Determinants of Population Change in Regional Economies: A Study of the Colorado Front Range

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Abstract: Households and businesses are distributed across regional economies based on a number of factors including location-specific natural and fiscal amenities and local and regional employment conditions. Very different hypotheses are proposed in past research to explain the determinants of this spatial distribution. In particular, it is argued that households must weigh the benefits of potential amenities against the costs of employment losses, lower wages or higher housing prices. The relative strength of these two categories determines the potential for government intervention in the market. This research project analyzes this issue in the specific case of the Denver labor market area. This region has experienced large swings in economic activity over the past decade, but more recently, has been one of the fastest growing metropolitan areas in the United States. As growth occurs, the role of fiscal amenities in this process needs to be understood since governments may inhibit, promote or have no effect on regional population and employment growth.

Introduction

Households and businesses are allocated across locations within local labor market areas based on a number of factors, including distance to production and consumption points fixed amenities of an area, labor supply and demand, relative local prices, cost of living and government policies and programs. As these economic agents locate in different regions, households and their associated labor supply may travel to distant employment (or labor demand) sites in other locations. Site-specific activity and resource holding by households, employees and employers generate government taxes and fees that are used to finance local public goods. When economic conditions change, the spatial distribution of households and businesses may be reallocated based on new incentive structures or comparative advantage.

The Colorado Front Range is often considered to the region from Fort Collins in the north to Pueblo in the south. This study focuses on the counties in the central part of the region around the city of Denver. These counties are: Jefferson, Arapahoe, Adams, Denver, Boulder, Elbert, Clear Creek, Park, Weld and Douglas. The labor market area population is 2.3 million with a personal income base of $66 billion (1997) and per capita income of $ 34,000. This region was selected because it has experienced wide swings in population change, losing population during the oil bust of the late 1980's and then gaining over 600,000 (30.4% increase) new residents the 1990's. An important question for policymakers is the influence of various factors driving population growth in the region.

Many factors determine the location decisions of households and firms. In particular, a debate has ensued in the economics literature regarding the relative role of

employment opportunities versus natural and fiscal amenities in determining population migration. Historically, economists have imagined that people would move based on economic differences between regions. "Differences in net economic advantages, chiefly differences in wages, are the main causes of migration," (Hicks, 1932, p. 76). So for example, wage differentials between states are arbitraged by households. Thus, differentials exist only until movement occurs to eliminate them.

Employment opportunities have long been considered a major factor driving population movement. Within this literature, wages, income, and unemployment rates have been used to proxy employment opportunity and income differentials. For many years, researchers assumed that regional differentials in unemployment rates or incomes would be arbitraged away as households and firms move in response to utility or profit enhancing opportunities. Unfortunately, studies were confronted with a large number of estimated wrong signs given expectations. In short, their findings revealed that population continued to flow into high rent and/or lower wage areas.

In the face of these anomalies, a new emerged explanation regarding the forces behind population movement. Non-employment based amenities were identified as major drivers of migration behavior. Amenities are location-specific, non-traded attributes of a region or local area. Factors such as sun, low rainfall and humidity, topography and visual beauty are determinants of household migration. Amenities help define the character and quality of life of a regional or local economy. They can be divided into natural and produced amenities, both of which could be identified as driving forces behind the distribution of population and employment in regional economies. Natural amenities are those goods and services that are a part of the landscape of a

region, such as climate, topography and water access. Although they are natural to a region, human activities may play a major role in their subsequent quality and quantity through production and consumption.

These initial analysts focused their attention on natural amenities, such as climate and topography. In a related vein, Charles Tiebout (1956) introduced the notion of fiscal (produced) amenities driving differential migration between jurisdictions. Tiebout claimed that people would "vote with their feet" and move to an area based on government-provided amenities, such as educational quality. These produced, fiscal amenities differed from natural amenities in that they had an explicit cost (taxes or fees) and were the result of human activity. Cities and counties may even explicitly use fiscal amenities in an attempt to manipulate population and employment growth. This theory was an attempt to circumvent the problems of demand for public goods as espoused by Samuelson. Tiebout argued that migration served as a revealed preference mechanism for local and state public goods.

Fiscal amenities are the result of state, local and federal government action. Governments may provide services such as road and highway infrastructure, utilities, park and recreation services and other activities. Similarly, many government-provided goods and services require presence for consumption. In some cases, government or fiscal amenities may be related to agglomeration effects. Also, fiscal amenities may interact with natural amenities to produce a mixed fiscal-natural amenity such as a campground in a state park or road access to a wilderness area. Nevertheless, the debate continues as to the degree which household location is based on employment conditions, natural amenities or fiscal amenities.

Research Objectives and Hypotheses

The purpose of this research project is to develop a model and test alternative theories as to the determinants of population and employment location within a labor market area. Fiscal amenities or public services are believed to play a role relative to other factors in that process. The word relative reflects the fact that amenities are only one of the forces that drives regional change. In particular, the role of fiscal amenities must be measured relative to the role of employment opportunities or wages.

The research objective is expressed as a specific hypothesis in an econometric analysis. The hypothesis relates to the influence of fiscal amenities on population. It is expected that general government spending on local fiscal amenities will have a positive influence on the degree of population growth. In particular, the share of government spending on categories such as public safety, parks and recreation and schools will have an economically significant and positive effect on population change in a county. It is possible, and perhaps likely, that government spending on categories such as welfare and public health will have a negative influence on population growth in a community. These amenity variables must be weighted against the influence of the employment and wage variables. It is possible that both types of variables, employment and amenities, will have an influence on population growth and the answer may depend on relative influence.

This study makes a contribution of methodology, policy analysis and outlining new conceptual areas of the regional development field. Very few regional econometric models have utilized a sub-regional examination of population and employment change. Further, few models have examined the direct link between local areas, preferring to focus on intermetropolitan regional distribution. However, many labor market areas,

including rural and urban areas, will benefit from this initial assessment of the relative forces of population and employment change. Hopefully, the model presented here can serve as a benchmark for further intraregional studies of labor market areas.

Literature Review

In undertaking an analysis of regional employment and population change, one is faced with two divergent explanatory theories. The equilibrium theory posits that regional amenity differences are the determinants of migration. As expressed through hedonic models, the theory assumes that wage and rent differentials that exist between regions are not the subject of population or employment movement. These differentials simply represent the capitalization of previous household and business movement. This theory assumes that perfect information exists about cross-regional differentials and spatial adjustment costs are negligible

The disequilibrium literature states that cross-regional differentials are the subject of spatial arbitrage by households and firms. Due to imperfect information and potentially high adjustment costs, firms and households take time to switch places in response to differences in profit maximizing opportunities and spatial utility differences. The movement of economic agents eventually reduces and eliminates regional variation in utility and cost differentials. This is the concept behind regional convergence where all regions experience equal per capita real income levels.

More recently, an attempt has been made to bridge the gap between disequilibrium and equilibrium theories. Economists now recognize that household and firm migration, whether into or out of a region, is a logical response to disequilibrium forces or shocks. It has also been recognized that population and employment migration

influence each other. At the point of zero net migration (firms or households), a regional economy will be in equilibrium. A variety of approaches have been developed to integrate these theories. The disequilibrium literature states that cross-regional differentials are the subject of spatial arbitrage by households and firms. Due to imperfect information and potentially high adjustment costs, firms and households take time to switch places in response to differences in profit maximizing opportunities and spatial utility differences. The movement of economic agents eventually reduces and eliminates regional variation in utility and cost differentials. This is the concept behind regional convergence where all regions experience equal per capita real income levels.

These ideas were most clearly specified in the theoretical model of Mathur and Stein (1993, see appendix 1). These authors directly tackle the issue of employment and population change simultaneously, whereas other authors hold employment exogenous. The Mathur-Stein model is based on an economy with endogenous population and employment movement.

(12) $P = \lambda_p[V(W, R, S, G) - k]$

(13) $N = \lambda_n[1\text{-}C(W, R, S, H)]$

(14) $W = W(P, N, S, I)$

(15) $R = R(P, N, S, J, \delta)$

Where:

P = change in population in a given region

N = change in employment in a given region

λ = Adjustment factor due to imperfect information, moving costs

W = regional wages

R = regional land and structure prices

S = amenities

G, H, I, J = predetermined and excluded variables for population, employment, wages and housing prices

K = constant utility factor

V = indirect utility

C = constant cost factor

Household utility is dependent on wages, rents and amenities. The k factor represents the equalization of utility across regions necessary to establish equilibrium. Firm or employment equilibrium is established in the second equation based on cost differentials. The (1) one factor represents equal costs across all regions. Otherwise, firm movement is based on wages, rents and amenities relative to other areas. The excluded variables, important for empirical work, represent factors such as industrial composition that affect only employment and not population. Both population and employment are affected by an adjustment factor (λ) that represents the disequilibrium notion that it requires time and resources to alter household and firm location.

However, wages and rents are also endogenous in this model to reflect the fact that capitalization occurs between amenities, wages and rents (equilibrium literature). This endogenity also reflects the fact that firm and household movement has a direct effect on wages and rents separate of the amenity effect. Wages are a function of population change (agglomeration economies), employment change and amenities. The wage-amenity effect is similar to a traditional hedonic model with the further recognition that population and employment movement are part of this process. Wages are expected

to be positively related to population and employment growth and negatively related to amenities. Land rents are a function of the same variables with different directional expectations. Rents are expected to be positively related to employment and population change as well as changes in amenities

Based on the approach in Mathur and Stein(1993), the effect of exogenous amenity changes on population and employment change depends on the relative magnitude and direction of cost and benefit effects. If firms are amenity adverse, the hypothesized relationship is that employment growth will slow or decline. Under these circumstances, the change in population depends on the marginal benefit of the amenity to households versus the higher marginal costs to firms. If increasing amenities leads to fewer firms and jobs, household welfare will be reduced due to fewer employment opportunities and potentially lower outcomes. The new economic geography would also suggest that fewer firms imply fewer varieties of products (monopolistic competition) which also reduces household utility. Yet, higher amenities, depending on their type and variety, leads to higher welfare for households. The empirical question is which of these forces is stronger. The coefficient on the amenity variable in the population equation, controlling for employment effects, will suggest the answer to this question.

Model and Data

The theoretical and empirical literature appears to be moving towards agreement around the issue of disequilibrium versus equilibrium components of firm and household migration. The first lesson is that part of the regional differentials in housing prices and wages reflects the capitalization of amenities or local factors. The second lesson is that this capitalization process is dynamic and occurs through the movement of households

and firms. At any point in time, however, land and labor markets may be in disequilibrium due to slower than expected adjustment by population and employment. The third lesson is that when one considers general equilibrium effects, the net result on household and firm movement depends critically on the direct effect of amenities on these agents.

The empirical question is how to measure the degree of equilibrium versus disequilibrium in local factor and housing prices. In this research, we propose that the instrumental variables of housing prices and wages represent the capitalized portion of amenities during a particular time period. To the extent that changes in housing prices and wages vary with changes in amenities, this is a reflection of the capitalization process. The non-capitalized portion of amenities on housing prices and wages, the equation residual, reflects the so-called disequilibrium gap. To the extent that county labor market conditions influence county population growth, disequilibrium-adjusted wages represent market signals that may attract households. Disequilibrium-adjusted housing prices also represent market signals that may effect household utility differences. With this adjusted specification, the most accurate analysis can be conducted measuring the relative effects of labor market conditions and amenities.

As discussed earlier, theory suggests that a four-equation system is appropriate for examining the determinants of population and employment distribution. The equations estimated are derived directly from the theoretical model of Mathur and Stein (1993). Population, employment, wages and housing prices will serve as the critical dependent variables. Each independent variable will be hypothesized to be partly dependent on the others. The wage and housing price equations are specified as traditional hedonic

models. An attempt is being made to determine the level and value of attributes related to those primary local prices. All equations are specified in the form of annual change (first-difference) from the years 1985 through 1997. The focus here will be on the population, wage and housing price variables.

The population equation specifies a relationship between changes in population (population growth) and exogenous factors such as wages, local and regional employment opportunities, housing prices and amenities.

(21) Pop = F[emp(+), hpindexf(-), reshp(+), wagesf(+), wageres(+), amenity(+), road(I), parks(+), health(I), safety(I), tax(-),]

Population and employment have been found to be simultaneously determined with population typically the stronger effect on employment. Of all research findings, the effect of population on employment has been the most consistent and economically important finding in both rural and urban settings. This finding appears to be consistent with research in economic development that shows most regional employment opportunities are taken by migrants rather than local residents.

If taxes and public services are perfectly capitalized into wages and rents, no effect would be expected on their coefficient signs with respect to population. This statement holds true if perfect labor and capital mobility exist. It is factor mobility that serves as a mechanism that to transmit fiscal service changes into price changes. However, if the economy is in disequilibrium at any point at any point in time, then this statement will not hold true. Disequilibrium implies that labor or capital mobility has not occurred fast enough to erase or eliminate the benefits of an amenity shock. A wedge

exists between wage/rent prices and amenities that is the catalyst for a continued movement of households.

The wage and housing price equations were included because of widespread support for the notion that regional population and employment growth are not inframarginal changes with respect to locally derived prices such as wages and housing.

(22) Wage = F[amenity(-),road(-), parks(-), welfare(-), health(-),safety(-), Empf (-), industry shares(I), hpindexf(+), popf(+)]

(23) Hpindex = F[amenity(+), road(+), parks(+), welfare(-), health(I), safety (I), school(+), popf(+), permits(-), vacancy(-), metropop(+), income(+)]

In fact, quantity changes are very much part of the story in determining local price changes and vice versa. However, the story does not end there. Due to the dynamic and open nature of regional economies, changes in relative price differences reflect population and employment change and part of the difference does not. As explained before, households are postulated to only respond to the non-capitalized or residual portion of housing prices and wages. Therefore, we have defined two variables for each factor in the population equation; nominal wages, residual wages, nominal housing prices and residual housing prices.

The wage equation represents an attempt to uncover the implicit prices or values that make up average annual wages in these Colorado counties. It is expressed in classic hedonic form with average annual wage as the dependent variable and attributes or characteristics as independent variables. The likely candidates for independent variables are general amenities, amenity shares, industrial shares, employment, as well as, the consumer price index as a measure of other local prices.

The housing price equation is also expressed as a classic hedonic function. The independent variables include general amenities, amenity shares, income, population, population squared (to proxy for population density and congestion), vacancy rates and housing permits. Housing prices, based on previous literature, are expected to vary positively with general amenities and amenity shares such as parks and recreation. However, the relationship between housing prices and other amenity are likely to be zero or negative.

The following table (table 1) presents each of the dependent and independent variables in the model. Information provided includes the name of the variable, description of the variable, units and mean value. Further details about each variable can be found in Scorsone (2001).

Table 1: Data Descriptive Statistics

Variable	Definition	Units	Mean Value
Employment (empp)	Percentage change in own-county employment	%	4.63
Population (popp)	Percentage change in own-county population	%	3.36
Amenity	Change in own-county per capita total local government expenditures	$/capita	$22.3
Roads	Level of own-county share of government spending on roads	%	.198
Parks	Level of own-county share of government spending on parks, recreation and arts	%	.078
Judical	Level of own-county share of government spending on court and Judical services	%	.003
Health	Level of own-county share of government spending on public health services	%	.026
Welfare	Level of own-county share of government spending on federal welfare programs	%	.124
Safety	Level of own-county share of government spending on public safety- police and fire	%	.236
Government	Level of own-county share of government spending on general administration (excluded variable)	%	.335
Wages	Change in county's regionally indexed average wage.		-.0016
Wagef	Predicted Value from wage instrument equation		-.0019
Reswage	Residual from wage instrument equation		-.0006
Hpindexf	Predicted value from housing price instrument equation		.011
Housing prices (hpindex)	Change in county's regionally indexed average single family housing price.		.010
Reshp	Residual from housing price instrument equation		-12257.72
Extract	Change in share of own-county employment in agriculture and mining	%	.149
Cnstshare	Change in share of own-county employment in construction	%	-.247
Manshare	Change in share of own-county employment in manufacturing	%	-.007
Tcpushare	Change in share of own-county employment in transportation, communications and utilities	%	-.005
Whleshare	Change in share of own-county employment in wholesale	%	-.007
Retshare	Change in share of own-county employment in retail	%	.061
Fireshare	Change in share of own-county employment in finance	%	-.017
Sershare	Change in share of own-county employment in services	%	.013
Permits	Change in own-county residential housing permits	#	145.04
Vacancy	Change in own-county residential vacancy rate	%	-.014
Tax	Change in own-county per capita local government taxes	$/capita	35.77
CPI	Change in Denver–Boulder-Greely consumer price index relative to national consumer price index	index	1.033
School	Change in own-county per pupil education expenditures	$/pupil	352.39
Metroemp	Percentage change in regional employment	%	2.9
Metropop	Percentage change in regional population change	%	1.5
Income	Change in own-county per capita personal income	Thousands	-.004

Results

Relative Housing Price Change Equation

The housing price equation has an R-squared of .51 and the F-statistic indicates overall significance at the .01 level. The Hausman tests indicated that population was simultaneously related to housing prices, so it was inserted into the housing price equation using an instrumental variable approach. To estimate the population instrument, all exogenous variables in the system were regressed against population, which is analogous to the two-stage least squares approach. Based on the Durbin-Watson test, an AR(1) term was added. The term was negative and significant at the .01 level.

As expected, population growth leads to higher housing prices since it represents a demand shift factor for the housing demand schedule. Due to the inelastic nature of housing supply (especially in the short run), demand is likely to outstrip supply. Colorado has experienced a very strong economy in the 1990's,and housing prices have risen as demand outstripped supply. Table 2 provides the results for the housing price equation.

Table 2: Housing Price Equation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.053365	0.053348	1.000317	0.3197
ROADS1?	-0.030474	0.080537	-0.378380	0.7060
PARKS1?	0.373276	0.100755	3.704793	0.0004
WELFARE1?	-0.320137	0.088354	-3.623356	0.0005
HEALTH1?	-0.492481	0.223526	-2.203243	0.0300
SAFETY1?	-0.029581	0.116224	-0.254517	0.7996
SCHOOL?	7.98E-06	5.84E-06	1.365203	0.1754
TAX?	6.90E-05	8.41E-05	0.819985	0.4143
JUDICAL1?	-0.762310	0.522451	-1.459104	0.1478
VACANCY?	0.006187	0.033648	0.183886	0.8545
PERMITS?	1.26E-06	6.19E-06	0.203457	0.8392
POPPF?	0.001402	0.002733	0.513060	0.6091
AMENITY?	0.000236	0.000105	2.257499	0.0262
AR(1)	-0.339808	0.105655	-3.216220	0.0018

A critical question for this study was the degree to which housing prices represent the implicit valuation of local amenities for households. The amenity share variables reveal the degree to which different types of spending affect housing prices. Parks spending is the one category that raises housing prices, which is not an unexpected result given the expected value people place on green and open spaces near their homes. Yet, welfare and health spending reduce housing price growth, since these variables may serve as an indicator of sociodemograhpic challenges for a county. It should be noted that welfare, safety and road spending have all been found in the past to potentially reduce housing prices.

This study found that per pupil school funding is positively correlated with housing price growth. Many studies have attempted to use differences in housing prices as a reflection of school quality. Not suprisingly, higher income districts can afford to spend more on schools, since spending is at least partially correlated with student achievement and people are willing to pay the costs for better schools.

Vacancy rates and housing permits are supply curve shift factors that should be negatively correlated with housing prices, since they indicate supply is increasing on the market. In this case, the permit and vacancy coefficients are positive, but statistically insignificant. Taxes potentially raise the cost of building homes, and are part of the home payments made by households, thus they shift the housing demand and supply curves by reducing both demand and supply of housing. The empirical results indicate that taxes actually do have a positive effect on housing prices although the result is not significant. This finding, together with positive findings on amenities, may suggest households are willing to pay taxes if spent on amenities according to their values.

Relative Wage Change Equation

The wage equation was the weakest in explanatory power of the four equations. The R-squared was .33 and the F-statistic indicated overall significance at the .01 level. The Hausman test was used to determine that population and employment were simultaneously related to wages. As with the housing price equation, instrumental variables were used to correct this bias. A lagged version of the wage variable was added based on results from the Durbin-Watson statistic indicating autocorrelation. This term was positive, but only weakly significant with a p-value of .26.

Concerning the labor market, Mathur and Stein believed that wages would be positively related to population growth and employment growth due to agglomeration economies of scale. As growth occurs, households would view rising wages as a benefit of growth along with better employment opportunities. In this model, the results clearly demonstrate that for this region, wages and employment are positively correlated with population growth. In a direct sense, households view more jobs and better wages with favor. However, the theory is contradicted with regard to population growth since the results indicate that higher county and regional population (metropop) lead to lower wage growth. This may be due to more traditional labor supply effects on wages.

The wage equation is specified as a classic hedonic function. Intraregional wage differentials are specified as a function of local attributes along with other characteristics that are likely to affect such differences. A key empirical question is the degree to which wage differentials between counties are capitalized. If wage differentials are capitalized, population should not respond to those differences. The correlation between the general government spending variable and wage changes is a measure of capitalization. The

wage residual, reflecting non-capitalized wages, was placed into the population equation to determine if this hypothesis is correct. Wage equation results are presented in Table 3.

Table 3: Wage Equation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.029208	0.026831	-1.088606	0.2793
AMENITY?	-9.86E-05	7.47E-05	-1.319075	0.1906
TAX?	-5.14E-06	4.10E-05	-0.125180	0.9007
ROADS1?	0.064833	0.041924	1.546424	0.1256
PARKS1?	0.153319	0.072592	2.112080	0.0375
WELFARE1?	0.040872	0.057930	0.705533	0.4823
HEALTH1?	-0.165045	0.154175	-1.070504	0.2873
SAFETY1?	0.012894	0.072683	0.177407	0.8596
JUDICAL1?	0.141227	0.330124	0.427799	0.6698
SCHOOL?	-5.11E-07	2.79E-06	-0.183537	0.8548
EMPPF?	0.003601	0.001589	2.266200	0.0259
EXTRACT?	0.001545	0.002405	0.642517	0.5222
METROPOP	-0.545936	0.347375	-1.571605	0.1196
CNSTSHARE?	-0.000814	0.002220	-0.366883	0.7146
TCPUSHARE?	0.004965	0.004915	1.010109	0.3152
WHLESHARE?	-0.044230	0.026064	-1.696999	0.0932
RETSHARE?	-0.001511	0.001661	-0.910148	0.3652
SERSHARE?	0.000444	0.003795	0.117069	0.9071
FIRESHARE?	-0.003837	0.010263	-0.373918	0.7094
MANSHARE?	-0.001325	0.002781	-0.476372	0.6350
POPPF?	-0.000536	0.003707	-0.144540	0.8854
WAGE?(-1)	0.113936	0.101247	1.125335	0.2635

In support of previous research, we find that wages are negatively correlated with total amenity spending and some amenity shares. In particular, public safety and public health spending are negatively and significantly correlated with wage growth. These results are also consistent with the housing price equation, however, the results on amenity shares coefficients are not completely consistent. Roads, welfare and park spending lead to higher wages. This may be due to the perceived effect of different types of government spending on firm productivity and costs. The general conclusion is that amenities tend to depress wages, due to an influx of workers attracted by amenities, but a couple of spending categories are reflected as unpaid inputs to the production process.

Industry shares explain part of the variation in relative wage growth. Changes in the percentages of workers in wholesale industries lead to lower relative wage growth, while service industry shares are associated with higher wage growth. These results are consistent with other findings.

Population Change Equation

Generally, the population equation has relatively good diagnostics. The R-squared is .85 and the F-statistic indicates overall significance at the .01 level. The Hausman test indicated that wages, housing prices and employment were simultaneously related to population. As with the other equations, an instrumental variable approach was used. A lagged dependent variable was also included based on the Durbin-Watson test. The term was negative and significant at the .01 level. In short, past population growth has a strong influence on current and future population growth.

Population growth is likely to be the result of residential factors together with access to jobs. Due to the difficulty of measuring spatial distance using county boundaries, a strong relationship was assumed between county population and metro employment. Jobs would attract people to the general region, but not necessarily dictate where they live . The choice of where to live would be driven by commuting time along with a host of other residential amenities including natural amenities and fiscal amenities and housing. The population equation was specified to represent the factors that drive net migration into or out of a region. For the Denver regional economy, the late 1980's represented a time of net migration loss while the decade of the 1990's was one of rapid population growth, due primarily to migration. Table 4 presents the population equation results.

Table 4: Population Equation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMPPF?	0.159611	0.073937	2.158731	0.0338
HPINDEXF?	14.51070	8.168048	1.776520	0.0794
RESHP?	1.91E-05	1.00E-05	1.905081	0.0603
WAGEF?	-11.99357	10.03191	-1.195542	0.2353
RESWAGE?	22.83740	6.218914	3.672250	0.0004
PARKS1?	-3.503790	4.178137	-0.838601	0.4041
SCHOOL?	0.000266	0.000201	1.321703	0.1899
ROADS1?	2.669722	1.646605	1.621350	0.1088
HEALTH1?	3.360909	10.26358	0.327460	0.7442
JUDICAL1?	35.82940	22.86696	1.566863	0.1210
DV6?	2.093514	0.839075	2.495025	0.0146
DV9?	1.604959	0.627764	2.556627	0.0124
TAX?	-0.004619	0.002595	-1.780160	0.0788
SAFETY1?	-5.730186	3.078890	-1.861121	0.0663
WELFARE1?	4.678363	2.860710	1.635386	0.1058
METROEMP	3.802058	14.93362	0.254597	0.7997
POPP?(-1)	0.663919	0.073588	9.022063	0.0000
AMENITY?	-0.009678	0.003381	-2.862307	0.0053

The housing price instrument variable is positive and significant as is the residual housing price variable in the population equation. These variables account for equilibrium and disequilibirum factors in the housing market and the coefficients indicate that these prices act as signals for household's choice. Meanwhile, the housing price residual result indicates that the demand for housing is much stronger than indicated by the hedonic equation. Higher housing prices appear to be signals for some unspecified indicators in these counties. So, what at first glance may appear to be white noise may in fact be capturing unmeasureable amenity attractors in a county or region.

In the labor market, the instrument wage result is not significant, while the residual wage result is significant and positive. In line with the discussion of Clark and Cosgrove (1991), the residual wage result seems to represent compensation for other type of regional or human capital characteristics. To the extent that households are attracted to a county based on wages, those wage differentials may also indicate some

disequilibirum force in the labor market. Taxes, as expected, are a negative and significant influence on population growth.

The amenity variable is of key interest to the stated research objectives. General amenity spending is negative and significantly related to population growth. The negative result makes sense in the context of the often large degree of anti-tax sentiment in these counties and relatively larger interest and preferences for natural or fiscal amenities (wilderness, open space and or less congestion and density). Suburban residents rely on core urban counties for many public services such as museums, large public libraries, zoos, conference centers and large urban parks, while many of the benefits of suburban living are captured in private markets such as shopping malls, homeowners associations, newer and larger homes and access to public open space. Rural public services, especially in mountain communities of Park and Clear Creek, may or may not be a population magnet, although higher spending is often required for snow removal and road maintenance.

Regarding population, it is unsurprising to find that counties in a region with strong employment growth also experienced greater own-county population growth. These two variables are strongly correlated to each other in almost every previous study. A very surprising result is the relative strength of own-county employment versus regional employment. Initially, the expectation was that, due to commuting linkages, regional employment would be more important. In fact, the own-county employment variable was highly significant while the regional employment variable was insignificant. This is true even with the regularity of commuting across county borders.

Conclusion

This research study began with a discussion of two opposing theories of regional growth and migration. One school of thought is that real wages and employment conditions drive growth, while the other school of thought believes that amenities, natural and fiscal amenities drive regional change. It was further acknowledged that within a labor market area, these dynamics are likely to be different than in an interregional setting. The commuting effect implies that households and employers will look across county lines and make different work and residence choices. In this setting, fiscal amenities may exhibit an effect on regional change relative to employment conditions. If this is the case, economic development and growth control strategies must take these interdependencies into account.

The focus here concerned the relative role of local government fiscal amenities (revenues and expenditures) in changing the patterns of employment and population growth. The general finding in this study is that public service spending (fiscal amenities) has a mixed effect on population and employment change. The empirical results revealed a lack of strong results, positive or negative, for population and employment growth. Still, this result is not unexpected; much of the previous empirical work found similar results. A more interesting result was that, after accounting for wage and housing price capitalization, these disequilibrium forces were major factors influencing population and employment growth. Providing support for the disequilibrium literature, wages are a positive attractor for population into a county. On the other hand, support for the equilibrium literature was found in the housing price equation. After accounting for capitalization, higher housing prices were found to attract households. Higher prices may

be signals of broader housing quality or other community characteristics that were not specified in this model. For example some public cultural amenities, which are not as fixed as natural amenities, may be captured in this notion.

The results are interesting in that they provide a mixed picture regarding the equilibrium versus disequilibrium debate. Clearly, some capitalization of amenities and productivity (as well as disamenities) occurs in wages and rents. However, the capitalization is not complete and disequilibrium forces are present in both wages and housing prices. In fact, it is these disequilibrium forces that are apparently influencing the Denver region's population and employment growth over the last decade.

The evidence presented also potentially supports the notion that both instrument variables and instrument residuals can be utilized in employment and population equations to analyze disequilibirum and equilibrium growth factors. Previous research has avoided this issue and potentially opened itself up to charges of omitted variable bias. In particular, previous simultaneous equations models have treated wages and housing prices as strictly exogenous variables. Also, amenities may be endogenous in some cases. The Hausman test for this model did not find evidence of this with local government fiscal amenities, but this may not be true in all cases.

It is possible that the results are skewed by data aggregation and county size. Fiscal management strategies may be better reflected at the municipal or even neighborhood level. Cities are generally more active participants in attracting businesses and/or households. Counties tend to be more reactive, especially in metropolitan regions. Also, the aggregation of taxes and spending misses the use of abatements and tax breaks for specific businesses or developments.

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Appendix 1

This appendix presents a chart that parallels the discussion in the text. Given all the assumptions made by Mathur and Stein in their framework, this chart allows for the interpretation of results based on the effect of exogenous amenity change on population and employment location.

Exogenous Amenity-Variable Relationship	**Firm-Amenity Relationship**	
	Amenity Adverse	**Amenity Assisted**
Population (dP/dE)	Uncertain, employment losses weighed against amenity benefits	> 0, population growth
Employment (dN/dE)	< 0, employment losses	Uncertain, amenities reduce costs, while pop. growth raises costs