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Xiaobing Shuai
University of Richmond, xshuai@richmond.edu

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Xiaobing Shuai
Chmura Economics & Analytics/University of Richmond – USA

Abstract. This paper investigates the interaction between commuting and migration within a local labor market, focusing especially on the question of whether commuting can lead to migration over time. Using Virginia data from 2000 to 2006, the study shows that the commuting flow between two locations has a positive and significant effect on the migration flow in the same direction in subsequent years. The underlying reasons are that increased commuting costs or reduced migration costs can induce commuters to become migrants. These results may have useful implications for urban communities in their revitalization efforts, as cities can explore ways of attracting daily commuters to their cities to become permanent residents, reversing the trends of declining urban population.

1. Introduction

Migration and commuting are fundamental issues in the study of the American labor market. The history of the past few decades shows that Americans are becoming more mobile, in terms of both longer commutes and more frequent migrations and relocations. In the past four decades, the percentage of American workers crossing county lines to work more than doubled, from 10% in 1960 to 27% in 2000. Locally in Virginia, the percentage of workers employed in their home county shrank from 52% in 1990 to 48% in 2000 (Shuai, 2010). During this process suburban counties experienced an influx of residents and development, while urban centers suffered a steady population decline. Many urban plights of today, such as high crime, high poverty, and poorly performing schools, are directly related to declining urban populations and the subsequent loss of tax bases. To reverse the trend of population loss and combat urban problems, many cities have undertaken ambitious urban revitalization programs, including building downtown malls and sports arenas or staging festivals. While these efforts focused on hospitality sectors have brought in temporary visitors to city centers, they have been less effective in attracting permanent residents (Turner and Rosentraub, 2002). How can cities around the country encourage more people to live in their downtowns?

To reverse downtown population decline, people need to be attracted to move to cities. Thus, the key question becomes where those potential migrants come from. When migration is discussed in public discourse, foreign migration normally gathers the most attention, as it is related to current political debates such as illegal immigration. However, foreign immigrants only account for a very small percentage of all migrants in the U.S. As Table 1 shows, from 2000 to 2006 only 4.0% of all migrants to Virginia counties were foreign[1] (IRS, 2006). The vast majority of migration occurred within the state border. Of all in-migrants to Virginia counties, 57% of them were from within Virginia, and 39% of them were from other states. Out-migration follows a similar pattern, with 60% of out-migrants moving to other counties in Virginia, and 38% moving to other states. Only 3% of migrants moved to other countries. An overwhelming number of migrations occur within the state of Virginia (IRS, 2006).

[1] In Virginia, cities are independent of counties. In this paper, for the sake of brevity, when Virginia counties are mentioned, it means both Virginia counties and independent cities.

Table 1. Average annual migration rate (2000-2006).

	In-State	Out-of-State	Foreign	Non-Migrants
In-Migration	6.80%	4.70%	0.50%	88.00%
Out-Migration	6.80%	4.30%	0.30%	88.60%

Source: Internal Revenue Service

The above data imply that cities need to look close to home for potential migrants, and strategies have been proposed for cities to attract early retirees (Cromartie and Nelson, 2009) and young and educated adults (Edmiston, 2009). This paper hypothesizes that one potential target is the large number of daily commuters to cities. Despite declining population, American cities remain employment centers, attracting a large number of commuters. For example, in Richmond, Virginia, 67% of its jobs were taken by commuters from surrounding counties in 2000, much higher than the state average of 50% (Census, 2000). Many of those commuters are highly-skilled educated people that cities need.

Theoretically, it is possible that commuting can lead to migration, as implied by a number of search models (Rouwendal, 2004). Commuting can also possibly lead to migration as a way to reduce migration cost. Migration is a big decision full of risks. Total migration costs include not only the cost to move the household, but also social and psychological costs associated with leaving family and friends behind (Mills and Hazarika, 2001; Clark et al., 2007). Commuting may become a process to adjust or reduce the migration cost. Information regarding the new location can be collected, and social contacts can be established in the workplace during the years of commuting. If this process can reduce migration cost sufficiently commuters can become migrants, but this complementarity will have a time lag.

This paper presents an empirical analysis of whether commuting can lead to migration, using county-to-county migration and commuting data in Virginia from 2000 to 2006. The study first establishes a simple theoretical framework whereby commuting can lead to migration. Using a regression approach, this study then estimates whether the commuting flow in a certain year affects the migration flow in subsequent years while controlling other variables such as job opportunities, spatial wages, and amenities differentials. The findings of this paper can provide useful ideas for urban policy makers and economic development professionals to attract residents to their city centers.

2. Brief literature review

This paper focuses on the empirical question of whether commuting can lead to migration. Due to a large amount of research related to migration, only articles germane to this question are summarized in this section. This review first summarizes theoretical and empirical work on migration in general and then focuses on the interaction between migration and commuting in particular.

In discussing migration decisions, the distinction between inter-regional and intra-regional migrations is important. According to Zax (1994), a residential move is inter-regional if it also implies a change of job. Similarly, a job move is inter-regional if it also requires a move of residence. Thus, most of the international and inter-state migration would be considered inter-regional (except those on border regions), while the suburbanization process witnessed in America when people move from cities of suburbs is intra-regional. In inter-regional migration decisions, residence and work locations are bundled together, and commuting is not an option. In intra-regional migration decisions, residence and work locations need to be determined separately as both commuting and migration are viable options for an individual.

The theoretical models of migration have been evolving over the years. Early migration theories treated migration decisions as largely a labor market decision, with key driving forces being spatial disparities in economic opportunities such as wages and the likelihood of gaining employment (Sjaastad, 1962). Migration costs were also one of the considerations in those early models. In that framework, if expected lifetime earnings in a new location are higher than the expected lifetime earnings in the current location plus migration costs, a decision to move is made. In that sense, migration is viewed as an investment in human capital with returns being future economic opportunities (Clark and Hunter, 1992). Variations of this type of model include family migration, where the expected earnings of the whole family, not just one individual, are considered (Mincer, 1978). The same basic theoretical model—

the tradeoff between expected earnings differentials and migration cost—also leads to models of repeat migration (DaVanzo, 1983) and international migration (Borjas, 1987). Later, migrations were seen as not only labor market decisions, but also life-cycle decisions, as people move for amenities and life-cycle events (Greenwood, 1985). Other theories on migration emphasized that the motivation of human migration is to consume public goods, with the prominent example being the Tiebout-Tullock Hypothesis. Tiebout (1956) argued that the "consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods." Tullock (1971) extended this hypothesis by emphasizing that consumers evaluated not only a bundle of public goods, but also tax liabilities. The focuses of the above theoretical models are primarily inter-regional migration, and they have not considered commuting as a credible option in decision-making.

The progression of empirical literature generally follows the direction of theoretical development. Early empirical models confirmed the following determinants of migration: wage level, unemployment rate, and distance between places as a proxy for migration cost (Lowry, 1966). In later studies, the role of amenities and quality of life factors, especially those related to climate, were ascertained as Americans exercised massive migration from Snow Belt to Sun Belt regions (Cebula, 2005; Cebula and Alexander, 2006; Porell, 1982; Graves, 1983). While amenities such as weather and natural beauty were studied extensively, Cebula (2005 and 2006) also examined the negative role of disamenities such as hazardous waste sites and pollution. Some empirical models focused on the role of housing costs in their analysis of regional migration within the United States (Huffman and Feridhanusetyawan, 2007). Extensive empirical studies have been conducted to test the Tiebout-Tullock hypothesis on the role of public policy on migration at the state level (Cebula, 2009, 2002, 1990, 1974; Saltz, 1998). Those studies identified the public policy factors such as education spending and state income taxation as important considerations for interstate migration. Additional studies evaluated the roles of government welfare programs such as welfare benefits and welfare duration (Snarr and Burkey, 2006). Many of these models used data for inter-regional migration and evaluated the migration decisions without the consideration of the option of commuting.

However, the majority of migration in the U.S. happens at the intra-state level, and most of those moves are intra-regional migrations that do not require a job change. The traditional labor market-centric migration model may be less effective in understanding such intra-regional migration, where wages are similar yet mass migration occurs. Studies have found that non-labor market factors such as amenities and life-cycle events are the driving forces for intra-regional migration decisions (So et al., 2001). Marriage and childbearing drive urban-to-suburban migration for better schools and larger houses (Miseszkowski and Mills, 1993). In recent years, with the impending retirement of baby boomers, reverse suburbanization has been observed as empty nesters move from suburbs to urban centers, with limited consideration for their labor market outcomes (Cromartie and Nelson, 2009).

Recent research in regional labor markets made considerable progress in understanding the commuting and migration dynamics within a local labor shed. Those studies have revolved around the Push and Pull hypothesis (Renkow and Hoover, 2000; Partridge et al., 2010). Rural development either occurs as rural areas benefit from the job spillover of urban conglomerations (pull, or decentralization), or it occurs as rural areas are developed based on the relocation of industry bases (push, or restructuring). Renkow and Hoover (2000) specifically test the Push and Pull hypothesis, with an emphasis on how migration can affect commuting flows in North Carolina. They found that migration to a rural county could increase out-commuting from that locality, because migrants to a labor market may choose to live in a place with better amenities, not necessarily their places of work. Their results supported the decentralization hypothesis. Renkow (2003) showed increased integration among communities. His study found that a large percentage of jobs created in North Carolina were taken by commuters, implying that suburban and rural counties benefit from job spillover from cities. Using Canadian data, Partridge et al. (2010) and Ali et al. (2011) also found consistent support for the decentralization hypothesis. They concluded that distance and the size of urban community have a strong influence on the rural-to-urban commuting. Goetz et al. (2010) utilized advances in network sciences in studying the effect of commuting on income growth in rural areas. They found that "high in- and out-commuting entropies are associated with lower per capita income growth, but their interaction enhances economic growth in places simultaneously open to both in- and out-commuters." The conclusion indirectly supports the decentralization hypothesis.

Though extensive research has been conducted on commuting behavior within a labor shed, intra-regional migration has received less attention. While the decentralization hypothesis predicts that in-migration to rural areas is associated with out-commuting, the flip side of the question, whether commuting has an effect on migration, remains unanswered empirically. Clark et al. (2003) built a theoretical model that explored the effect of the commuting distance on residence choices. They concluded that longer distances between work and residence tend to induce a move of either work or residence location. If growing congestion on roads were to increase the commuting cost, residents may move closer to their work after a period of commuting (Clark et al., 2003). Commuting can lead to migration as a risk-averse strategy to internalize migration costs, especially the social costs associated with migration. Those possibilities will be tested empirically in this paper.

3. Analytical framework

In an inter-regional migration decision, an individual decides between two options, whether to stay or move, as commuting is not an option. However, in intra-regional migration decisions choices have to be made not only on whether to move or stay, but also on whether to keep the current job or seek a job in a new location, as residence and job moves are not bundled together. Theoretically, an individual can change both residence and job, or change job without changing residences, engaging in commuting. This person can also stay put without changing job or residence, or he can also change residence and keep the current job, thus engaging in commuting.

The basic theoretical model of individual decisions used here is similar to the structure used by Huffman and Feridhanusetyawan (2007). This model, allowing simultaneous decisions of residence and work locations, can be formulated as follows.

Let a person choose between two locations, *O* and *D*, as different work and residence options. Let *W* stand for income and *A* stand for amenities. Thus, W_O and W_D are potential earnings of the locations *O* and *D*, while A_O and A_D are the amenities of locations *O* and *D*. C_{OD} is the commuting cost between *O* and *D*, while M_{OD} is the migration cost between *O* and *D*.

The indirect utility function of the individual, *V(O,D)*, represents the utility of living in *O* and working in *D*. The indirect utility function of the individual depends on the expected income from working in *D*, amenities from living in *O*, and the commuting or migration cost, if any. Thus, the indirect utility function *V(O,D)* of this person can be expressed as $V(W_D, A_O, C_{OD}, M_{OD})$.

Assuming that the individual lives and works in *O* initially, this individual chooses among the four options: 1) working and living in *O*; 2) living in *O* and commuting to *D* to work; 3) moving to *D*, but continue working in *O*; and 4) moving to and working in *D*. To simplify, assume that local amenities and commuting and migration costs can be measured in monetary units (Huffman and Feridhanusetyawan, 2007), so that the indirect utility function is the sum of the above four components, which can be expressed as follows:

$$A1: \ V(O,O) = W_O + A_O \tag{1}$$

$$A2: \ V(O,D) = W_D + A_O - C_{OD} \tag{2}$$

$$A3: \ V(D,O) = W_O + A_D - C_{OD} - M_{OD} \tag{3}$$

$$A4: \ V(D,D) = W_D + A_D - M_{OD} \tag{4}$$

Assuming that commuting and migration costs are fixed, the key decision rests on the magnitude of W_D-W_O and A_D-A_O, the wage differentials and amenity differentials between two locations. Solving this model, the decision pattern of this individual can be illustrated in Figure 1, where W_D-W_O and A_D-A_O are two axes.

In Figure 1, the area labeled *A1* indicates that *A1* is the utility maximization solution among the four options for an individual, given the particular combinations of W_D-W_O and A_D-A_O. In *A1*, the person will live and work in location *O* as expected earnings in *D* is not high enough to compensate for commuting cost. Neither is the amenity in *D* high enough to induce a move. In area *A2*, commuting to *D* but living in *O* is the best solution, because the expected earnings in location *D* are high enough relative to commuting cost to justify changing jobs, but the amenities in *D* are not strong enough to justify a relocation. In area *A3*, the amenities in location *D* are high, but the expected earnings in *D* are low, so the individual would move to *D* but commute to work in *O*. In *A4*, the individual will move to and work in location *D*.

In this simple theoretical framework, commuting from *O* to *D* can lead to migration from *O* to *D* under two circumstances. First, if commuting cost (C_{OD}) increases, more people will stop commuting and choose to migrate to *D*. In Figure 1, when commuting cost increases, the line C_{OD} will shift up, while the line M_{OD}-C_{OD} will shift to the left. The result of those moves is that area *A2* will shrink, while area *A4* will expand. That means some of the commuters will become migrants. When commuting cost increases, area *A1* will also expand while area *A2* shrinks, meaning some commuters will stop commuting, instead finding jobs closer to their homes in *O*. However, that change is not what we try to test empirically in this paper.

Another way that commuting can lead to migration is a reduction in migration cost. When M_{OD} is reduced, the line M_{OD}-C_{OD} in Figure 1 will move to the left, while the line $(A_D\text{-}A_O) + (W_D\text{-}W_O) = M_{OD}$ will shift down. That move will increase area *A4* while reducing area *A2*, meaning people will switch from commuting to migration. That usually occurs when initial migration cost is very high due to incomplete information and high perceived risk of migration. After a period of commuting, the commuters are acquainted with new places and establish social contacts in a new work location, lowering their migration costs. Thus they will switch from commuters to migrants.

The empirical results of Renkow and Hoover (2000) showed that migration could lead to commuting, which would happen when commuting cost (C_{OD}) is sufficiently low. When C_{OD} is reduced, line M_{OD}+C_{OD} will shift to the left and line –C_{OD} will shift upward, resulting in an expansion of area *A3* and a reduction of area *A1*. In that case, people in location *O* will choose to move to *D* but commute back to location *O* to work. As a result, the local labor market will experience higher migration and high commuting.

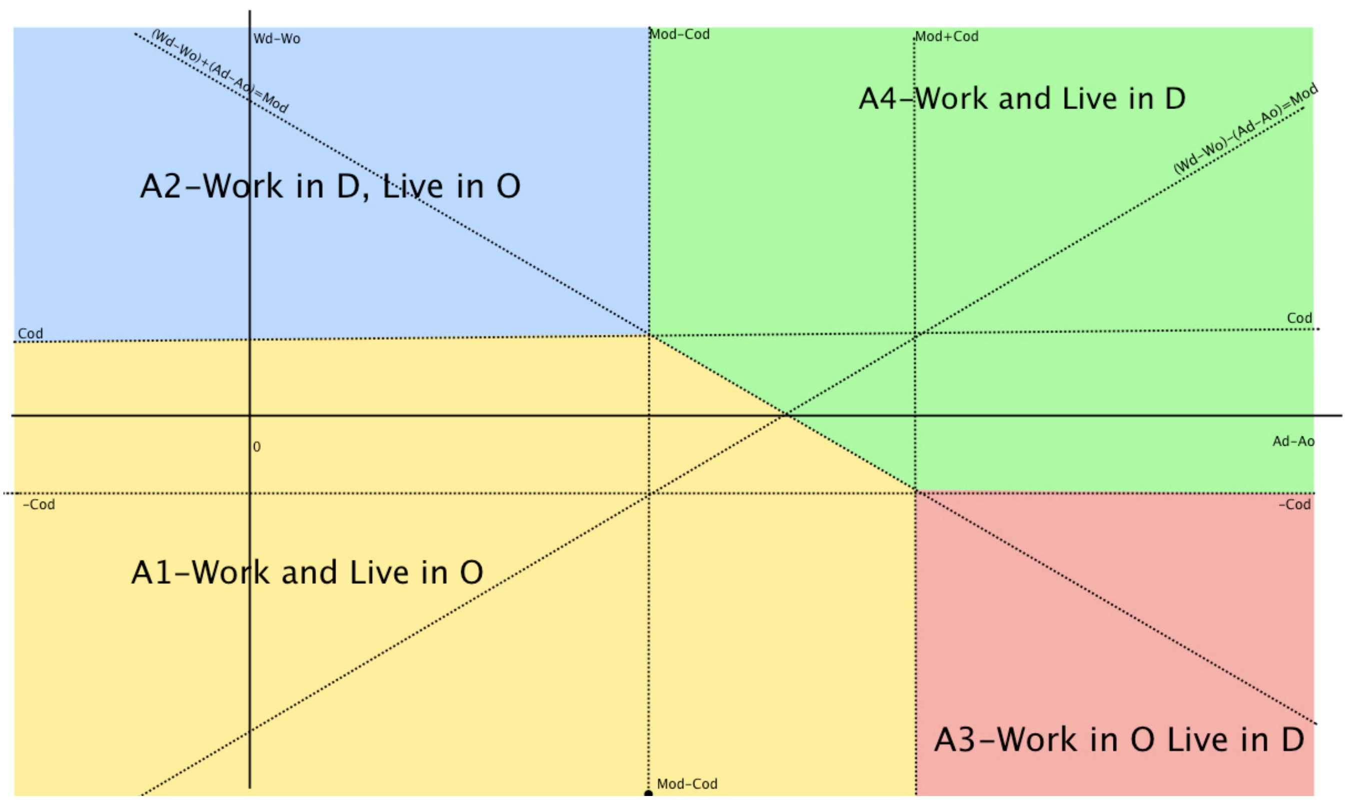

Figure 1. Commuting and Migration Decisions

4. Empirical model

The focus of the analysis here is whether commuting can lead to migration. Migration is a complex phenomenon that is influenced by many social and economic factors. As a result, a set of variables needs to be controlled to ascertain whether a positive relation exists between commuting and migration. Even though many studies used individual data (So, et al., 2001; Huffman and Feridhanusetyawan, 2007) to study the migration decision-making, Renkow and Hoover (2000) provided justification for using aggregate commuting and migration data in empirical analysis, because individual decision choice underlies observed aggregate patterns of commuting and migration within a particular labor market. Following that practice, county level data are used in the empirical model, which is specified below:

$$\begin{aligned} MIGR_{OD}^{t} = {} & \alpha_1 + \alpha_2 COMMUTE_{OD}^{t0} \\ & + \alpha_3 RUNEMP_{OD}^{t0} + \alpha_4 RWAGE_{OD}^{t0} \\ & + \alpha_5 RHOUSE_{OD}^{t0} + \alpha_6 RAMENITY_{OD}^{t0} \\ & + \alpha_7 DIS_{OD}^{t0} + \alpha_8 Comm\_Time_{OD}^{t0} \\ & + \alpha_9 POP_{D}^{t0} + \alpha_{10} POP_{O}^{t0} \\ & + \alpha_{11} RYOUTH_{OD}^{t0} + \alpha_{12} ROLD_{OD}^{t0} \\ & + \alpha_{13} REDU_{OD}^{t0} + \alpha_t\, Year\_Dummy^{t} \\ & + \alpha_d\, County\_Dummy^{d} + \varepsilon_{OD} \end{aligned} \quad (5)$$

where year t varies from 2001 to 2005, $t_0 = 2000$ and county d varies from 1 to 133. The complementarity between commuting and migration will be implied by a positive coefficient (α_2) on the number of commuters from O to D ($COMMUTE_{OD}$).

All of Virginia's cities and counties are included in this study. Since the analysis is on the interaction of migration and commuting in an intra-regional framework, any pair of locations with a distance over 100 miles between them are excluded in the model as they are out of the typical commuting range. This criterion is similar to several studies in Europe, which used the 150 kilometers as a demarcation line between inter- and intra-regional migration (Deding, Filges, and Ommeren, 2009). Other studies such as So et al. (2001) used the distance of a one-hour drive as the demarcation line of the commuting zone, while some studies on Canadian commuting used 120 kilometers (Partridge et al., 2010).

The county level migration data came from the Internal Revenue Service (IRS, 2006), which used individual income tax filing to track county-to-county migration patterns. There are concerns that people who do not file tax returns are not captured by this data set, which could bias the estimating results. A close examination showed that in 2001, the IRS collected 3.5 million tax returns in Virginia, representing a population of 7.3 million in the state (IRS, 2006). In the 2000 Census, Virginia had 2.7 million households with total population of 7.1 million (Census, 2000).[2] The difference in population is less than 3%, indicating that the IRS tax filing database provides good coverage of the state population.

The county-to-county commuting flow data came from the 2000 Census. The year of commuting flow is set at 2000, while the migration data are annual data from 2001 to 2006, after the year 2000. This specification can minimize the direct endogeneity, consistent with the practice of recent studies on local commuting behaviors (Patridge, et al., 2010; Ali et al., 2011). However, there are still concerns over indirect simultaneity due to possible omitted variables bias. As a result, a set of county dummy variables is introduced for each destination county to capture any county-specific factors that are not explicitly modeled, minimizing indirect simultaneity.[3]

The expected earnings of a location are represented by two variables, the average wage and the unemployment rate, similar to those used in Huffman and Feridhanusetyawan (2007). Combined, they represent the expected earnings of a location. A high relative wage of location D with respect to that of location O ($RWAGE_{OD}$), computed as county D's average wage divided by that of county O, tends to attract in-migrants to D. On the contrary, high relative unemployment of location D to location O ($RUNEMP_{OD}$), calculated in the same fashion, is expected to have a negative impact on the number of migrants from O to D. Both wage and unemployment data were from the Bureau of Labor Statistics (2009).

Amenities in this model are direct inputs of an individual's utility function. Two types of amenity – natural and social amenities – are incorporated in the model. Natural amenity data came from Economic Research Service of the Department of Agriculture (USDA ERS, 2009). Natural amenity scores are based on a set of indicators such as temperature, topography, and river or seashore in a county. Based on those indicators, the natural amenities of all Virginia counties are ranked from 1 to 7, with 7 being the highest. The relative amenities of D with respect to O ($RAMENITY_{OD}$), expressed as the ratio of the amenity ranking of the destination D to that of

[2] People living in one household may choose to file federal tax returns separately, resulting in a higher number of returns than the number of households in Virginia.

[3] Ideally, dummy variables should be created for both destination and source counties, but including those two sets of dummy-generated high level of co-linearity among them. Thus only destination dummy variables are included. The author is grateful for an anonymous referee for this suggestion.

source county *O*, should have a positive effect on the number of migrants from *O* to *D*.

Social amenity includes a measure of education quality, as it is one of the primary considerations for family migration, especially those families with children. There are several measures to represent school quality, such as graduation rates, test scores and dropout rates. In this study per-pupil school spending, collected from the Virginia Department of Education (2010), is used as a proxy for school quality. Relatively high social amenities are expected to attract migrants.

Moving cost represents not only the amount of monetary expense it takes to move a household, but also the social cost of leaving family and friends (Mills and Hazarika, 2001). Moving cost from *O* to *D* is represented by the distance between the two locations. A longer distance not only represents a higher cost of relocation but also captures high social cost, as long distance makes visits to family and friends more expensive. This variable is expected to have a negative effect on migration flow from *O* to *D*. The distance between Virginia locations is retrieved from Oakridge National Laboratory distance database (2008). It is measured as the distance between the geographic center of *O* and the geographic center of *D*.

Relative housing cost can also be considered as part of the moving cost, as migrating households have to acquire residences in destination *D* while selling existing houses in *O*. Several studies (So et al., 2001; Renkow and Hoover, 2000) have found that housing price is an important variable for residential, and consequently migration, choices. An increase in the relative housing price of county *D*, computed as location *D*'s median house price divided by that of location *O* ($RHOUSE_{OD}$), is expected to reduce the likelihood that individuals will move to *D*. Relative housing cost was computed using 2000 Census data. On a side note, some empirical literature has emphasized the effect of cost of living in migration decision, but cost of living is highly correlated with housing price, as housing price is normally a big component of the cost of living index. As a result, the cost of living is not included in this model.

Commuting cost is represented by commuting time. Though commuting cost is also loosely related to distance, commuting time is a better indicator of such commuting cost (So et al., 2001). That is because the same distance will take much more time to commute in congested urban areas than rural areas, indicating a higher toll to commuters. High commuting cost should have a positive effect on the migration flow (Clark et al., 2003). The average travel time to work from Census 2000 is used to represent the commuting costs. In this study, the average travel time to work of all workers from a locality, from Census 2000, is used to represent the commuting cost.[4]

Aside from variables derived directly from the theoretical framework, people also relocate for reasons other than labor market opportunities, such as the life cycle events of marriage, child-bearing, or retirement. Though the theoretical framework does not account for life-cycle events explicitly, several demographic variables are also incorporated into the empirical model to serve as control variables. Total population of both *O* and *D* counties will be incorporated into the model to control for the number of potential migrants. Relative percentages of population who are young adults (20-35) and older adults (over 65) are also included to control for life cycle events (Huffman and Feridhanusetyawan, 2007). The population between 20-35 is the group most likely to enter into the life stage of marriage and childbearing, while those adults over 65 will enter retirement. Both life events are strong motivators to migrate.

Another demographic variable included is educational attainment, as studies have established that human capital investment is one of the major motivations of migration and that individuals with higher educational attainment were more likely to move (Clark et al., 2006; Huffman and Feridhanusetyawan, 2007)[5]. The educational attainment of a locality is measured as the percentage of the adult population (25 and over) with a bachelor's degree or higher. Relative educational attainment of source to destination counties is included in the model to control for difference in educational attainment. All demographic data are from 2000 Census.

Since the migration examined here occurred from 2001 to 2006, yearly dummies are also included in the model to account for any fixed effects, such as macro economic conditions, not explicitly modeled for each year. Similarly, dummy variables for each destination county are included to control for non-specified county-fixed factors, and to minimize missing variable bias. Summary statistics are listed in Table 2.

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[4] Ideally, the commuting time between each locality pair should be used. Unfortunately, the pair-wise data are not available.

[5] The author thanks an anonymous referee for this suggestion. The explanatory power of the model was enhanced by the addition of this variable.

Table 2. Descriptive statistics for model variables.

	Average	Standard Deviation	Maximum	Minimum
Number of Migrating Households (2001-2006)	123	413	6,405	10
Number of Commuters 2000	1,197	3,990	55,963	0
Destination Population 2000	99,969	154,935	969,749	3,904
Source Population 2000	103,674	161,645	969,749	2,536
Distance (miles)	30.75	18.03	87.40	0.70
Commuting Time (minutes, 2000)	28.54	5.38	41.42	14.71
Relative Housing Price 2000	1.07	0.34	2.59	0.31
Relative Wage 2000	1.04	0.31	2.62	0.38
Relative Unemployment Rate 2000	1.05	0.33	3.18	0.31
Relative Amenity Ranking 2000	1.02	0.18	2.00	0.67
Relative School Quality 2000	1.02	0.21	2.06	0.05
Relative Young Population 2000	1.77	3.35	57.92	0.02
Relative Old Population 2000	1.12	0.58	20.58	0.05
Relative Education Attainment 2000	1.19	0.75	5.61	0.18

5. Estimation and results

The ordinary-least-square (OLS) regression results are listed in Table 3. In this table, Model 1 represents coefficient estimates of all observations from 2001 to 2006. Models 2-5 represent the same regression model with different subsets of observations, as will be explained later in this section. Table 4 presents the regression results for individual years from 2001 to 2006. All independent variables representing an actual value (number of commuters, population, distance, and commuting time) are in logarithmic form, as is the dependent variable. As a result, the coefficient estimates of those variables can be interpreted as the elasticity of migration with respect to those variables. For variables measuring the relative value of the source and destination localities, such as relative unemployment, wages, and amenities, no logarithmic transformations were taken.

Overall, the model can explain more than 80% of the variation in intra-regional migration flow between Virginia counties, with an adjusted R^2 of 0.82. Considering that county-to-county migration flows are affected by a complex set of national and regional factors, the performance of this regression model is satisfactory.

5.1. *Effect of demographic and economic variables*

Before analyzing the effect of commuting on migration, this section first discusses the estimated effects of other demographic and economic variables on intra-regional migration, based on Model 1 results.[6] The coefficient estimates of the most independent variables are consistent with the prediction of theoretical framework as well as other empirical studies. First, the demographic variables exert a strong influence on the migration flow between counties. The population sizes of both the source (POP_O) and destination counties (POP_D) have positive and significant effects on migration flow from *O* to *D*. Those two variables represent the magnitude of the supply and demand of migrants. A large population in destination county *D* implies a high capacity to absorb new migrants and a higher possibility of matching jobs and houses for potential migrants (McQuaid, 2006). In this model, since both the population and migrants are in logarithm forms, the coefficient estimate represents the elasticity of migrant flow (MIG_{OD}) with respect to destination population (POP_D). A one percent increase of POP_D induces a 1.5% growth in the number of migrants from *O* to *D*. Similarly, a large population of the source county (POP_O) implies a large supply of potential migrants. The elasticity of source county population on out-migrants is 0.44%. The positive and significant effects of both source and destination populations suggest that the migration flow between Virginia counties resembles the "gravity" model for commodity trade flow between two regions, which has also been observed by Karemera et al. (2000) in the context of international migration.

[6] Coefficient estimates in Model 2 through 5 are generally consistent with the Model 1 results in terms of signs of the coefficient estimate.

Table 3. Coefficient estimates (pooled six-year model).

	Model 1 Overall Model	**Model 2** Congested Area Model	**Model 3** Rural Model	**Model 4** Low Migration Cost Model	**Model 5** High Migration Cost Model
Intercept	-16.8714	-6.2718	-4.5058	-22.53	-1.536
	(8.62)**	(14.60)**	(2.54)**	(11.14)**	(1.61)
Number of Commuters	**0.3460**	**0.3639**	**0.3384**	**0.4796**	**0.1085**
	(58.13)**	**(35.19)****	**(42.23)****	**(58.24)****	**(10.21)****
Destination Population	1.4986	0.3785	0.3793	1.997	0.0672
	(7.58)**	(15.56)**	(2.14)**	(9.75)**	(0.77)
Source Population	0.4432	0.4824	0.3667	0.4184	0.4676
	(48.93)**	(40.99)**	(23.58)**	(38.21)**	(28.47)**
Distance	-0.7256	-0.9182	-0.5762	-0.5428	-0.7657
	(40.48)**	(33.34)**	(24.96)**	(28.20)**	(9.98)**
Commuting Time	0.3339	0.9088	0.0623	0.2601	0.5371
	(4.77)**	(10.01)**	(0.58)	(3.26)**	(4.82)**
Relative Housing Price	-0.0405	-0.0908	0.0192	-0.0854	0.0203
	(1.36)	(2.36)**	(0.40)	(2.38)**	(0.50)
Relative Wages	-0.27	-0.2908	-0.1501	-0.3736	-0.132
	(6.19)**	(5.64)**	(1.77)*	(7.48)**	(1.94)*
Relative Unemployment Rate	-0.1083	-0.6566	-0.0621	0.1387	-0.337
	(3.26)**	(13.07)**	(1.50)	(3.50)**	(5.89)**
Relative Natural Amenity	0.2833	0.3293	0.2825	0.1759	-0.3375
	(5.53)**	(4.71)**	(3.78)**	(2.88)**	(4.36)**
Relative School Quality	-0.1979	-0.0482	-0.1865	-0.5361	-0.2289
	(3.50)**	(0.67)	(1.99)**	(7.96)**	(2.73)**
Relative Youth Population (20-35)	-0.0119	0.0073	-0.0063	-0.0186	0.0029
	(2.38)**	(0.90)	(1.23)	(3.67)**	(0.23)
Relative Senior Population (65+)	0.2152	0.2306	0.1966	0.2743	0.1157
	(10.64)**	(8.03)**	(6.80)**	(10.59)**	(4.24)**
Relative Education Attainment	-0.1069	-0.1022	-0.067	-0.0613	-0.1185
	(5.95)**	(8.43)**	(2.40)**	(2.72)**	(4.89)**
2001 Dummy	-0.1856	-0.2337	-0.1268	-0.2049	-0.1244
	(8.98)**	(8.27)**	(4.29)**	(9.05)**	(4.21)**
2002 Dummy	-0.1492	-0.1838	-0.102	-0.1668	-0.1012
	(7.20)**	(6.51)**	(3.44)**	(7.34)**	(3.44)**
2003 Dummy	-0.154	-0.1665	-0.1262	-0.147	-0.1196
	(7.21)**	(5.81)**	(3.99)**	(6.25)**	(3.95)**
2004 Dummy	-0.1295	-0.1416	-0.1114	-0.1304	-0.1158
	(6.35)**	(5.07)**	(3.83)**	(5.80)**	(4.04)**
2005 Dummy	-0.03211	-0.0537	-0.0045	-0.0325	-0.0402
	(1.58)	(1.92)*	(0.15)	(1.45)	(1.40)
Number of Observations	7072	3829	3242	5054	2017
Adjusted R-Square	0.8229	0.8537	0.751	0.8652	0.6528

Note: ** and * indicate significance at 5% and 10% level, respectively. Terms in parentheses are absolute values of t-statistics
For brevity, the estimated coefficients of destination county dummy variables (100+) are not listed. Please contact author for the list.

For intra-regional migration, age structure plays an important role as people move for life-cycle events in addition to labor market opportunities. The regression results show that younger people are more mobile than older populations. The negative and significant coefficient of relatively young adults ($RYOUTH_{OD}$) implies that a locality with a higher percentage of young adults is more likely to generate outmigration. On the other hand, a locality with a relatively higher percentage of older residents ($ROLD_{OD}$) is less likely to generate outmigration.

Consistent with Clark et al. (2006), high educational attainment is associated with a higher propensity to migrate within a local laborshed. The positive and significant coefficient of relative educational attainment ($REDU_{OD}$) implies that residents of localities with a higher percentage of adults with college or higher degrees are more likely to move out.

As concerns economic variables, the model reveals that job opportunities in the destination county with respect to the source county, represented by the relative unemployment rate ($RUNEMP_{OD}$), are important in influencing the migration flow between two localities. For example, if the relative unemployment increases by 10 percentage points, it can reduce migrant flow by 1.7 per year for an average county. Similar results are observed by Huffman and Feridhanusetyawan (2007).

The effects of relative wages of the destination to source counties are puzzling. Higher relative wages ($RWAGE_{OD}$) seem to have a negative impact in attracting migrants, contradicting the prediction of migration theory. A possible explanation may be related to the industrial structures that make the wage gaps persistent. For example, Northern Virginia has a higher concentration of high tech jobs with high wages. Because other counties have no such skills, those jobs are not filled by commuters or migrants from within the laborshed due to skills mismatch. Thus, we do not see a positive relation between migration and relative wages. This could be caused by the drawback of using aggregate wages rather than individual wages, as average wages deviate from individual ones.

The model suggests that higher relative natural amenities of destination *D* attract migrants. A ten-percent increase in relative amenity index can increase migration to a destination county by 2.5 per year for an average county in Virginia. These results are in line with the findings of Graves (1987) and Deller et al. (2001).

The regression result suggests that school quality has a negative effect on attracting migrants in an intra-regional context. That seems to be inconsistent with the theoretical prediction of the Tiebout-Tullock Hypothesis, as well as results from some empirical studies on inter-state migration (Cebula, 2002; 2009). A high level of school quality, in theory, should attract immigrants. However, that conclusion is not universal in empirical studies. An early study by Cebula and Curran (1978) found public education spending had a positive effect on migration to metropolitan areas, but the estimate is not statistically significant. In a study on household mobility in Cleveland region, Margulis (2001) found evidence to support the Tiebout Hypothesis for smaller metro counties, but school quality is less of a factor in household mobility in large metro counties. In my model, the negative coefficient on school quality could be generated by two influences. First, it could be caused by the interaction between school expenditures and local taxes, especially property taxes. In Virginia, public K-12 schools are primarily funded by property and other local taxes. High levels of education spending are typically associated with high property tax rates, which might deter inmigration. Since the model does not include variables on local taxes, it is likely that negative coefficient on school quality reflects the correlation between school quality and local taxes. In addition, Clark and Hunter (1992) found that the effect of the education expenditure on migration depends on the lifecycles of the migrants. If a significant number of the intra-regional migrations in Virginia are those who move for economic reasons, school quality may be a non-factor. It can even be a negative factor if those migrants are retirees, as they are more likely to treat high school quality as a high social burden.

Migration costs, represented by the distance between two locations, have a significant toll on the migration flow between them. The elasticity of migrants in response to distance is 0.63. One mile of additional distance can reduce the number of migrating households by 2.9 per year for an average Virginia county. This result supports the findings of Clark et al. (2007).

The relative housing price of the destination to source locality has a significant negative impact on the number of migrants between them. The estimates show that a ten-percent increase in relative price is associated with 2.7 fewer migrants for an average county. The importance of housing prices in local migration has been observed by So et al. (2001). The affordability of housing is one of the most essential factors people consider while making the migration and relocation decision.

Commuting cost, represented by commuting time, has a positive effect on the migration flow, as predicted by Clark et al. (2003). A one-percent increase in commuting time will reduce the number of migrants by 0.33%. Evaluating at the means of the variables, the elasticity indicates that one more minute commuting time from *O* to *D* can increase the number of migrants by 1.4 per year. High commuting costs between two localities encourage the migration between two locations.

5.2. *Effect of commuting on migration*

The key variable of interest is the effect of the number of commuters from *O* to *D* in the year 2000. This variable has a positive and significant impact on the migration flow from *O* to *D* in the subsequent years. The elasticity of migration with respect to commuting is 0.35, meaning 1% increase in commuters from *O* to *D* in 2000 can lead to 0.35% increase in the migrants each year in subsequent years. This result implies that commuting can lead to migration. As explained in the theoretical model, there are two reasons that commuters can convert to migrants: increased commuting costs or a reduction in migration costs. Two additional regression models (Model 2 and 3) are estimated to explore whether the elasticity from commuting to migration differs with respect to commuting and migration costs.

If traffic congestion can affect commuters' propensity to move, the elasticity of migration to commuting should be larger in congested areas. In Virginia, congestion often occurs in the state's three largest metropolitan areas — Northern Virginia, Hampton Roads, and Richmond. This is especially true for Northern Virginia, one of the most congested areas in the nation. For example, data from Texas Transportation Institute show that the Travel Time Index (TTI) for Northern Virginia was 1.39 in 2007, meaning commuting time at peak hours is 39% more than the time needed in a traffic-free-flow environment. The Travel Time Index for Hampton Roads and Richmond are 1.18 and 1.09, respectively, showing some congestion. On the other hand, TTI for all other metro areas in Virginia are only between 1.02 and 1.03, showing little congestion. For the split models, all observations are separated into two groups. Model 2 includes all observations with work locations in the three big metro areas, while Model 3 includes observations with work locations in other regions. The regression results (Table 3) show that in congested areas the elasticity of commuting on migration is almost 0.36, while outside those areas the elasticity is only 0.34. Both coefficient estimates are highly significant, confirming the hypothesis that commuters in congested areas are more likely to convert from commuters to migrants. While the difference in the coefficient estimate is significant statistically[7], in practice it only amounts to a difference of about 5 migrants converted from commuters in congested metro areas as opposed to rural areas for an average locality, *ceteris paribus*.

The same exercise is also repeated to test whether decreasing migration costs can increase the propensity of commuters converting to migrants. In this exercise, the total observations are separated into two groups—those with a distance of less than 30 miles between destination and source (Model 4), and those with over 30 miles between two locations (Model 5), as the distance is an indicator of the migration costs. In the low migration cost model, the elasticity of migration with respect to commuting is 0.48, compared with only 0.11 for high migration cost model. That provides strong evidence that low migration costs tend to increase the likelihood for commuters to move. The difference in coefficient estimates is statistically significant at the 95% level.

5.3. *Timing of commuting-to-migration conversion*

The multiple years of migration data also allow exploration of the timing of the response of migration to commuting. Table 4 reports the regression results with individual years of migration flow as dependent variables while commuting flows are fixed at the year 2000 level. The result indicates that the elasticity from commuting to migration is the highest in three years. The elasticity is 0.36 for 2001. It remained at 0.36 in 2002 and increased to 0.43 in 2003. Afterward, the elasticity fell to 0.35 in 2004 and 0.31 for 2005 and 2006. These results indicate that the propensity to move is the highest in three years. The reason could be that it may take three years for commuters to get assimilated with the new places. Afterward, commuting will not help commuters to internalize migration and commuting costs or assimilate new information.

5.4. *Implications*

The results of the model may provide ideas for Virginia cities in their urban revitalization efforts. Many cities in Virginia, such as Richmond and Norfolk, have experienced stagnant population growth or population decline in the past few decades. Cities

[7] The distributions of the coefficient estimates of two models are asymptotically normal. As a result, the difference of the coefficient can be tested through a Z-test.

in Virginia and around the country have tried many efforts to revitalize their downtown areas through tourism development, such as building downtown sports arenas and downtown shopping centers and staging conventions and festivals. Although those efforts can boost visitors to the city, they have limited effects in attracting permanent residents to cities (Turner and Rosentraub, 2002).

Table 4. Coefficient estimates (Individual Year Model)

	2001	2002	2003	2004	2005	2006
Intercept	-20.5531	-23.1812	-22.8517	-21.6187	-14.8123	-13.8338
	(3.80)**	(4.24)**	(3.82)**	(4.31)**	(3.17)**	(3.14)**
Number of Commuters	**0.3608**	**0.3617**	**0.4325**	**0.3521**	**0.3178**	**0.3049**
	(23.80)**	**(23.43)****	**(25.52)****	**(23.58)****	**(22.01)****	**(21.98)****
Destination Population	1.7345	2.0606	2.0515	1.8147	1.3986	1.2465
	(3.21)**	(3.77)**	(3.41)**	(3.61)**	(3.00)**	(2.83)**
Source Population	0.47114	0.4523	0.4365	0.4655	0.4209	0.4326
	(20.33)**	(19.42)**	(18.54)**	(23.25)**	(18.97)**	(19.72)**
Distance	-0.6822	-0.7070	-0.5929	-0.7489	-0.7938	-0.8314
	(15.10)**	(15.18)**	(12.60)**	(16.48)**	(17.88)**	(19.17)**
Commuting Time	0.5017	0.3976	0.1717	0.6858	0.2384	0.3217
	(2.68)**	(2.08)**	(0.94)	(3.72)**	(1.34)	(1.84)*
Relative Housing Price	0.0911	-0.0830	-0.0830	0.0492	0.0908	0.0981
	(0.71)	(0.64)	(1.73)*	(0.39)	(0.73)	(0.8)
Relative Wages	-0.2688	-0.3728	-0.2223	-0.3123	-0.1761	-0.2714
	(2.45)**	(3.37)**	(2.05)**	(2.82)**	(1.58)	(2.55)**
Relative Unemployment Rate	-0.0670	-0.0680	-0.0641	-0.0700	-0.1437	-0.1169
	(0.74)	(0.73)	(0.79)	(0.75)	(1.59)	(1.36)
Relative Natural Amenity	0.2730	0.2512	0.2940	0.2749	0.2704	0.2937
	(2.12)**	(1.92)*	(2.28)**	(2.14)*	(2.07)**	(2.33)**
Relative School Quality	-0.1968	-0.0700	-0.3683	-0.2638	-0.3589	-0.0451
	(1.35)	(0.48)	(2.61)**	(1.86)*	(2.50)**	(0.33)
Relative Youth Population (20-35)	-0.0128	-0.0099	-0.0096	-0.0016	-0.0093	-0.0147
	(0.96)	(0.60)	(0.74)	(0.11)	(0.86)	(1.32)
Relative Senior Population (65+)	0.0303	0.1175	0.2111	0.1942	0.3673	0.3213
	(0.58)	(2.25)**	(3.99)**	(3.76)**	(7.58)**	(6.68)**
Relative Education Attainment	-0.1357	-0.0936	-0.1159	-0.1108	-0.1161	-0.1635
	(2.38)**	(1.64)*	(2.95)**	(2.01)**	(1.61)*	(2.94)**
Number of Observations	1141	1135	1122	1200	1212	1257
Adjusted R-Square	0.8149	0.8160	0.8279	0.8171	0.8131	0.8161

Note: ** and * indicate significance at 5% and 10% level, respectively. Terms in parentheses are absolute values of t-statistics
For brevity, the estimated coefficients of destination county dummy variables (100+) are not listed. Please contact author for the list.

The results of the model show that one potential source of residents is commuters, rather than visitors. The large numbers of daily commuters can be fertile recruiting grounds for cities to convert from commuters into residents. Currently, without any incentives, those commuters have a steady propensity to migrate to their work locations. The study implies that cities can work to attract migrants. One is to reduce the social and economic costs of commuting. Cities can highlight their rich cultural amenities, schools, and city neighborhoods, reducing information uncertainty related to their cities. Civic groups can be formed that provide networking opportunities for commuters which can help them establish ties in the city. While policies may not be the determining factors in migration decisions, for commuters who are weary of the long commutes and road congestion in large metro areas those measures can push them closer to moving to cities.

6. Conclusion

This paper contributes to the literature studying the interactions between migration and commuting in an intra-regional labor market by explicitly modeling the effect of commuting flow on migration flow between two counties. The paper concludes that commuting between two counties in the initial year has a positive and significant effect on the migration in subsequent years, with an elasticity of 0.33. This paper provides evidence that increased commuting costs or reduced migration costs can help to convert commuters to migrants.

Further research in the area includes using individual data on commuters and migrants, especially longitudinal data at the individual level, to study the effect. Those data can provide finer details than the aggregate models. The individual-level data may also help to reconcile the results for relative wages, which contradict the theoretical prediction.

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References

Ali, K., M.R. Olfert, and M.D. Partridge. 2011. Urban footprints in rural Canada: Employment spillover by city size. *Regional Studies* 45(2):239-260.

Borjas, G.J. 1987. Self-selection and the Earnings of Immigrants. *American Economic Review* 77:531-553.

Bureau of Labor Statistics. 2011. *Quarterly Census of Employment and Wages, 1990 and 2000*, www.bls.gov/cew/home.htm.

Cebula, R.J. 2009. Migration and the Tiebout-Tullock hypothesis revisited. *American Journal of Economics and Sociology* 68(2):541-551.

—— 2005. Internal migration determinants: Recent evidence. *International Advances in Economics Research* 11:267-274.

—— 2002. Net interstate population growth rates and the Tiebout-Tullock hypothesis: New empirical evidence, 1990-2000. *Atlantic Economic Journal* 30(4):413-420.

—— 1990. A brief empirical note on the Tiebout hypothesis and state income tax policies. *Public Choice* 67(1):87-90.

—— 1974. Interstate migration and the Tiebout hypothesis: An analysis according to race, sex and age. *Journal of the American Statistical Association* 69:876-879.

Cebula, R.J, and G.M. Alexander. 2006. Determinants of net interstate migration, 2000-2004. *Journal of Regional Analysis and Policy* 36(2):116-123.

Cebula, R.J., and C. Curran. 1978. Property taxation and human migration. *American Journal of Economics and Sociology* 37(1):43-49.

Clark, D.E., W.E. Herrin, T.A. Knapp, and N.E. White. 2006. Incomplete compensation and migration behavior: Has anything changed between 1990 and 2000? *Journal of Regional Analysis & Policy* 36(2):140-152.

Clark, D.E., and W. J. Hunter. 1992. The impact of economic opportunity, amenities, and fiscal factors on age-specific migration rates. *Journal of Regional Science* 32(3):349-365.

Clark, W., Y. Huang, and S. Wilthers. 2003. Does commuting distance matter? Commuting tolerance and residential change. *Regional Science and Urban Economics* 33:199-221.

Clark, X., T. Hatton, and J. Williamson. 2007. Explaining U.S. immigration 1971-1998. *Review of Economics and Statistics* 89(2):359-373.

Cromartie, J., and P. Nelson. 2009. Baby boom migration and its impact on rural America. *USDA Economic Research Report 79*.

DaVanzo, J. 1983. Repeat Migration in the United States: Who moves back and who moves on. *Review of Economics and Statistics* 65:552-559.

Deding, M., T. Filges, and J.V. Ommeren. 2009. Spatial mobility and commuting: The case of two-earner households. *Journal of Regional Science* 49(1):113-147.

Deller, S.C., T. Tsai, D.W. Marcouiller, and D.B.K. English. 2001. The role of amenities and quality of life in rural economic growth. *American Journal of Agricultural Economics* 83(2):352-365.

Edmiston, K.D. 2009. Attracting the power cohort to the Tenth District. *Federal Reserve of Kansas City Economic Review* 2009(IV):69-91.

Goetz, S.J., Y. Han, J. Findeis, and K.J. Braisier. 2010. U.S. commuting networks and economic growth: Measurement and implications for spatial policy. *Growth and Change* 41(2) 276-302.

Graves, P.E. 1983. Migration with composite amenity: The role of rents. *Journal of Regional Science* 23:541-546.

Greenwood, M.J. 1985. Human migration: Theory, models, and empirical studies. *Journal of Regional Science* 25(4):521-544.

Huffman, W.E., and T. Feridhanusetyawan. 2007. Migration, fixed costs, and location-specific amenities: A hazard analysis for a panel of males. *American Journal of Agricultural Economics* 89(2):368-382.

Karemera, D., V.I. Oguledo, and B. Davis. 2000. A gravity model analysis of international migration to North America. *Applied Economics* 32:1745-1755.

Lowry, I.S. 1966. *Migration and Metropolitan Growth: Two Analytic Models*. San Francisco: Chandler Publishing.

Margulis, H.L. 2001. Household mobility, housing traits, public goods, and school quality in Cleveland's metropolitan statistical area. *Urban Affairs Review* 36(5):646-677.

McQuaid, R.W. 2006. Job Search Success and Employability in Local Labor Market. *Annals of Regional Science* 40:407-421

Mills, B., and G. Hazarika, 2001. The migration of young adults from non-metropolitan counties. *American Journal of Agricultural Economics* 89(2):329-340.

Mincer, J. 1978. Family migration decisions. *Journal of Political Economy* 86:749-773.

Miseszkowski, P. and E.S. Mills. 1993. The cause of metropolitan suburbanization. *Journal of Economic Perspectives* 7(3):135-147.

Partridge, M.D., M.K, Ali, and M.R. Olfert. 2010. Rural-to-urban commuting: Three degrees of integration. *Growth and Change* 41(2):303-335.

Porell, F.W. 1982. Intermetropolitan migration and quality of life. *Journal of Regional Science* 22:137-158.

Renkow, M. 2003. Employment growth, worker mobility, and rural economic development. *American Journal of Agricultural Economics* 85(2):503-513.

Renkow, M., and D.M. Hoover. 2000. Commuting, migration, and rural-urban population dynamics. *Journal of Regional Science* 40(2):261–287.

Rouwendal, J. 2004. Search theory and commuting behavior. *Growth and Change* 35(3):391-418.

Saltz, I.S. 1998. State income taxation and geographic labor force mobility in the United States. *Applied Economics Letters* 5(5):599-604.

Shuai, X. 2010. Who benefits from job creation at county level? An analysis of leakage and spillover of new employment opportunities in Virginia. *Business Economics 45(1):38-48.*

Sjaastad, L.A. 1962. The costs and returns of human migration. *Journal of Political Economy* 70:80-93.

Snarr, H.W., and M.L. Brukey. 2006. A preliminary investigation of welfare migration induced by time limits. *Journal of Regional Analysis & Policy* 36(2):124-139.

So, K., P. Orazem, and D. Otto. 2001. The effects of housing prices, wages, and commuting time on joint residential and job location choices. *American Journal of Agricultural Economics* 83(4):1036-1048.

Tiebout, C.M. 1956. A pure theory of local expenditures. *Journal of Political Economy* 64:416-424.

Tullock, G. 1971. Public decisions as public goods. *Journal of Political Economy* 79:913-918.

Turner, R.S., and M.S. Rosentraub. 2002. Tourism, sports and the centrality of cities. *Journal of Urban Affairs* 24(5):487-492.

U.S. Census Bureau. *United States Census 2000.* www.census.gov/main/www/cen2000.html.

U.S. Department of Agriculture Economic Research Service (ERS). *Natural Amenity Scales*. www.ers.usda.gov/Data/NaturalAmenities/.

Zax J. 1994. When is a move a Migration? *Regional Science and Urban Economics* 24:341-360.