COMMUTING AND EMPLOYMENT SHOCKS:
IMPLICATIONS FOR ECONOMIC AND FISCAL IMPACT ASSESSMENT

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Abstract

We develop a labor market model that explicitly accounts for movements of workers across county lines – in addition to within-county labor market adjustments – when an exogenous labor demand shock takes place. The model thus allocates newly created jobs between residents of nearby counties and local residents, the latter group including both those currently working outside the county and new entrants into the local labor force. We estimate the model using 1990 county level data from North Carolina. The results indicate that about two-thirds of the adjustment of labor supply to new employment opportunities is accounted for by increased in-commuting, and that nearly all the rest of the response is made up by decreases in out-commuting. We conclude from this that, at least in the short-run, fiscal impacts associated with residential demands for publicly provided services (e.g., schools) and residential provision of tax revenues (e.g., property taxes) will be quite
Commuting and Employment Shocks: Implications for Economic and Fiscal Impact Assessment

Introduction

Community economic and fiscal impact models rely on a correctly specified labor market model to measure the effects of a change in local industrial structure on a community’s economy and its public finances. All too often, these models ignore flows of laborers who commute across county lines or other relevant jurisdictional boundaries. Instead, it is typically assumed that all labor market adjustments occur within the confines of the spatial unit of observation. To the extent that laborers are in fact mobile, this assumption generally will lead to overestimation of local labor supply response to exogenous labor demand shocks. This in turn would tend to bias upward estimates of the fiscal impacts of employment growth.

In this paper we develop a labor market model that explicitly accounts for movements of workers across county lines – in addition to within-county labor market adjustments – when an exogenous labor demand shock takes place. The model features structural equations for in-commuting, out-commuting, labor force participation, and local unemployment, relating these variables to labor demand shocks and controlling for spatial wage and housing price differentials. The model thus allocates newly created jobs between residents of nearby counties and local residents, the latter group including both those currently working outside the county and new entrants into the local labor force.

We estimate the model using 1990 county level data from North Carolina. Estimation results are generally consistent with a priori expectations concerning the impact of relative wages and employment shocks on commuting and unemployment. We find that about two-thirds of the adjustment of labor supply to new employment opportunities is accounted for by increased in-commuting, and that nearly all the rest of the response is made up by decreases in out-
commuting. We conclude from this that, at least in the short-run, fiscal impacts associated with residential demands for publicly provided services (e.g., schools) and residential provision of tax revenues (e.g., property taxes) will be quite limited.

The paper is laid out as follows. In the next section, we offer a simple conceptual framework for assessing employment shocks when commuting is explicitly recognized as an option available to workers. Next, we propose an empirical model for implementing the conceptual framework. Following discussions of data used and econometric issues, we present our results. Some concluding remarks are found in the final section.

**Conceptual Framework**

Consider a spatial labor market composed of mobile workers living in several counties. We take as an underlying premise that individuals make three related choices regarding workplace and residence: where to live, whether or not to participate in the labor force, and – contingent on the labor force participation decision – where to work.\(^1\) Workers are assumed to be able to move between counties in response to changes in employment and residence opportunities within the multi-county area. Thus, a working person may choose to live and work in the same county, or s/he may live in one county and commute to another.\(^2\)

Within a given county, total employment at time \(t\) (\(\text{EMP}_t\)) is accounted for by individuals who both live and work within the county (\(L^H_t\)) plus workers who commute in from nearby counties (\(\text{INCOM}_t\)):

\[
\text{EMP}_t = L^H_t + \text{INCOM}_t
\] (1)

The labor force (\(\text{LF}_t\)) within a given county is composed of individuals who both live and work in the county, workers who live in the county but work in a different county (\(\text{OUTCOM}_t\)), and unemployed persons (\(\text{UNEMP}_t\)):
\[ LF_t = L_{L_t}^H + OUTCOM_t + UNEMP_t \]  

Combining these expressions yields an identity partitioning a county’s labor force:

\[ LF_t = EMP_t - INCOM_t + OUTCOM_t + UNEMP_t \]  

Taking first differences of equation (3) and re-arranging makes it clear that labor market responses to an employment shock in a particular county will at least potentially take a variety of forms, including changes in the number of in-commuters and out-commuters, changes in the level of unemployment, and changes in labor force participation:

\[ \Delta EMP = \Delta LF + \Delta INCOM - \Delta OUTCOM - \Delta UNEMP \]  

It is useful to contrast this formulation to standard treatments of local labor markets in most input-output and fiscal impact models. Those models generally have assumed (usually implicitly) that positive employment shocks are equilibrated internally (Miernyk 1965; Halstead and Johnson 1986; Swallow and Johnson 1987; Siegel and Leuthold 1993). In other words, when a firm or industry brings new jobs to a county, these jobs are taken entirely by residents of the county. The new employees may be in-migrants, in which case employment growth within a county translates into a one-to-one increase in population and the concomitant increase in the effective demand that accompanies population growth. Alternatively, the new employees may be current residents of the county, either emerging from the ranks of the unemployed or newly entering the labor force. In this case, population would remain constant; however, effective demand growth would still grow in line with the income growth created by the new jobs.

But as equation (4) makes clear, employment shocks are likely to lead to adjustments in commuting flows as well. To the extent that these adjustments in commuting flows are
important empirically, standard input-output models will overestimate the size of increases in final demand and attendant multiplier effects. This has significant implications for fiscal impact assessment of employment shocks. By ignoring adjustments accounted for by increased commuting flows, standard treatments will tend to overstate the impact of positive labor demand shocks on both the demands for publicly provided services and the contribution of tax revenues (especially property tax revenues). Determining the degree of this overstatement is an empirical question whose answer depends on the relative magnitude of the response to employment shocks of labor force participation, in-commuting, out-commuting, and unemployment.

**Empirical Model**

We posit the following set of equations describing in-commuting, out-commuting, unemployment, and labor force participation within a given county $i$:

\[
\text{INCOM}_i = f^I(\text{EMP}_i, \text{LF}_i, \text{CZEMP}_i, \text{RWAGE}_i, \text{RHOUSE}_i, \text{METRO}_i) \\
\text{OUTCOM}_i = f^O(\text{EMP}_i, \text{LF}_i, \text{CZEMP}_i, \text{RWAGE}_i, \text{RHOUSE}_i, \text{METRO}_i) \\
\text{LF}_i = f^L(\text{EMP}_i, \text{CZEMP}_i, \text{RWAGE}_i, \text{METRO}_i) \\
\text{UNEMP}_i = f^U(\text{EMP}_i, \text{CZEMP}_i, \text{RWAGE}_i, \text{METRO}_i)
\]

where

- $\text{CZEMP}_i$ = total employment in other counties within county $i$’s commuting zone
- $\text{RWAGE}_i$ = the wage in county $i$ relative to other counties within the same commuting zone
- $\text{RHOUSE}_i$ = the cost of housing in county $i$ relative to the cost of housing in other counties within county $i$’s commuting zone
- $\text{METRO}_i$ = a dummy variable equal to 1 for metro counties and 0 for rural counties
The expected signs of the first derivatives are given underneath the individual variables. We take the employment variables EMP and CZEMP to be proxies for labor demand within the county and within the wider commuting zone within which the county is located. Hence, a positive shock to within-county employment (EMP) is expected to have a positive impact on in-commuting and a negative impact on out-commuting, while a positive shock to CZEMP is expected to have the opposite effects on commuting flows. We further expect increased employment within the county to have a positive impact on the size of the labor force, either through increased participation rates or through in-migration. Its likely impact on the level of unemployment is ambiguous, however, depending on whether or not labor force growth is greater than the number of new jobs. The impact of CZEMP on labor supply and unemployment within a given county is ambiguous. These effects will depend on two things, neither of which can be signed a priori: (a) the degree to which residential mobility is greater or less than workplace mobility; and (b) the relative balance between job growth in the commuting zone and labor force growth within individual counties.

We expect relative wages to exert a positive influence on in-commuting and a negative influence on out-commuting. Ceteris paribus, higher relative wages will draw in workers from nearby counties and make non-local employment opportunities comparatively less attractive to (current) out-commuters. Higher wages should also have a positive impact on labor force participation. Their effect on unemployment is ambiguous, however, depending on whether the positive impacts on participation cause more laborers to enter the market than can be accommodated by greater employment opportunities underlying wage increases.

The in-commuting and out-commuting equations also include labor force and relative housing price variables. The former is included to capture forces emanating from the supply side of the labor market. All else equal, we would expect a greater local labor supply to be negatively
correlated with in-commuting and positively correlated with out-commuting. Relatively costly housing in a county is expected to increase the likelihood that individuals employed within that county choose to live elsewhere. Thus, we expect the sign of the coefficient on the housing cost variable to be positive for in-commuting and negative for out-commuting.

Finally, in order to account for scale effects we included a dummy variable taking the value of 1 for a metro county and 0 for a rural county. This variable also picks up agglomeration effects in urban labor markets. The metro dummy is expected to have positive coefficients in all cases.

**Data and Variable Construction**

We implemented our empirical model using 1990 county-level data for North Carolina. The commuting, employment and wage data come from the Journey-to-Work files of the Census. County-level data on employment, unemployment, labor force, and population were taken from the BEA’s Regional Economic Information System. Employment is the number of full time job equivalents by place of work, while labor force and unemployment data are by place of residence. Commuting zone employment (CZEMP) for each county was calculated as the total employment within the county’s commuting zone net of county employment. Designation of counties as metro and rural counties are based on the BEA’s 1980 definition. By this definition, North Carolina is composed of 25 metro and 75 rural counties.

Relative wages were computed based on the county average wage for six one-digit SIC categories – construction, government, manufacturing, services, transportation and communication, wholesale and retail trade. Together, these account for more than 90% of total employment in North Carolina (Renkow, Hoover, and Yoder 1997). The average wage for each industry was weighted by the number of individuals working in that industry to compute the countywide average wage. The relative wage variable (RWAGE) was then computed as the ratio
of the average wage in county and the commuting zone average wage. This is similar to the procedure used by Tokle and Huffman (1991) for measuring relative wages in their study of male and female labor force participation.

Housing costs were computed using Census data on the median price of a single family house in each county. As with the relative wage variable, our indicator for the relative housing price is the ratio of the county median housing price to the commuting zone median housing price.

Table 1 presents summary statistics, broken down by metro and rural counties. These indicate substantial variation in all workforce and population size components, and considerably less spatial variation in wages and housing prices. Not surprisingly, all figures are larger for metro counties than for rural counties; t-tests confirmed that these differences are significant.

**Results**

We estimated equations (4) - (7) using three stage least squares. Endogenous variables in the system included in-commuting (INCOM), out-commuting (OUTCOM), labor force participation (LF), and unemployment (UNEMP). Our instrument set included county population, county population density and the distance to the nearest SMSA, in addition to all of the exogenous variables contained in the system. We restricted the system on the basis of the identity partitioning changes in county employment into its component parts (equation (4)). That is, we imposed the cross-equation restriction $\beta_I - \beta_O + \beta_L - \beta_U = 1$ where $\beta_I, \beta_O, \beta_L, \beta_U$ denote the coefficients on employment in the in-commuting, out-commuting, labor force, and unemployment equations, respectively.

Based on existing evidence of significant rural-urban differences in the response of commuting to various factors (Renkow and Hoover 2000), we ran regressions that included
variables interacting the metro dummy with employment, relative wages, and relative housing prices. Somewhat to our surprise, we found little evidence of rural-urban disparities in the response of any of the dependent variables. Because of this, we only report econometric estimates that assume common responses for rural and metro counties.

Table 2 presents the regression results. The data fit the model extremely well, as indicated by a system weighted $R^2$ of .977. In the main, parameter estimates were significant and of the hypothesized sign. There were a couple of unexpected results, however. Contrary to expectations, the coefficient on the commuting zone employment variable (CZEMP) was positive for the in-commuting equation. It is possible is that this variable is capturing the effects of the size of the overall (multi-county) labor market within which specific counties are located, rather labor demand in neighboring counties. The fact that the parameter estimates for CZEMP are nearly identical for both in-commuting and out-commuting equations would appear to support this contention.

The other unexpected result is that the signs of the parameter estimates for the wage and housing cost variables in the out-commuting equation were the opposite of what had been predicted. Renkow and Hoover (2000) found that net out-commuting flows in North Carolina were significantly affected by both of these variables in the direction hypothesized here. However, they were examining data for county pairs, whereas the current analysis is examining out-commuting regardless of destination. It may well be that the normalization used here for computing relative wages and housing prices is inadequate to capture the true spatial differences within the geographic area over which commuters are actually traveling.

The key empirical result of interest lies in a comparison of the relative size of the response of the dependent variables to employment. This can be seen in the first row of Table 2. There it
will be observed that for every 100 jobs created by a hypothetical employment shock, 67 will be filled by new in-commuters, 32 will be taken by individuals who formerly were out-commuting, one less person will be unemployed, and there will be no significant change in the size of the labor force.

The finding that two-thirds of new jobs created by an employment shock go to workers from outside the county highlights the large degree of spatial mobility among North Carolina workers. It also has important implications for economic impact analysis. That such a large share of employment growth is met externally suggests that leakages associated with employment shocks are substantial. Failure to take account of these leakages translates into overstatement of increases in final demands for the county in which the shock occurs. Of course, were the spatial unit of observation to expand from county to, say, commuting zone, the magnitude of this overstatement would be attenuated.

The implications of our empirical results for assessing fiscal impacts of employment growth are perhaps even more striking. There has been a tendency in the impacts literature to assume that employment growth translates into equivalent population growth. Our results offer a starkly contrasting view, indicating that nearly all adjustments are accounted for by changes in commuting flows (including both increased in-commuting and reduced out-commuting). As such, fiscal impacts associated with changes in both residential demands for publicly provided services (e.g., schools) and residential provision of tax revenues (e.g., property taxes) will in fact be quite limited.

One caveat to these conclusions is warranted, however. Given that we have been working with cross-sectional data, we could not explicitly account for migration flows that might accompany follow from employment shocks. There is ample evidence that these can be
significant (Carlino and Mills 1992), at least over the long-run. Consequently, our conclusions should be viewed as more applicable to short-run impacts.

**Concluding Remarks**

In this paper we have developed and estimated a labor market model that explicitly accounts for movements of workers across county lines – in conjunction with labor market adjustments that occur within a county – when an exogenous labor demand shock takes place. The model features structural equations for in-commuting, out-commuting, labor force participation, and local unemployment, relating these variables to labor demand shocks while controlling for spatial wage and housing price differentials.

Our empirical model allowed us to allocate newly created jobs between in-commuters from nearby counties and local residents – residents currently working outside the county, unemployed workers, and new entrants into the local labor force. The empirical results indicate that nearly all of the adjustment of labor supply to new employment opportunities is accounted for by changes in commuting flows (including both increased in-commuting and reduced out-commuting). As such, we conclude that fiscal impacts associated with residential demands for publicly provided services (e.g., schools) and residential provision of tax revenues (e.g., property taxes) will be quite limited. In addition, we found that increased in-commuting accounts for the lion’s share of labor supply adjustment. Hence, internal increases in final demands brought about by employment shocks – and the attendant economic impacts – are substantially smaller than would be indicated by standard models that ignore commuting.

One important caveat to our results is that we have not modeled residential mobility here. This was inevitable, since ours was a cross-sectional analysis using data from only one point in time. As such, our empirical findings are best interpreted as being short-run in nature. Over a
longer run, one would expect labor market shocks to give rise to residential relocation.

Explicitly modeling migration as part of the system of equations describing local labor market adjustments employment shocks represents a useful extension to the current analysis.
References


Footnotes

1. Note that we abstract from issues surrounding multiple earner households throughout this paper, assuming that each household is composed of no more than one earner. Several researchers have modeled explicitly the location behavior of dual income households (cf. White, 1977; Madden, 1980; Freedman and Kern, 1997).

2. In this paper “commuting” refers to crossing county lines to go to work.

3. Shields, Stallman, and Deller (1999) and Shields (2000) are examples of recent attempts to incorporate in-commuting into economic and fiscal impacts models, but do not consider out-commuting. Swenson and Otto (2000), on the other hand, propose a labor market model that includes both out-commuting and in-commuting.

4. We employ the delineation of commuting zones established by Killian and Tolbert (1991).

5. Strictly speaking, labor force participation is a function of the real wage within the county and its relationship to the average reservation wage of the county’s workers. However, the variable we use as a proxy for the relative wage – the mean county wage relative to the commuting zone average – will pick up this effect, since a change in our constructed wage variable will be dominated by within-county wage movements.

6. Most of the data were provided by the Community Policy Analysis Network (CPAN) data bank, whose assistance is gratefully acknowledged.
Table 1. **Sample Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Coefficient of Variation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Metro counties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor force</td>
<td>82,492</td>
<td>0.86</td>
<td>15,001</td>
<td>288,410</td>
</tr>
<tr>
<td>Employment</td>
<td>83,333</td>
<td>1.04</td>
<td>7,606</td>
<td>358,008</td>
</tr>
<tr>
<td>In-commuters</td>
<td>19,046</td>
<td>1.23</td>
<td>1,414</td>
<td>99,065</td>
</tr>
<tr>
<td>Outcommuters</td>
<td>14,762</td>
<td>0.52</td>
<td>5,056</td>
<td>35,954</td>
</tr>
<tr>
<td>Unemployment</td>
<td>3,442</td>
<td>0.87</td>
<td>522</td>
<td>11,183</td>
</tr>
<tr>
<td>CZ employment</td>
<td>326,308</td>
<td>0.48</td>
<td>118,725</td>
<td>533,328</td>
</tr>
<tr>
<td>Population</td>
<td>150,304</td>
<td>0.84</td>
<td>27,544</td>
<td>511,433</td>
</tr>
<tr>
<td>Wage</td>
<td>17,946</td>
<td>0.14</td>
<td>13,256</td>
<td>23,882</td>
</tr>
<tr>
<td>Housing price</td>
<td>61,871</td>
<td>0.20</td>
<td>48,070</td>
<td>93,290</td>
</tr>
<tr>
<td>Relative wage a</td>
<td>1.039</td>
<td>0.13</td>
<td>0.818</td>
<td>1.345</td>
</tr>
<tr>
<td>Relative housing price a</td>
<td>1.086</td>
<td>0.16</td>
<td>0.776</td>
<td>1.447</td>
</tr>
<tr>
<td><strong>Rural counties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor force</td>
<td>18,683</td>
<td>0.74</td>
<td>1,708</td>
<td>55,950</td>
</tr>
<tr>
<td>Employment</td>
<td>15,978</td>
<td>0.80</td>
<td>873</td>
<td>53,240</td>
</tr>
<tr>
<td>In-commuters</td>
<td>2,972</td>
<td>0.87</td>
<td>107</td>
<td>14,294</td>
</tr>
<tr>
<td>Outcommuters</td>
<td>4,649</td>
<td>0.73</td>
<td>418</td>
<td>17,601</td>
</tr>
<tr>
<td>Unemployment</td>
<td>1,027</td>
<td>0.70</td>
<td>130</td>
<td>3,653</td>
</tr>
<tr>
<td>CZ employment</td>
<td>135,850</td>
<td>1.03</td>
<td>9,289</td>
<td>533,328</td>
</tr>
<tr>
<td>Population</td>
<td>38,281</td>
<td>0.70</td>
<td>3,856</td>
<td>107,924</td>
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<tr>
<td>Wage</td>
<td>15,206</td>
<td>0.12</td>
<td>11,730</td>
<td>21,293</td>
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<tr>
<td>Housing price</td>
<td>50,006</td>
<td>0.22</td>
<td>34,375</td>
<td>99,357</td>
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<tr>
<td>Relative wage a</td>
<td>0.987</td>
<td>0.10</td>
<td>0.748</td>
<td>1.357</td>
</tr>
<tr>
<td>Relative housing price a</td>
<td>0.971</td>
<td>0.16</td>
<td>0.709</td>
<td>1.534</td>
</tr>
</tbody>
</table>

a. These are mean county values divided by average values for averages for the entire commuting zone within which the county is located.
### TABLE 2. REGRESSION RESULTS

<table>
<thead>
<tr>
<th>Variable</th>
<th>In-commuting</th>
<th>Out-commuting</th>
<th>Labor Force</th>
<th>Unemployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>County employment</td>
<td>0.668***</td>
<td>-0.319***</td>
<td>0.002**</td>
<td>-0.011***</td>
</tr>
<tr>
<td></td>
<td>(.037)</td>
<td>(.037)</td>
<td>(.001)</td>
<td>(.001)</td>
</tr>
<tr>
<td>County labor force</td>
<td>-0.494***</td>
<td>0.438***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.042)</td>
<td>(.042)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commuting zone employment</td>
<td>0.011***</td>
<td>0.011***</td>
<td>-0.071***</td>
<td>-0.004***</td>
</tr>
<tr>
<td></td>
<td>(.002)</td>
<td>(.002)</td>
<td>(.005)</td>
<td>(.0004)</td>
</tr>
<tr>
<td>Relative wage$^b$</td>
<td>7257.2**</td>
<td>8413.7**</td>
<td>114012***</td>
<td>6386.8***</td>
</tr>
<tr>
<td></td>
<td>(3131.1)</td>
<td>(3302.4)</td>
<td>(6749.5)</td>
<td>(648.7)</td>
</tr>
<tr>
<td>Relative housing price$^b$</td>
<td>184.5</td>
<td>188.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1846.9)</td>
<td>(1848.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro dummy</td>
<td>2030.7**</td>
<td>3076.1***</td>
<td>58606.3***</td>
<td>2853.4***</td>
</tr>
<tr>
<td></td>
<td>(804.8)</td>
<td>(848.9)</td>
<td>(1513.8)</td>
<td>(160.9)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-6736.9**</td>
<td>-7792.7**</td>
<td>-88067***</td>
<td>-4763.0***</td>
</tr>
<tr>
<td></td>
<td>(3018.1)</td>
<td>(3194.1)</td>
<td>(6874.5)</td>
<td>(650.5)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.967</td>
<td>.832</td>
<td>.982</td>
<td>.912</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

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a. These are three-stage least squares estimates. Standard errors are in parentheses. ***, **, and * denote significance at the .01, .05, and .10 levels, respectively. System weighted $R^2 = .977$

b. These are mean county values divided by commuting zone average values for wages and housing prices, respectively. See text for detail.