Class Slides CRP 566 Week 3
Firm location, regional trade evaluation

Community Economics Slides
From Shaffer, Deller, & Marcouiller
Market for Goods and Services

Central Place Dynamics

Stage 1: Single firm’s circular market area

Stage 2: Multiple single firm’s circular market areas and some unerved areas
Central Place Dynamics

Stage 3: Entry of competing firms forcing smaller market areas

Stage 4: Multiple firms forming hexagonal market areas covering entire market surface

Hexagonal Outcome

Figure 4.5. Idealized central place hierarchy.
Types of Firms Supported by Density of Demand

Figure 4.6. Central functions and central place hierarchy.

[Map of Iowa with data points]
**CENTRAL PLACE THEORY**

Assumes …
- Firms will seek to maximize the trade area served
- Consumers will minimize distances traveled
- Links the central place to its complementary area … how consumer spending is distributed across space.

Range … the maximum distance consumers will travel to purchase goods and services at some location (max trade area)

Behavioral Space … consumer perceptions of whether their demand for a good/service has been satisfied. Includes shopping experience as well as cost of commodity.

Demand Threshold … the minimum market size needed to support a good/service and yield a profit to the business

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Determinants of Firm Location and Consumer Demand Preferences

Why do firms locate in a particular place?
- Minimize costs:
  - Transport costs
  - Land and labor (total costs)
  - Seek economies of agglomeration
- To maximize demand area to potentially reach as many customers as possible
- To maximize profit – look both at the revenue and the cost side

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Customers

• Customers – whether households or businesses seek ...
  • Adequate supply of goods, inputs, or services.
  • High attention paid to costs of obtaining them: if costs are too high will seek substitutes or do without
  • Time is money
  • Space is tyrannical
  • Gravity weighs heavily on decisions

And the intersection of firms and people?

• A very basic principle:
  • People go to where they think they can find work and the goods and services that they desire
  • Firms go, after considering all of the reasons for firm location, where they either find the workers that they need or the customers that they need
About that Gravity Problem

• Yours and my likelihood of doing something in place A decreases the farther away that I am. The reason is simple: the cost of the transaction goes up as I travel.

• For example,
Tyranny of Distance

Distance – Decay Function

In-commuting to Polk County

Number of Incommuters

Miles from City Center
So, we get some rules

- Businesses try to maximize their trade territories,

  And

- Consumers try to minimize the distance that they travel to obtain goods and services (and work)

But we have hierarchies

- Lowest level – personal services, retail, convenience goods
- Medium level – specialized retail and services, wholesaling, different ranges of goods and service availability depending on size
- Highest level – Government, cultural centers, highly specialized trade and services, finance, etc.
Other factors

• Overall density of demand is influenced by
  • Population
  • Income (purchasing power)
  • Economies of scale (agglomerations)
  • Transport costs
  • Energy costs as they affect travel and housing

Market Share Analysis

• What is our trade area?
• How are we doing?

• A trade area is the space in which trade is occurring – it can be well circumscribed or it now can be virtual.
• Is usually a function of the degree of specialization / urbanization in an area.
How do we define a trade area?

- Make one up – assume a fixed territory
- Postal codes (zips) / telephone prefixes
- Newspaper circulation areas
- Surveys – spot, samples,
- License plates
- Check and credit card receipts
- Gravity models

**REILLY’S LAW**

*Reilly’s Law of Retail Gravitation ...*
- Used to identify market boundaries in geographic space
- Measures shopping areas between two communities
- Is a simple type of Gravity Model
- Most useful for shopping goods (i.e. furniture, health care, autos) than for convenience goods (i.e. gasoline, food)

**Limitations ...**
- Not useful for urban neighborhoods
- Not good at comparing between wealthy and poor communities
- Not good for different sized communities
- Overestimate shopping population ... no market cross-overs

**Two Types ...**
- Reilly’s Gravitation Model
- *Reilly’s Break Point Model*
**REILLY’S LAW**

**Reilly’s Gravitation Model ...**

\[ S_{AXBi} = \frac{P_{Ai}}{P_{Bi}} \left( \frac{D_{BX}}{D_{AX}} \right)^2 \]

- \( P \) can be population, sales, employment, etc.
- \( i \) is some good or service (NAICS is also commodity) or total trade
- \( D \) can be distance in miles or travel time via road network

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**REILLY’S LAW**

**Reilly’s Break Point Model ...**

- Adapts the Gravitational model to estimate a “breaking point” or maximum distance from market A that a customer will travel to shop in market A rather than market B.
- Is useful in delineating the trade area for market A on a map.
- Assumes people will only shop in the market with the greatest attraction
- Assumes people will not cross market boundaries

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**REILLY’S LAW**

Reilly’s Break Point Model ...

\[ D_{\text{ABI}} = \frac{D_{\text{AB}}}{1 + \sqrt{\frac{P_{\text{Bi}}}{P_{\text{Ai}}}}} \]

- \( D_{\text{ABI}} \) = distance consumers will travel to market A rather than market B for good \( i \)
- \( D_{\text{AB}} \) = is the distance between markets A and B
- \( P_{\text{Ai}} \) = is the power (gravity) of market A for good \( i \)
- \( P_{\text{Bi}} \) = is the power (gravity) of market B for good \( i \)

\( P \) can be population, sales, employment, square feet, etc.
\( i \) is some good or service or total trade
\( D \) can be distance in miles or travel time via road network

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**Reilly’s Law**

<table>
<thead>
<tr>
<th>Miles</th>
<th>Population</th>
<th>All Trade (in Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>From Storm Lake (City A)</td>
<td>9,706</td>
<td>$144.60</td>
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<tr>
<td>TO: (different City Bs)</td>
<td></td>
<td></td>
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<tr>
<td>Cherokee</td>
<td>21.3</td>
<td>4,786</td>
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<td>Spencer</td>
<td>38.2</td>
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<td>Pocahontas</td>
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<td>Sac City</td>
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<td>Ida Grove</td>
<td>43.6</td>
<td>2,081</td>
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<tr>
<td>Sioux City</td>
<td>79.0</td>
<td>82,684</td>
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<tr>
<td>Carroll</td>
<td>56.4</td>
<td>10,000</td>
</tr>
<tr>
<td>Ft. Dodge</td>
<td>70.9</td>
<td>25,230</td>
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</table>

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Reilly's Law

<table>
<thead>
<tr>
<th>Miles</th>
<th>Population</th>
<th>All Trade (in Millions)</th>
<th>Reilly's Law (Miles)</th>
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<tr>
<td></td>
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<td></td>
<td></td>
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<td>21.3</td>
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<td>38.2</td>
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<td>$238.80</td>
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<td>Ida Grove</td>
<td>43.6</td>
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<tr>
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<td>82,684</td>
<td>1235.3</td>
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<tr>
<td>Carroll</td>
<td>56.4</td>
<td>10,000</td>
<td>192</td>
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<tr>
<td>Ft. Dodge</td>
<td>70.9</td>
<td>25,230</td>
<td>455.5</td>
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</table>

To Cherokee: \(21.3/(1+(4786/9706)^{(1/2)}) = 12.5\) and so on ...

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**REILLY’S LAW**

**EXAMPLE ... Trade Areas**

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**THRESHOLD ANALYSIS**

Threshold Analysis ...

- Used to identify the minimum market required to support a good/service and still yield a normal profit to the firm.
- Holds consumer preferences and buying power constant
- Assumes population drives demand (but alternatives exist – can use income)
- Assumes firm cost structure operates independent of community ... that the market must be of a minimum size regardless of its characteristics.

- If market size for a good/service is under threshold, then market is not large enough to cover costs and profit ... firms will close, eventually, or never open.
**THRESHOLD ANALYSIS**

Limitations …

- Does not account for differences in income/wealth
- Does not account for differences in HH spending patterns
- Does not account for differences in tastes
- Assumes only local population drives demand

- Choosing the proper reference area is essential!
- Local market demand can be measured using establishments per capita, sales per capita, or employment per capita.
- Good data is needed at high level of geography and NAICS
- Best data sources …
  - Economic Census from US Census Bureau (estb, jobs, sales)
  - County business patterns for employer firms
  - Taxable sales data from your state Revenue Dept or local govt

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**THRESHOLD ANALYSIS**

How to conduct a simple Threshold Analysis …

- Choose a representative market that best matches your local market. State averages are often used (although we have issues with averages!)

- Choose relevant local market sectors to analyze

- Choose threshold variable ... usually number of establishments per capita or sales per capita.

- Calculate the threshold ratio by dividing the threshold variable by the population for your representative market (ie your state).

- Calculate local demand by multiplying the threshold ratio by your local market population.

- Find local supply, or the actual amount of local activity.

- Compare local demand and local supply to identify gaps.

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<table>
<thead>
<tr>
<th>Industry Code Description</th>
<th>Iowa Firms</th>
<th>Demand Per 1,000 Persons</th>
<th>Jasper County Demand</th>
<th>Jasper County Supply</th>
<th>Difference</th>
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<tbody>
<tr>
<td>New Car Dealers</td>
<td>436</td>
<td>0.1453</td>
<td>5.32</td>
<td>7</td>
<td>1.68</td>
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<td>Used Car Dealers</td>
<td>342</td>
<td>0.1140</td>
<td>4.17</td>
<td>1</td>
<td>(3.17)</td>
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<td>Recreational Vehicle Dealers</td>
<td>56</td>
<td>0.0187</td>
<td>0.68</td>
<td>1</td>
<td>0.32</td>
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<tr>
<td>Motorcycle, Boat, and Other Motor Vehicle Dealers</td>
<td>192</td>
<td>0.0640</td>
<td>2.34</td>
<td>3</td>
<td>0.66</td>
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<tr>
<td>Automotive Parts and Accessories Stores</td>
<td>584</td>
<td>0.1947</td>
<td>7.12</td>
<td>6</td>
<td>(1.12)</td>
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<tr>
<td>Tire Dealers</td>
<td>281</td>
<td>0.0937</td>
<td>3.43</td>
<td>2</td>
<td>(1.43)</td>
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<tr>
<td>Furniture Stores</td>
<td>314</td>
<td>0.1047</td>
<td>3.83</td>
<td>3</td>
<td>(0.83)</td>
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<tr>
<td>Floor Covering Stores</td>
<td>200</td>
<td>0.0667</td>
<td>2.44</td>
<td>3</td>
<td>0.56</td>
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<tr>
<td>Other Home Furnishings Stores</td>
<td>184</td>
<td>0.0613</td>
<td>2.24</td>
<td>0</td>
<td>(2.24)</td>
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<tr>
<td>Appliance, Television, and Other Electronics Stores</td>
<td>468</td>
<td>0.1560</td>
<td>5.71</td>
<td>3</td>
<td>(2.71)</td>
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<td>Computer and Software Stores</td>
<td>116</td>
<td>0.0387</td>
<td>1.41</td>
<td>3</td>
<td>1.59</td>
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<td>Camera and Photographic Supplies Stores</td>
<td>14</td>
<td>0.0047</td>
<td>0.17</td>
<td>0</td>
<td>(0.17)</td>
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<tr>
<td>Home Centers</td>
<td>89</td>
<td>0.0297</td>
<td>1.09</td>
<td>0</td>
<td>(1.09)</td>
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<tr>
<td>Paint and Wallpaper Stores</td>
<td>95</td>
<td>0.0317</td>
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<td>1</td>
<td>(0.16)</td>
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<td>Hardware Stores</td>
<td>264</td>
<td>0.0880</td>
<td>3.22</td>
<td>4</td>
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<tr>
<td>Other Building Material Dealers</td>
<td>599</td>
<td>0.1997</td>
<td>7.30</td>
<td>9</td>
<td>1.70</td>
</tr>
</tbody>
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**LOCAL MARKET ANALYSIS**

**Benefits of using Trade Area statistics ...**

- Take into account actual sales
- Benchmarked for average consumer spending, can be modified
- Takes into account income/wealth differences
- Estimates the number of people in a trade area
- Estimates the proportion of trade captured in the area
- Estimates the total dollar value of local demand
- Estimates the dollars gained from or lost to other communities
- Gives both relative and absolute trade area performance
- Can be used for specific categories of sales
- When mapped with contiguous geographies, allows one to see trade flows between areas
LOCAL MARKET ANALYSIS

Limitations of Trade Area statistics …

• Need to identify function economic trade areas that may not match common political areas (i.e., cities and counties).

• Assumes consumer preferences and tastes are similar to state averages. Although you can change the reference economy to minimize errors, you cannot change HH preferences.

• Does not tell you where dollars actually flow. However, you can infer this through comprehensive mapping.

• You can compile probability of shopping estimates using a Huff’s procedure.

For Example, In Iowa I can calculate how many counties are trade self-sufficient
Or, I can calculate the number of shopper-equivalents that they are either gaining or losing

![Graph showing trade area calculations](attachment:image.png)

**Trade Area Calculations**

- **Potential sales** =  
  \[ \text{Local Pop} \times \text{State Per Capita Sales} \times \text{Local PCI} / \text{State PCI} \]

- **Percentage of retained sales** =  
  \[ \frac{\text{Actual local sales}}{\text{Potential sales}} \times 100 \]

- **Trade Area Capture (in persons)** =  
  \[ \frac{\text{Actual Sales}}{(\text{state sales per capita} \times \text{Local PCI} / \text{State PCI})} \]

- **Pull Factor** =  
  \[ \frac{\text{Trade area capture}}{\text{local pop}} \]

- **Surplus or Leakage** =  
  \[ \text{Actual Sales} – \text{Potential Sales} \]
Potential sales =
Local Pop X State Per Capita Sales X Local PCI / State PCI

- This tells what our regional expected sales values would be given our population and our income (our purchasing power).
- It indexes us to the average for the whole state.
- It give us a ready indicator of our regional sales potential.

Percentage of retained sales =
Actual local sales / Potential sales X 100

- Here we produce a simple percentage:
  - If greater than 100 percent then we are producing for more than our primary region
  - If less than 100 percent then we are serving less than our populations needs – leakage is occurring.
Trade Area Capture (in persons) = 
Actual Sales / (state sales per capita × Local PCI / State PCI)

• This is a very good statistic.
  • It gives you an estimate of the number of shopper equivalents as persons.
  • If you are serving your population or larger you are, statistically, self-sufficient or exporting sales.
  • If you are not serving your population, then your citizens are obtaining goods and services elsewhere.

Pull Factor =
Trade area capture / local pop

• This is one of the most common trade area values used.
  • If greater than 1.0, then you are producing export sales.
  • If less than 1.0 then you are leaking sales, given your population and income levels.

This ratio is the same as your Percent of Sales Retained value, just arrived at a different way.

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**Surplus or Leakage = Actual Sales – Potential Sales**

- Here you get a sales value of the surplus or the leakage.
- If you have calculated these values by particular type of retail or service activity, you can provide a type of threshold analysis that tells whether you might be able to support a particular type of industry.

**Information needed**

- For your State and for your Study Area get
  - Population
  - Per capita income
  - Total retail sales

<table>
<thead>
<tr>
<th>Trade Area Calculations</th>
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<tr>
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<tr>
<td>Retail trade $</td>
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<td>Population</td>
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<td>Per Capita Income $</td>
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<td>Trade Area Calculations</td>
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<tr>
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<tr>
<td>2012</td>
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<tr>
<td>Per Capita Income $</td>
</tr>
<tr>
<td>Retail Trade Per Capita $</td>
</tr>
<tr>
<td>Potential Sales $</td>
</tr>
<tr>
<td>Percent of Retained Sales</td>
</tr>
<tr>
<td>Trade Area Capture (Persons)</td>
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<tr>
<td>Pull Factor</td>
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<td>Surplus of Leakage $</td>
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