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Who Benefits from Job Creation at County Level? An Analysis of Leakage and Spillover of New Employment Opportunities in Virginia

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ABSTRACT

Using an econometric model system built on county level labor market data, this study allocates new employments in Virginia from 1990 to 2000 into various demographic segments: commuters, residents, and new immigrants. The study finds significant leakage of new employment opportunities in Virginia. 52% of new jobs created in the 1990s in a locality were taken by outside commuters. However, Virginia's localities also benefit from spillover benefits from job creation elsewhere. Economists need to account for employment leakage and spillover to accurately evaluate the fiscal impacts of potential economic development projects.

Key Words: commuting, migration, employment leakage and spillover, Virginia

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1. Introduction

Professional economists are often tasked by local governments to study the economic and fiscal impacts of economic development projects, such as industry recruiting. A typical economic and fiscal impact study estimates the total economic output and job creation of a project. It also estimates the ripple economic impact this project brings to a region, as well as tax revenues generated for local government. In those studies, three types of impact—direct, indirect, and induced are usually analyzed. The direct impact refers to the total spending and job creation directly associated with an economic development project. For example, in the case of a construction project, direct impact refers to the total amount of construction spending and the construction jobs created by this project. Indirect impact refers to economic benefits to other regional businesses which support the direct spending. In the case of a construction project, indirect impact is measured as increased sales for regional businesses which provide support services for construction, such as truck transportation and equipment leasing. Induced impact refers to the economic benefits to regional businesses as a result of additional household income. In the case of a construction project, the workers on the project will spend their wages on local businesses such as restaurants and retail shops. Those additional sales to local business are classified as induced impact.

In performing those types of analysis, especially in estimating indirect and induced economic impacts, one important assumption is where the people taking those newly created jobs live. Do they live within the study area, or outside of it? Users of the economic software packages such as IMPLAN Pro® or REMI®[1] often make the assumption that all new jobs are taken by local residents in estimating the fiscal impacts of those projects. However, economists should not take it for granted that benefits of new jobs will stay fully local. New jobs can be taken by outsiders, resulting in a leakage of employment opportunities. As America becomes more mobile, a significant and growing proportion of workers commute substantial distances between home and work. For instance, the percentage of Virginia workers who crossed county lines to work increased from 48% in 1990 to 52% 2000[2] [Census 2008]. Nationally, the percentage of individuals commuting across county lines more than doubled, from 10% in 1960 to 27% in 2000 [Renkow 2003; Census 2008]. With the exceptions of Alaska, Hawaii and Nevada, all other states experienced an increase in the percentage of out-of-county commuters between 1990 and 2000 [Census 2008]. With improvement in infrastructure and the advent of the Internet and new tele-communication technologies, the separation between location of residence and location of employment is only intensifying for American workers. Rather than moving families for job opportunities, individuals are more likely to stay where they are and undertake long-distance commuting for work. The increased mobility in labor market means that there will be leakage of job creation.

For professional economists often tasked to analyze the fiscal impacts of job creation, it is essential for them to understand job allocation among different groups of people. Taking Virginia as an example, local taxes are levied based on either businesses or residents. Local business-based taxes include sales, meal, lodging, and business, professional and occupational license (BPOL) taxes. If all local taxes are business-based, local governments may not care where workers for new jobs come from. But in Virginia, the majority of local tax revenues come

[1] Those are two of the widely used economic impact analysis tools in industry.
[2] In Virginia, cities are independent from counties, and cities and counties are equivalent jurisdictions. In this paper, for brevity purpose, when "county" is mentioned, it implicitly refer both county and independent city.

from resident-based taxes such as real estate and personal property taxes. In 2005 Fiscal Year[3], for an average Virginia locality, 48% of its local taxes were real estate taxes and 9% were personal property taxes. Adding other resident-based taxes such as utility taxes, over 60% of local tax revenues came from residents [Virginia Department of Taxation 2008]. In addition, many business-based taxes, such as sales and meal taxes, are closely related to the number of local residents, as people are more likely to spend money close to their homes.

<<Table 1 here>>

Table 1 presents the implications of different job allocation scenarios[4] on various types of local taxes.[5] Suppose a new company moves into a county, the county government can receive business-based taxes from this company regardless of who get hired, including sales, meal and lodging tax if the development projects are retail, restaurants and lodging development. If those new jobs are taken by immigrants, the local government may receive not only increased real estate and personal property tax, but also additional sales and meal taxes as those immigrants are more likely to spend their wages in their counties of residence. However, the local government will also incur additional costs to provide education, protection, and other public services for new immigrants. If new jobs are taken by existing residents, especially those who are currently unemployed, even though the local government may not benefit from incremental property taxes, it can receive more sales and meal taxes due to increased wages and salaries. Moreover, the local government can also save social cost it used to pay to the unemployed local residents. But if the

[3] In Virginia, 2005 Fiscal Year ran from July 1st 2004 to June 30th, 2005.

[4] The job allocation analyzed in this paper is the final allocation, not the initial allocation. For example, it can be the case that all jobs in a new company are taken by current resident working in the county. However, if they leave current companies for the new company, their old employers need someone to fill those vacancies. And eventually, those may be filled by commuters or immigrants.

[5] In Virginia, for 2005 fiscal year, an average of10% of local government revenues come from user fees charged for various government services. There are many types of fees, from charge for park and recreation service to vehicle registration fees. The job distribution may have different effects on those user fees. Due to numerous types of feeds local governments charge, the detailed analysis of each of those user fee are omitted in this paper.

new jobs are taken by commuters from outside this county, the local government will gain minimal tax benefits. It cannot gain any new property tax, neither can it benefit from increased sales and meal taxes, as many of those commuters will spend their wages close to their residences.[6] To accurately determine the fiscal benefits of an industry recruitment project, economists need to understand the allocation of new jobs among different population groups.

This paper presents an econometric analysis on how new employments in Virginia are distributed among different population segments—current residents, new entrants to local labor markets such as immigrants[7], or commuters. A county-level labor market model is estimated that explicitly accounts for the movements of workers across county lines, as well as adjustments within county boundaries. This study first establishes a structural equation to allocate new employments among in-commuters, out-commuters, new entrants to labor force (including in-migrants to the county, current residents who enter labor force after graduating from high schools or colleges, and current residents who return to workforce after a period out of the labor force), and the unemployed. This study then estimates how the numbers of those groups change in response to new employment opportunities, while controlling other variables such as jobs opportunities outside the county, and spatial wages and housing prices. This study finds that over 50% of new jobs created between 1990 and 2000 in Virginia were taken by in-commuters. Over 10% of them were taken by current out-commuters who stopped commuting, and close to 40% were taken by new entrants to local labor force such as immigrants. The increased new residents to a county could also raise unemployment. This leakage of employment opportunities is substantial and it calls for regional cooperation in pursuing economic development. The same methodology can be replicated to study job leakage in other states.

[6] Granted, commuters will spend some money close to work, such as lunch spending, that could increase sales or meal tax. But those impacts are minimal.

[7] In this paper, immigrants are new residents to a city or county. It is different from immigrants referred in media, which mean foreign immigrants to the United States.

This article is organized as follows. The next section summarizes the county-to-county commuting patterns in Virginia, laying foundations for model specification. The article then describes the analytical framework for examining the allocation of new jobs in a local labor market, followed by the specification of econometric model. Finally, this article analyzes the regression results and how economists can apply the findings in their economic and fiscal impact analysis.

2. Summary of Virginia Commuting Pattern

Virginia, like the rest of the nation, is becoming more mobile, resulting an increasingly large number of people traveling out of their residential counties to work. In 1990, 52% of Virginia's workers were employed in their home counties. In 2000, this percentage shrank to 48% [Census 2008]. Census data show that Virginia is one of the most mobile states in the nation, with the highest out-commuting percentage. In 2000, 52% workers commuted across county lines to work, compared with the national average of 27%. The percentage of workers commuting more than 30 miles to work also increased from 34% in 1990 to 38% in 2000 [Census 2008]. The increased labor mobility may have a profound impact on employment leakage and spillover in Virginia.

<< Figure 1 here>>

Geographically, several observations emerge regarding the commuting patterns in Virginia. Figure 2 presents the number of out-commuters from a county as a percentage of its resident labor force. The map reveals two types of communities with relatively little out-commuting activities. The first type is the job centers where businesses concentrate. Examples are Fairfax County in northern Virginia, the City of Richmond in central Virginia, and the City of Norfolk in southeast Virginia. Since there are plenty of employment opportunities in those communities, residents do not have to travel outside their home counties to work. The second type of low-commuting communities are those isolated from major job centers by natural barriers, such as counties in the western part of Virginia where the Appalachian Mountains make long distance commuting difficult. One extreme example is Page County, where over 90% of its workforce worked within the county limit in 2000. Similarly, the counties in Eastern Shore of Virginia are isolated from the rest of state by the Chesapeake Bay. Even there are few employment opportunities in those two counties, the cost of commuting outside are simply prohibitive. As a result, few residents choose to work outside Eastern Shore.

<<Figure 2 here>>

On the other hand, communities where a large portion of residents commuting outside their counties of residence to work are mostly the ones close to major job centers and along major highways. Examples are Goochland and Powhatan Counties in central Virginia, Charles City and New Kent Counties between Richmond and Hampton Roads, Prince William and Stafford Counties in Northern Virginia. Though employment opportunities in these counties may be scarce, residents can travel easily to nearby job centers to work, resulting in high out-commuting activities.

<<Figure 3 here>>

Figure 3 presents the number of cross-county in-commuters to a county as a percentage of its total employment in 2000. The places with high in-commuting activities (over 70%) are mostly independent cities such as Williamsburg, Fredericksburg, and Falls Church. Cities are traditionally business and commercial centers of a region with relatively fewer residents, resulting in high in-commuting activities. Major employment centers such as Fairfax and Richmond also had high level of in-commuting activities, but not as high as independent cities because those large job centers also had sizable resident populations. On the other hand, counties with limited in-commuting activities were economically depressed areas such as those in Southside Virginia. Limited job prospects there suppressed potential in-commuters. In addition, geographically isolated areas also experienced little in-commuting activities, such as those in Eastern Shore and western part of Virginia.

The commuting patterns in Virginia imply two powerful forces that may drive commuting flows and economic integration in Virginia—economic opportunities and geographic factors, which could impact employment leakage and spillover. Those two elements should be carefully incorporated into any models studying job allocation among different demographic segments, especially commuters.

3. Analytical Framework

This study uses a labor market model similar to the one utilized by Renkow [2003] to study the interaction between commuting and immigration in North Carolina. In this model, a county's labor market is composed of mobile workers living in a multi-county labor shed. Workers can move or commute freely among localities in a labor shed in response to changes in employment and residence opportunities. Consequently, a person in labor force may choose to live and work in the same county, or to live and work in different counties. Within each county, an individual can also be unemployed. The structural model of a local labor market is formulated below.

For county *i*, its total employment (EMP_i) equals the individuals who both live and work within the county—called resident workers (EMP_R_i), plus the workers who commute in from outside this county (COM_IN_i):

(1) $$EMP_i = EMP\_R_i + COM\_IN_i$$

The labor force of county i (LF_i) consists of the individuals who live and work in this county (EMP_R_i), the workers who live in county i but commute elsewhere to work (COM_OUT_i), and unemployed workers ($UNEMP_i$):

(2) $$LF_i = EMP\_R_i + COM\_OUT_i + UNEMP_i$$

Combining Equation (1) and (2) by substituting EMP_R_i yields an identity partitioning of a county's resident labor force:

(3) $$LF_i = EMP_i - COM\_IN_i + COM\_OUT_i + UNEMP_i$$

The purpose of this study is to see how employment changes in county i are accounted for by changes in labor force, commuting flows, and unemployment. This study uses the first order difference between 1990 and 2000 values of all variables in Equation (3) in econometric analysis. The key advantage of using the first order difference in variables is to eliminate unobserved county fixed factors [Bartik 1993; Renkow, 2006]. Differentiating Equation (3) and re-arranging it yields Equation (4):

(4) $$\Delta EMP_i = \Delta LF_i + \Delta COM\_IN_i - \Delta COM\_OUT_i - \Delta UNEMP_i$$

Equation (4) decomposes employment changes within county i into four components. Suppose a new company moves into town and has demand for labors, those new jobs can be accommodated by increased in-commuters, reduced unemployment, reduced out-commuters, or increased labor force. A reduction in the number of unemployment or out-commuters indicates that job opportunities benefit current residents, while an increase in the number of in-commuters indicates the leakages of employment opportunities to outsiders. An increase in labor force has several interpretations. It can be caused by natural population growth, increased labor market participation of local residents, or immigration. Furthermore, natural population growth depends on the birth and death rates of a locality, while labor market participation is affected by demographic factors such as new entry into and exit from local labor markets.

The rest of this section describes the econometric specification used to analyze how employment changes can affect above mentioned four population groups.

$$(5) \qquad \Delta COM\_IN_i = \alpha_1 + \alpha_2 \Delta EMP_i + \alpha_3 \Delta LSEMP_i + \alpha_4 RWAGE_i + \alpha_5 RHOUSE_i + \alpha_6 ROAD_i + \alpha_7 AREA_i + \alpha_8 METRO_i + \varepsilon_{1i}$$

Equation (5) is used to estimate the effect of factors that could influence the number of in-commuters to a local labor market. In this equation, ΔCOM_IN_i is the change in the number of in-commuters to county *i* from 1990 to 2000. ΔEMP_i, representing new job creations between 1990 to 2000, is the key independent variable. An increase in a county's new employment opportunities is expected to have a positive impact on the number of in-commuters. Changes in labor shed employment ($\Delta LSEMP_i$) represent new employment opportunities elsewhere in county *i*'s labor shed from 1990 to 2000. An increase in ($\Delta LSEMP_i$) is expected to decrease the number of in-commuters to this county.

Relative wage ($RWAGE_i$) of county *i* with respect to that of the rest of its labor shed could affect commuting flows [So et. al. 2001]. High relative wages tend to attract in-commuters and reduce out-commutes. Several studies [So et. al 2001; Renkow 2003] have also found that housing price is an important variable for residential, and consequently commuting choices. Equation (5) includes a variable measuring the relative housing price of county *i* with respect to that of the rest of its labor shed ($RHOUSE_i$). An increase in the relative housing price of county *i* is expected to raise the likelihood that individuals working in county *i* choose to live elsewhere, increasing in-commute. Thus, $RHOUSE_i$ is expected to have a positive effect on in-commuting.

Since the majority of commuting in Virginia is undertaken by cars, rather than by trains or public transits, interstate mileage in a county ($ROAD_i$) may capture certain level of commuting cost of Virginia workers. Better roads can reduce the commuting costs, resulting in increased number of in-commuting.

Virginia has an independent city system. Of all 134 local jurisdictions, 40 of them are independent cities, accounting for over 30% of all county-level jurisdictions. The Virginia system is unique that a city does not belong to a county, neither can Virginia's cities annex surrounding communities as cities in other states can. This legislative peculiarity may artificially inflate cross-county commuting flows in Virginia. Since many jobs are in cities, should city belong to a county, or can freely annex nearby counties, the high in-commuting to cities may be reduced. To control those effects, the model introduces the variable of land area ($AREA_i$) in the model.

In addition, some previous studies have found that there was difference in labor market adjustment to new employment opportunities between metro and rural counties. For example, Renkow [2006] found that new jobs in metro counties are more likely to be taken by commuters. To capture rural-metro differences, this model system incorporates a dummy variable (*METRO*), taking the value of 1 for a metro county and 0 for a rural county.

$$(6) \quad \Delta COM\_OUT_i = \beta_1 + \beta_2 \Delta EMP_i + \beta_3 \Delta LSEMP_i + \beta_4 \Delta LF_i + \beta_5 RWAGE_i + \beta_6 RHOUSE_i + \beta_7 ROAD_i + \beta_8 AREA_i + \beta_9 METRO_i + \varepsilon_{2i}$$

Equation (6) describes factors that could affect the number of out-commuters from a county. In this equation, ΔCOM_OUT_i is the change in the number of out-commuters from county *i* between 1990 and 2000. An increase in a county's new employment opportunities (ΔEMP_i) is expected to have a negative impact on the number of out-commuters, while an increase in labor shed employment ($\Delta LSEMP_i$) should have a positive effect on the number of out-commuters from this county. The size of the labor force of a locality (ΔLF_i) should also have a positive effect on out-commuters, as it represents the source population of out-commuters.

Relative wage ($RWAGE_i$) of county *i* with respect to that of the rest of its labor shed may reduce out-commutes, while an increase in the relative housing price ($RHOUSE_i$) of county *i* is expected to raise the likelihood that individuals working in county *i* choose to live elsewhere, decreasing out-commute. Similar to Equation (5), more interstate mileage in a county ($ROAD_i$) may lead to increased out-commuting activities, and land area ($AREA_i$) could have a negative correlation with number of out-commuters. To capture rural-metro differences, this equation incorporates a dummy variable (*METRO*), taking the value of 1 for a metro county and 0 for a rural county.

$$(7) \qquad \Delta LF_i = \varphi_1 + \varphi_2 \Delta EMP_i + \varphi_3 \Delta LSEMP_i + \varphi_4 RWAGE_i + \varphi_5 RHOUSE_i + \varphi_6 METRO_i + \varphi_7 AGE10\_20_i + \varphi_8 AGE50\_65_i + \varepsilon_{3i}$$

Equation (7) describes factors that could affect size of labor force in a county. In this equation, ΔLF_i is the change in the size of labor force in county *i* from 1990 to 2000. ΔEMP_i is expected to lead to an increase in the size of labor force in county *i*, as new employment opportunities may induce higher labor participation or attract people to migrate to this county. Changes in labor shed employment ($\Delta LSEMP_i$) represent new employment opportunities elsewhere in county *i*'s labor shed. This variable is expected to have a positive effect on the size of labor force of county *i* as people move to the region for new jobs may choose to live in county *i*. Relative wage ($RWAGE_i$) of county *i* with respect to that of the labor shed is expected to have a positive effect on people's residential choices, as people tend to move into areas with higher income. The relative housing price of county *i* with respect to that of the rest of its labor shed ($RHOUSE_i$) should decrease labor force living in that county *i*. To capture rural-metro differences, this model incorporates a dummy variable (*METRO*), taking the value of 1 for a metro county and 0 for a rural county.

In addition, since a county's labor force is also influenced by demographic forces such as birth, death and retirement, Equation (7) includes two demographic variables to capture those effects. In particular, variables representing the size of population in two age cohorts in 1990 were incorporated. $AGE10\_20_i$ is number of persons expected to enter labor force from 1990 to 2000, which should have a positive effect on the size of labor force. $AGE55\_65_i$ is number of persons expected to retire or exit from labor force during the decade, which should have a negative effect on the size of labor force in a county.

Finally, after Equation (5)-(7) are estimated, the unemployment of a region can be solved using the following equation.

(8) $$\Delta UNEMP_i = \Delta LF_i - \Delta EMP_i + \Delta COM\_IN_i - \Delta COM\_OUT_i$$

4. Data and Data Source

All Virginia's cities and counties are included in this study, resulting in a total of 134 observations. This analysis also employs data from a handful of counties in adjoining states that belong to the labor shed of Virginia's localities. These include bordering counties in Maryland, West Virginia, Tennessee, Kentucky, North Carolina, and the District of Columbia. Data on those localities are used to calculate labor shed employment, wages and housing prices. The labor shed of county *i* is defined as a set of counties and cities (including *i*), in which 90% people working in county *i* live. On average, each county's labor shed includes about 8 surrounding counties and cities.

The county-to-county commuting flow data came from the 1990 and 2000 Census. ΔCOM_IN_i is the change in the number of in-commuters to county *i* from 1990 to 2000. ΔCOM_OUT_i is the change in the number of in-commuters to county *i* from 1990 to 2000. The labor force and unemployment data also came from the 1990 and 2000 Census. ΔLF_i is the change in the size of labor force in county *i* from 1990 to 2000. A person is in labor force is he or she is either employed, or unemployed but is looking for work. $\Delta UNEMP_i$ is the change in the number of unemployed workers in county *i* from 1990 to 2000. Labor shed employment

($LSEMP_i$) was calculated as the total employment within county *i*'s labor shed, excluding that in county *i*. This variable was calculated for both 1990 and 2000 before the difference ($\Delta LSEMP_i$) was computed. Additionally, $AGE10\_20_i$ and $AGE55\_65_i$ were the number of residents between age 10 and 20, and between age 55 and 65 in 1990 in county *i*. They were from Census 1990.

Relative housing cost ($RHOUSE_i$) was computed using Census 1990 data. The 1990 Census provided median home value of each county. To arrive at relative housing price, county *i*'s median house price was divided by the weighted average of median home prices of all counties within *i*'s labor shed, excluding county *i.*

Relative wage ($RWAGE_i$) was calculated with county annual average wage data from the Bureau of Labor Statistics. They were computed as county *i*'s average wage per worker divided by the weighted annual average wages of all counties in the labor shed, excluding county *i*. 1990 value were used in the regression.

Land area and population data for each locality also came from the Census Bureau. Finally, interstate mileage data ($ROAD_i$) were obtained from a database maintained by Virginia Economic Development Partnership. Table 2 presents summary statistics of those variables.

<< Table 2 here >>

5. Estimation and Results

Table 3 presents the Ordinary Least Square (OLS) regression results. This set of independent variables explained changes in in-commute, out-commutes and labor force well, with R^2 of 0.94, 0.83, and 0.76 for Equation (5), (6), and (7) respectively.

<<Table 3 here>>

The responses of changes in in-commute, out-commute, and labor force to employment changes in county *i* (ΔEMP_i) all have expected signs. The coefficient estimates (α_2, β_2 and φ_2) are significant at the 95% confidence level. For one new job in a Virginia's locality, the number of in-commuters will increase by 0.52, while the number of out-commuters will decline by 0.12. The county's resident labor force will increase by about 0.39, through immigration or increased participation. Those estimates implied an employment leakage of 52%. Solving for Euqation (8), it is estimated that each new job in a county actually increases the number of unemployment by 0.02. In theory, increased employment opportunity in a county should reduce its unemployment. However, the model result indicates an increase in the unemployment in response to new employment opportunities. This peculiar result has been observed by other studies [Renkow 2006; Barkley et. al. 2002]. One interpretation of this result is that there is some type of over-shooting in the adjustment of labor force to new employment opportunities. For example, it is common for a household to immigrate to a county for new jobs. Often, only one member of the dual-worker household finds a job, and the other member becomes unemployed. In that case, increased employment opportunities would increase unemployment.

Employment opportunities elsewhere ($\Delta LSEMP_i$) in the labor shed of county *i* has significant impacts on two of the three independent variables—out-commuters and labor force. Each new job elsewhere can increase the number of out-commuter from county *i* by 0.04. In addition, each new job elsewhere can also increase local labor force by 0.03. Both coefficients (β_3 and φ_3) are significant at 95% confidence level and have expected signs. Those results indicate that employment opportunities elsewhere in a labor shed attract immigrants to county *i*, and they can also benefit current residents in county *i*, as both existing and new residents in county *i* can enjoy the spillover benefits of job creation elsewhere. The model also shows that employment opportunities elsewhere may also reduce the number of in-commuters to county *i*, as it has an expected negative sign. Yet, the coefficient estimate (α_3) is insignificant.

Relative wage of a county ($RWAGE_i$) has an expected significant and positive effect on in-commute to county *i*. High relative wages in county *i* attract more commuters, as the coefficient estimate (α_4) is positive and significant. This variable should also reduce out-commuting, but that coefficient (β_5) is not significant.

The relative housing price of a county ($RHOUSE_i$) emerges as a significant factor for both commuting flows and labor force. High relative housing price in county *i* should drive people out, resulting in more in-commuting and less out-commuting. While the model results indicate that high relative housing price can reduce out-commuting, they also seem to suggest that high housing price seems to reduce the number of in-commuters also. The possible explanation is that during the 1990s, there is tremendous growth in outlying low-cost counties as opposed to cities. For example, the annual employment growth rate of all Virginia's central cities was 0.21% from 1990 to 2004, while that of all their suburbs was 1.76% [Shuai 2005]. That results in more in-commuting to low cost suburban counties, even though housing costs in cities are relatively high.

The empirical results also show that geographical factors are important in affecting commuting flows. For example, the length of interstate highway in a county ($ROAD_i$) has significant impact on both in-commuting and out-commuting. More interstate highway can reduce commuting time and commuting cost, thus stimulating commuting in both directions. An extra mile of interstate can boost the number of in-commuters by 37 persons per county, and out-commuters by 32 persons per county. Note that this variable has symmetric impact on commuting in both directions, as the magnitudes of coefficient estimates are similar.

The regression results also reveal that the intensity of commuting also has an artificial aspect. The independent city system of Virginia leads to artificially small land areas for 40 Virginia's cities. The model shows that the land area of a county ($AREA_i$) has strong and negative impacts on commuting flow in both directions, with smaller localities experiencing more commuting activities. Each new square mile of land area can reduce the number of in-commuters by 2.6 and the out-commuters by 1.6. If cities are free to consolidate or annex nearby communities as they grow, there may not be such high level of commuting activities in Virginia.

The demographic forces have a strong influence on the size of a county's labor force. As expected, the number of people aged between 10 and 20 year old ($AGE10\_20_i$) in 1990 has a strong and positive effect on the change in a county's labor force, while the number of people aged between 55 and 65 year old ($AGE55\_65_i$) has a strong and negative effect on a county's workforce.

In addition, the change in a county's labor force (ΔLF_i) has a strong and significant effect on the number of out-commuters from a county. An increase in the labor can increase the number of out-commuters by 0.8. The coefficient estimate (β_4) is significant at 95% confidence level.

Examination of the coefficient estimate of dummy variable ($METRO_i$) indicates significant rural-urban differences in labor market adjustment. The coefficients estimates of the metro dummy are positive and significant for both in-commute and out-commute equations. Other things equal, localities in MSA are much more mobile than rural counties, with high level of commuting activities. This can be due to factors such as easy information flow and communication in metro counties, resulting in more people aware of the job opportunities in a metro labor market, boosting commuting. This is consistent with other studies that more adjustment to employment changes is through commuting in metro areas than rural counties [Renkow 2006]. No significant rural/metro difference is found in terms of labor force as coefficient estimates for dummy variables are insignificant in those two equations.

The key findings of this analysis is that 64% of new employment opportunities in Virginia is accounted for by changes in commuting flows, with 52% as increased in-commuting and 12% as decreased out-commuting. This is after controlling other variables affecting commuting, such as land area, interstate miles, relative wages, and labor shed employment. The rest (39%) of new jobs are accounted for by new entrants to labor force such as migration. The fact that over half (52%) of new jobs are taken by outsiders suggests substantial leakages of benefits associated with job creation in Virginia. Failure to take account of this leakage in fiscal analysis may lead to an overstatement of benefits of economic development projects. At the same time, the results here also point to sizable spatial spillovers of employment growth. Each new job elsewhere in the labor shed of a county can increase its out-commuters from a county by 4% and its labor force by 3%.

This analysis provides practical guidelines for professional economists to evaluate the fiscal impacts of industry recruitment projects. When a new company moves to town, compared with the assumptions that all benefits stay in a county, local government in Virginia needs to realize that the actual tax revenue will be much smaller. For tax related to consumer spending, such as sales and meal tax, fiscal benefits should be discounted by about half, as only about 48% of increased wages and salaries will likely go to county residents. For residents based taxes such as property tax, the realized tax should be discounted by about 61%, as only about 39% of the new job opportunities are accommodated by new entrants to labor market, resulting in demand for new housing.

Another implication of this model is that regional governments should cooperate with each other and share the costs of incentive packages in industry recruitment. The analysis of employment leakage and spillover indicates significant positive and negative externalities of job creation. Industry recruitment should be done through the cooperation by several counties in a highly integrated local economy. Results in this study about allocation of new jobs can be used to draft revenue and cost sharing agreements for regional partnership.

6. Conclusion

In this article, a local labor market model for Virginia's cities and counties is estimated that explicitly accounts for movements of workers across county lines, in addition to within-county adjustments. The model allocates new employment in a county among residents of nearby counties and local residents, with the latter group comprising both residents currently working outside a county and new entrants into the local labor force, such as new immigrants.

The econometric results indicate that 52% of new jobs are filled by in-commuters, 12% by current residents who would stop commuting outside to work, and 39% by new entrants to labor force such as immigrants. Economists need to take account of this leakage in economic planning and analysis to avoid overstating the economic impacts of a project.

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