusted-R^2, show that models for the 2000-2010 period were, with the exception of the working-age adult regressions, stronger for than those for the 1990s. The variables in the 2000-2010 model, for example, explained 30.5% of the variation in overall migration rates, compared with 22.2% of the variation in the prior decade. For the age-specific base models, R^2 values for the 2000-2010 period ranged from .14 for young adults to .27 for working-age adults and older seniors, while R^2 values for the 1990s regressions ranged from .07 for older seniors to .28 for working-age adults.

Adjusted-R^2 statistics, which are adjusted downward to account for adding variables that carry little explanatory power, are considerably lower, and, in some cases, close to zero. The large gaps between R^2 and adjusted-R^2 values suggests that discarding some independent variables and creating a parsimonious models might better fit the data. All variables are retained and reported here, however, because of their theoretical impact on migration decisions and their importance in other research.

The R^2 and adjusted-R^2 values reported here, however, are lower than those found in many other analyses of population dynamics in rural areas. Two recent analyses of 1990s population change in rural counties, for example, have yielded R^2 values between .49 and .56 (Partridge, et al., 2012; Partridge, et al., 2011). Similar research on smaller units of analysis, however, have yielded somewhat lower explanatory power. Ferguson, et al., (2007), reports adjusted-R^2 statistics between .49 and .27 for age-specific population change in rural Canadian census consolidated subdivisions, and Partridge, et al. (2007) analyze overall population change for the smallest Canadian subdivisions and report an R^2 value of .44.

One reason for the lower R^2 statistics found here is the error introduced by estimating migration rates for small areas. While census data are likely extremely accurate in depicting population change in rural communities, the use of county-level data to estimate local births and deaths inevitably introduces error. The small populations analyzed here serve to magnify these errors, as the death of a single young adult in a small community can dramatically effect that community's estimated young adult migration rate. This random error in net migration estimates has the effect of not only biasing regression coefficients toward zero, but also of reducing the overall fit of the models in comparison with studies that analyze larger units of analysis or focus on population change rather than estimated migration.

Discussion

This paper has used aggregated county-level birth and mortality data to calculate age-specific migration rates for Oregon's incorporated communities. Analysis of these estimates shows wide variation across time, community size, and age cohort. All sizes of communities experienced higher aggregate net migration and natural increase in the 1990s than in the first decade of the twenty-first century. This finding reflects lower overall population growth in Oregon between 2000 and 2010. Lower post-2000 growth rates in small communities are also consistent with the generally lower net migration rates for non-metropolitan counties documented by Johnson and Lichter (2012).

In both decades, the net migration and natural increase rates for small communities were lower than those for larger ones. The difference in migration was largely due to large-scale outmigration of people in their twenties, a phenomenon that was partially mitigated by net inmigration by working-age adults. The patterns in age-specific migration in Oregon, and particularly the outmigration of young adults, are quite similar to the pattern in national nonmetropolitan county-level migration documented by Johnson and Cromartie (2006) and Johnson and Fuguitt (2000).

Ordinary least squares regression was used to assess the effects of labor markets, distance to urban centers, natural amenities, community size, and access to services on overall and age-specific migration rates in small Oregon communities. The results show considerable differences in the effects of the variables across decades and age categories.

Natural amenities were a major driving force in overall migration in both the 1990-2000 and 2000-2010 periods, with migrants tending to favor places with low annual precipitation, and, in the 1990s, places with large amounts of nearby open water. The importance of natural amenities is broadly consistent with McGranahan's (1999) finding that natural amenities were better predictors of population growth for nonmetropolitan counties than urban proximity, population density, or economic type.

Much amenity-related migration research (e.g., Partridge, et al. 2012; McGranahan 1999) has used an index of natural amenity variables to predict differences in county-level migration across the United States. The incorporation of individual amenity variables here allows separation of various amenity affects. The findings regarding precipitation and open water are as expected, but the findings for forest land and farm land differ from McGranahan's (2008) county-level land cover findings. Forest land cover, for example, exerts a weaker, less consistent force in this paper, and farm land, while serving as a disamenity for younger seniors, is actually found to help retain young adults. Elevation variation is, surprisingly, often found to be a disamenity here. This may be because the high levels of topographical variation found throughout much of Oregon, render the benefits of greater variation less important than the associated difficulties of providing infrastructure in mountainous places.

The effects of distance to urban centers, found to limit net migration during the 1990s, all but disappeared during the subsequent decade. Though Partridge, et al., (2008) found that distance penalties at the county level increased somewhat between 1950 and 2000, this finding suggests that, in the 2000-2010 period, improvements in transportation or communication, changes in size-of-place preferences, or increased ability of migrants to act on such preferences, have lowered the growth penalties that small, isolated communities are generally thought to face.

The effects of labor market forces were surprisingly weak in both decades. Employment in agriculture and forestry was found to be insignificant for overall migration and for all age groups, with the exception of a weak and inconsistent effect on young adult net migration in the 2000-2010 period. The lack of an effect for forestry and farming employment supports the assertion of McGranahan and Beale (2002), that the national trend of population decline in farm-dependent counties is largely explained by the geographic isolation and lack of natural amenities in such counties. It is also important to note that the variable does not include employment in wood products manufacturing, meaning that the decline of Oregon's forest industry may have effected migration through a decline in mill employment rather than through the loss of actual logging jobs.

The civilian unemployment rate, however, also showed surprisingly limited effects on migration. Although unemployment was found to be a significant factor in migration rates for working-age adults in the 1990s, this effect disappears in the 2000-2010 period, with amenities like open water assuming a primary role. The muted effect of labor markets on working-age adults between 2000 and 2010 may be due to the post-2000 diminution of migration responses to labor markets documented by Partridge, et al., (2012). It also may be an indication that non-economic factors are most important for decisions to remain in or move to small communities, a position supported by the Oregon community-level research of Chen, et al. (2012). The relative weakness of labor market factors may come as a relief some communities that are struggling with mill closures and high unemployment, but it is also somewhat worrying for rural communities since labor market conditions are a main potential avenue for policy intervention.

Another finding of considerable concern for small rural communities is the significant and positive effect that starting population is found to have on migration in the 2000-2010 period. This finding is consistent with the negative net migration experienced by communities with fewer than 500 people in the 2000-2010 decade, and, at face value, would seem to reinforce fears of downward spirals of decline.

Controlling for access to services, however, partially explains the tendency of small communities to have lower net migration rates. This suggests that the declines experienced by very small communities are not due to their low population, *per se*, but rather to the dearth of services in such communities.

Although the effects of individual services are inconsistent across time and age groups, the instances where services are significant indicate large migration gains. In the 2000-2010 period, the presence of an eating or drinking establishment in a community was associated with a marginally significant but a quantitatively large eleven percentage-point increase in net migration. Grocery stores show enormous, and nearly identical, 27 and 25 percentage-point advantages in retaining young adults in the 1990-2000 and 2000-2010 periods, respectively. Distances to doctors, grocery stores, and hospitals all had significant, negative effects for some decades and age groups, with health services generally most important to seniors. The presence of a high school, however, showed no positive effects on overall of age-specific migration.

Conclusions and Policy Implications

This paper's analysis of net migration rates in small Oregon communities has found that natural amenities, particularly annual precipitation and open water, were the strongest predictors of net migration rates. Access to services, such as grocery stores, doctors, hospitals, and eating and drinking establishments, shows evidence of dramatically boosting net migration rates.

The results also show considerable differences between the 1990-2000 period and the subsequent decade. The most notable of the changes in the latter period are a general reduction in net migration, the near-disappearance of distance and labor market effects, and the emergence of low net migration rates in small communities. This greater tendency for small communities to decline is partially accounted for by lower access to services in such places.

The effects of distance and labor markets, though strongest among working-age adults, were generally surprisingly weak predictors of net migration, particularly in the 2000-2010 period. Though decade-to-decade this may be a reflection of shifts in migration patterns, the general weakness of the variables also provides support for the hypothesis, offered by Chen, et al. (2012) and Partridge, et al. (2012) that small communities have different migration dynamics than counties or larger places.

Though this research clearly has identified drivers of migration rates in small Oregon communities, it is more difficult to find a policy avenue to reverse population decline in places where it is occurring. Small Oregon communities fared much worse in net migration in the 2000-2010 period than in the 1990s. Given that their natural amenities were largely unchanged, their access to services diminished only slightly, and their average unemployment rate actually decreased between 1990 and 2000, it appears that this downturn was driven not by changes in the characteristics of small communities, but rather by a shift to lower net migration rates for Oregon as a whole, and for rural areas more generally. The reasons for the changes in these state and national migration patterns are beyond the scope of this paper, but it is reasonable to conclude that they are driven by forces that are largely beyond the control of individual communities.

Although the migration estimates in this paper show wide variation in overall and age-specific migration rates between communities, the factors that are found to drive these differences cause further concern about the potential efficacy of local policy intervention. Characteristics that rural communities have little to no control of over, such as precipitation and nearby open water, are found to have large effects on small community net migration, while unemployment and income factors, which are often targets of policy interventions, played a relatively small role in determining net migration rates in the most recent decade.

Taken as a whole, these findings provide three general lessons for small communities that are concerned about outmigration and population decline. The first is that the role of labor market forces in small community migration dynamics does not appear to be a primary one. This means that strategies to better retain young people, entice the return of outmigrants, and attract new residents should not focus solely on economic development.

The second is that natural amenities, including low precipitation, open water, and, to a lesser extent, forest land cover, are strong determinants of migration rates. While communities, of course, cannot control the amount of rain they receive or the amount of water nearby, they should realize that these characteristics, to the extent that they are favorable, are potential assets, and consider their utilization in formulating development strategies. For example, communities that are close forest land might invest in creating infrastructure for recreation opportunities, such as hiking or biking trails, that would attract potential inmigrants and possibly increase retention of current residents.

Finally, this research shows that having services—particularly grocery stores, restaurants, bars, hospitals, and doctors—in or near a community can have large effects on net migration rates. Given the relatively small scale of many rural businesses, counties or communities might redirect a small portion of their economic development funds to grants for improvements to local businesses. In the case of local grocery stores, this might mean funding for repair or replacement of old refrigeration units, or for purchase of kitchen equipment to produce value-added products like hot meals. Because small markets in rural areas hurt the viability of small businesses, local governments could also facilitate cooperation between businesses in different communities to pool purchasing power and realize economies of scale. Although the market forces working against small rural businesses are difficult for communities to counteract, it appears that, given the fixed nature of most of a community's natural amenities, finding ways to support local services, either in a community or in a nearby location, is one potentially effective way for communities to reverse outmigration.

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