Accessibility, Income, and Person Trip Generation: Multilevel Model of Activity at Food Retail Establishments in Portland, Oregon

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Accessibility, Income, and Person Trip Generation: Multilevel Model of Activity at Food Retail Establishments in Portland, Oregon

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Abstract

In the past decade, the methods for estimating multimodal transportation impacts of urban land use development have improved substantially. One assumption commonly made in these new methods is that overall person-trip rates at similarly-sized establishments of the same land use do not vary across a region. This is an assumption that is not consistent with empirical evidence of person-trip rates for food retail establishments in Portland, Oregon. In a multilevel negative binomial regression, we test the relationship of regional accessibility, local accessibility, income, and income effects, even though socio-economics are a proven driver of travel behavior. To test this assumption and understand the effects of accessibility and income on levels of activity at the establishment level, we examine transaction counts for 97 grocery and convenience markets in Portland, Oregon. In a multilevel negative binomial regression, we test the relationship of regional accessibility, local accessibility, income, and income effects, even though socio-economics are a proven driver of travel behavior. To test this assumption and understand the effects of accessibility and income on levels of activity at the establishment level, we examine transaction counts for 97 grocery and convenience markets in Portland, Oregon.

Using Transaction Data for Transportation Impact Analyses

As mentioned previously, there are distinct differences between “transaction counts” and “person-trip counts.” A person-trip count, as used in ITE’s recommended practice, is a general term that is often used interchangeably with the more apt term “person trip end” count. We use them interchangeably in this manuscript for simplicity. Person-trip counts are defined as the number of people entering or leaving the study development within a given time period. If a person enters and exits a 2,500-square-foot convenience market within a PM peak hour (5-6PM), for example, the person (trip) count is 60 person-trips (30 entering and 30 exiting). These counts are often expressed as person-trip rates controlling for the size of the development; in the case of convenience markets and grocery stores, this is typically square footage of gross leasable area (GFA) in thousands of square feet (SQFT). For the example above, the person-trip rate would be 24 person-trips (end counts) per 1,000 SQFT of GFA.

Transaction counts—aggregated by length of time—reflect the number of sales transactions within each time period the business is open. Similar with person-trip rates, transaction counts are aggregated by the establishment (for parity, we also use GFA in 1,000 SQFT increments. For this purpose, we use transaction data as a means for understanding relative variation in overall levels of activity, not as a way of estimating overall trip rates. To consider this, one must understand the turnover of activity—the transaction is, after all, at the end of the activity—as well as the relative size of each group of transaction. For example, transaction rates for food retail establishments mostly occur near noon, as the consumer enters the store and enters the transaction market. In this initial analysis, we assume that all arrivals occur within the same day and week from which the transaction occurred. As we previously identified that average vehicle occupancy, a proxy for group size of automobile trips, considered at the trip end does not vary across urban context within a region for retail establishments, we assume that this holds for relative measures of accessibility.

<table>
<thead>
<tr>
<th>TABLE 1: Description of Accessibility-Related Variables and Their Pearson Correlation Matrix</th>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable</td>
<td>Transaction Count</td>
<td>PM</td>
<td>Marina</td>
<td>Beach</td>
<td>City</td>
<td>Rural</td>
<td>GFA</td>
<td>Income</td>
<td>Region</td>
<td></td>
</tr>
<tr>
<td>Accessibility</td>
<td>Local Accessibility</td>
<td>0.62</td>
<td>0.60</td>
<td>0.49</td>
<td>0.50</td>
<td>0.45</td>
<td>0.51</td>
<td>0.62</td>
<td>0.60</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Regional Accessibility</td>
<td>0.63</td>
<td>0.61</td>
<td>0.50</td>
<td>0.51</td>
<td>0.46</td>
<td>0.52</td>
<td>0.63</td>
<td>0.61</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Total Accessibility</td>
<td>0.63</td>
<td>0.61</td>
<td>0.50</td>
<td>0.51</td>
<td>0.46</td>
<td>0.52</td>
<td>0.63</td>
<td>0.61</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td>0.62</td>
<td>0.60</td>
<td>0.49</td>
<td>0.50</td>
<td>0.45</td>
<td>0.51</td>
<td>0.62</td>
<td>0.60</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>GFA</td>
<td>0.63</td>
<td>0.61</td>
<td>0.50</td>
<td>0.51</td>
<td>0.46</td>
<td>0.52</td>
<td>0.63</td>
<td>0.61</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Access to a more diverse set of measures, like the one proposed here, is a significant step in understanding the relationship between accessibility and market performance. However, the results presented here should be interpreted with caution, as the sample size of the study is relatively small, and the conclusions drawn from this analysis may not be generalizable to other regions or markets.

For income predicted along the range of incomes observed in our sample (approximately $23,000-$60,000), the variation of predicted values ranges from -15% and 10% (convenience market) and -3% to 3% (grocery stores) around the mean predicted value. Taken at the average daily transaction rate (approximately 82 transactions per 1,000 SQFT), a 3% difference for grocery stores may result in a variation in approximately 2 transactions per 1,000 SQFT. But for convenience markets, with an average daily transaction rate of about 250 transactions per 1,000 SQFT, a 10-15% difference in rate variation suggests between 25 and 37 additional transactions per 1,000 SQFT per day.