
Territorial Analysis Putting Your Company on the Map

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Key Considerations in Smoothing and Clustering

- Data
- Smoothing Equations and Parameters
- Smoothing Process Statistics
- Clustering Styles
- Clustering Statistics
- Portfolio Impact



Why Re-Discover Territories

- Better match of rate with exposure
- Desire for greater segmentation
- Reflection of underlying changes since last territory analysis
- Action to avoid anti-selection
- More companies are developing territories based upon their experience



Underlying Data for Territory Analysis

- Historical Company or Model Output Statistics by
 - County
 - Zip Code
 - Census Block
 - Census Tract
 - Address
- Location
 - Longitude
 - Latitude
 - Adjacency



Present from GLM Analysis

- Adjustment of historical experience to a common rating class level.
- Removes distributional biases from the underlying data
- Items such as:
 - Age of driver
 - Insured Value of Homes
 - Protection Class



Smoothing

- Data at the basic element level lacks “credibility”
- Smoothing process allows inclusion of more localized data rather than statewide information

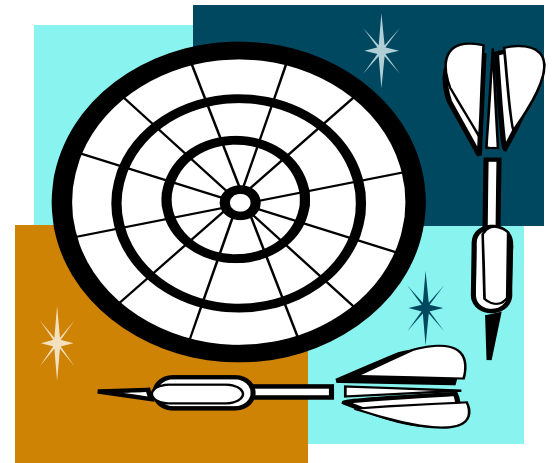


Smoothing

- Key smoothing variables
 - Predictive value of local data
 - Identification of complement data
 - How many observations are required to smooth
 - How far to allow smoothing search to continue
 - Many equations are available to combine local data with surrounding information
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Smoothing Considerations

- State Borders and Corners
- Use of smoothing across state boundaries
- Potential separate smoothing of urban and rural areas
- Distance based smoothing process or contiguous based smoothing process

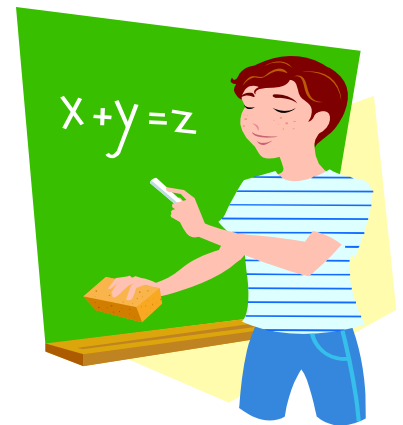


Sample Smoothing Data

ZIP	LATITUDE	LONGITUDE	DATA	WEIGHT
43001	40.0933	-82.6090	21.70	2,583.25
43002	40.0755	-83.1781	11.16	530.60
43003	40.4124	-82.9571	17.36	1,817.82
43004	40.0030	-82.8044	12.96	10,978.98
43006	40.4661	82.1549	38.55	277.41
43009	40.1689	-83.6442	19.88	2,032.91
43011	40.3119	-82.6898	23.78	7,363.46
43013	40.2349	-82.6918	19.23	1,077.18
43014	40.4677	-82.2625	19.01	2,187.14

Smoothing Equation Examples

- Exposure Weighted Average
- Straight Line Declining Distance formula
- Squared Declining Distance formula
- Werland-Christopherson Method



Exposure Weighted Formula

1. Calculate zip code “credibility” – Z
2. Identify surround area required for complement
3. Smoothed Value =
Zip Code value * Z +
surrounding Zip Codes value $(1-Z)$

Declining Distance Formula

1. Calculate zip code “credibility” – Z
2. Identify surround area required for complement and maximum distance required
3. Complement exposures adjusted by
(Max Distance – Zip distance from initial zip)
/Maximum Distance
4. Smoothed Value =
Zip Code value * Z +
surrounding Zip Codes adj. value (1-Z)

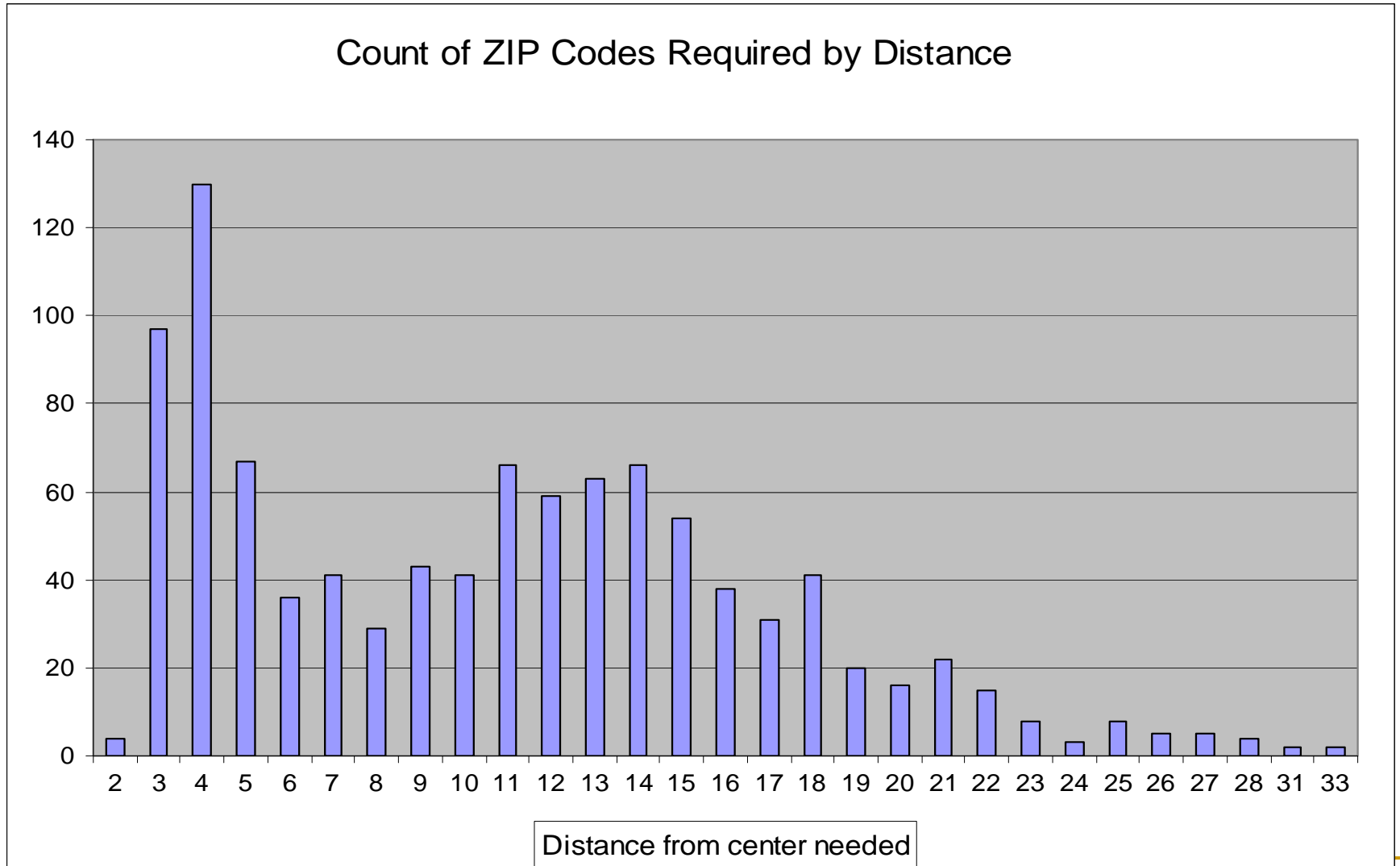
Squared Declining Distance Formula

1. Calculate zip code “credibility” – Z
2. Identify surround area required for complement and maximum distance required
3. Complement exposures adjusted by
((Max Distance – Zip distance from initial zip)
/Maximum Distance) ²
4. Smoothed Value =
Zip Code value * Z +
surrounding Zip Codes adj. value (1-Z)

Werland-Christopherson Method

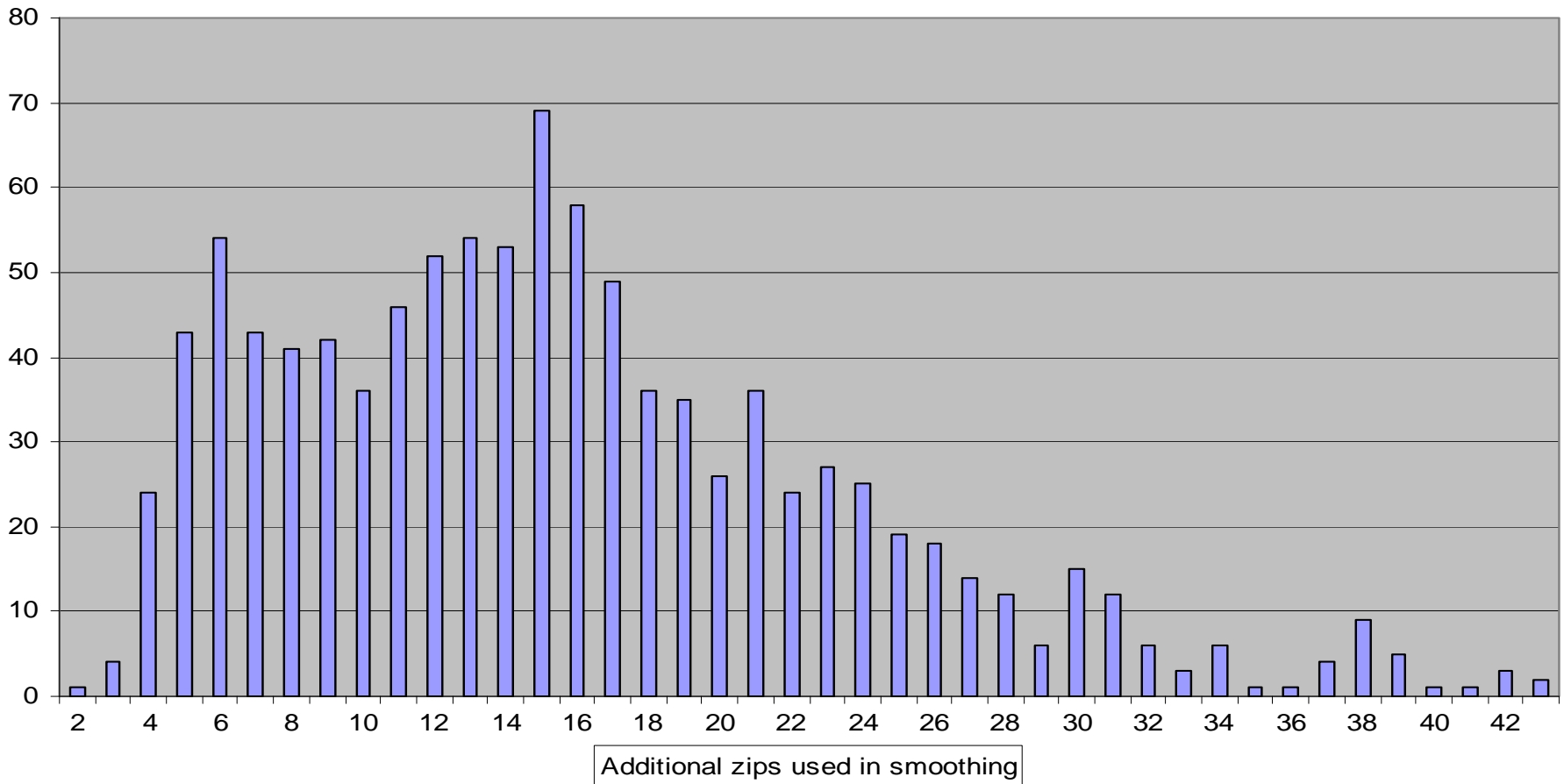
- Adjusts exposure weights using the following process based on distance from center of zip code ($= a$) being smoothed
 - 0 to 5 Kilometers 100%
 - 5 to 30 Kilometers $(30 - a) / (30 - 5)$
 - Beyond 30 Kilometers 0%

Required Smoothing Distance

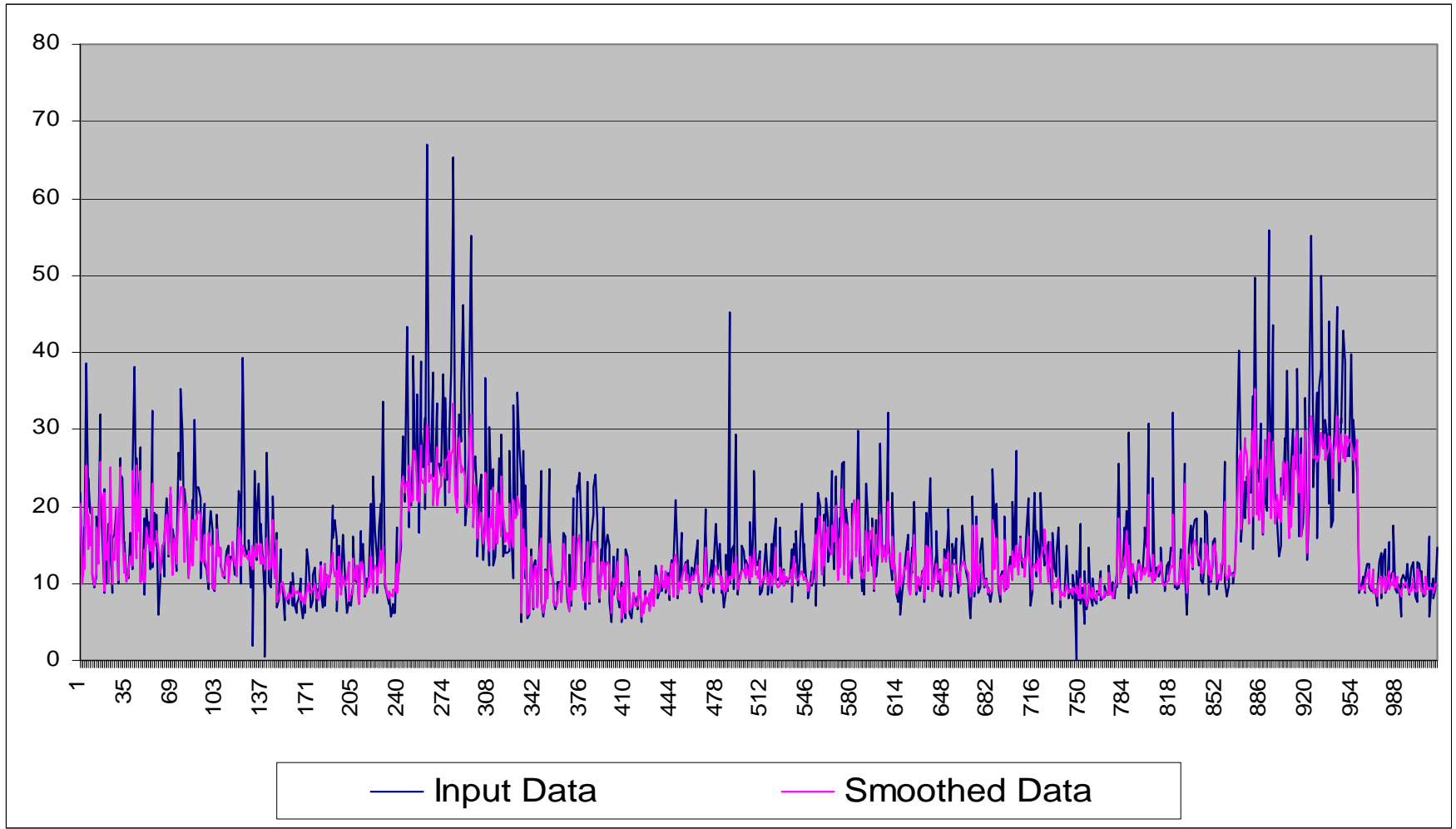


Zips Required to Smooth

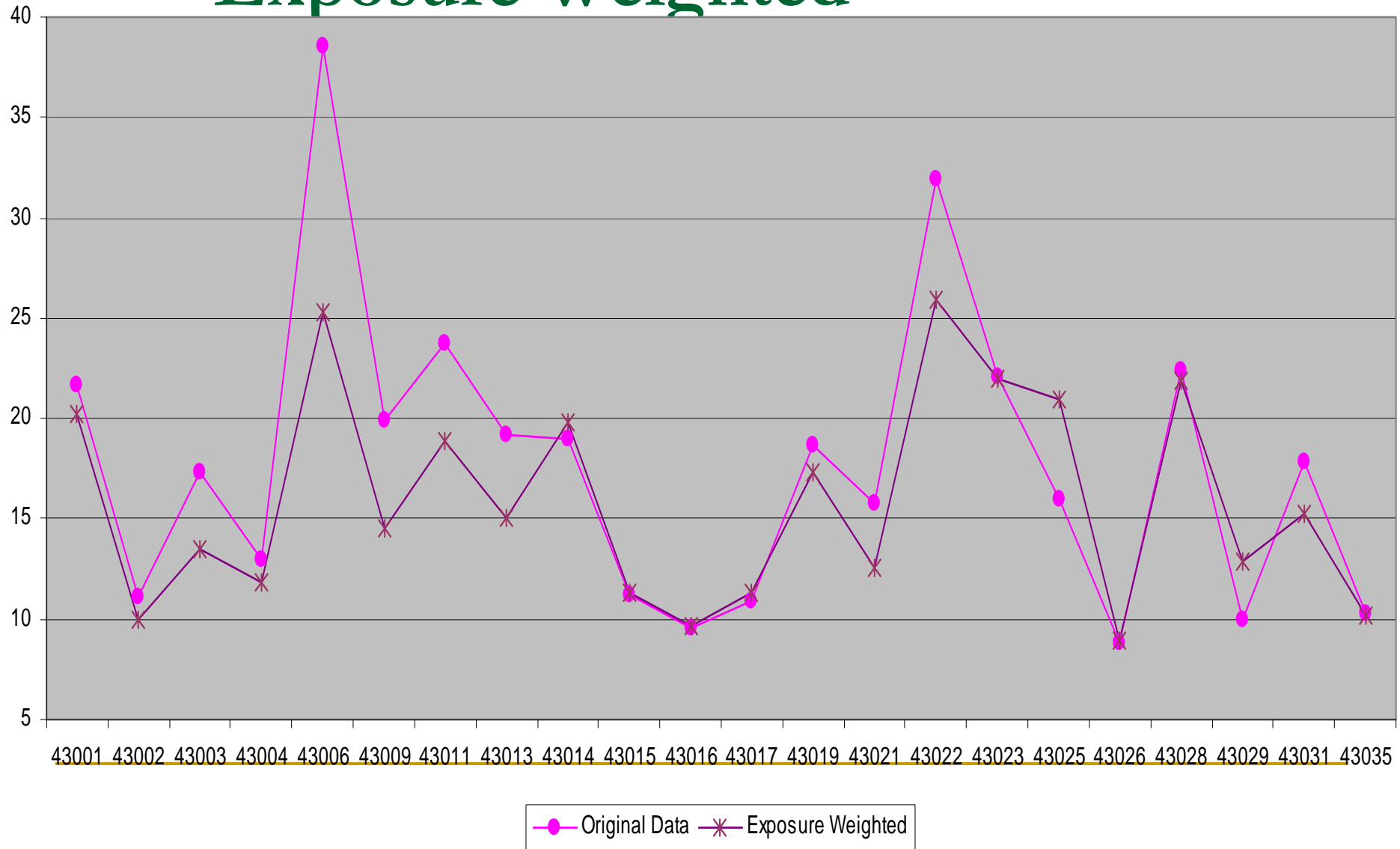
Count of ZIP Codes



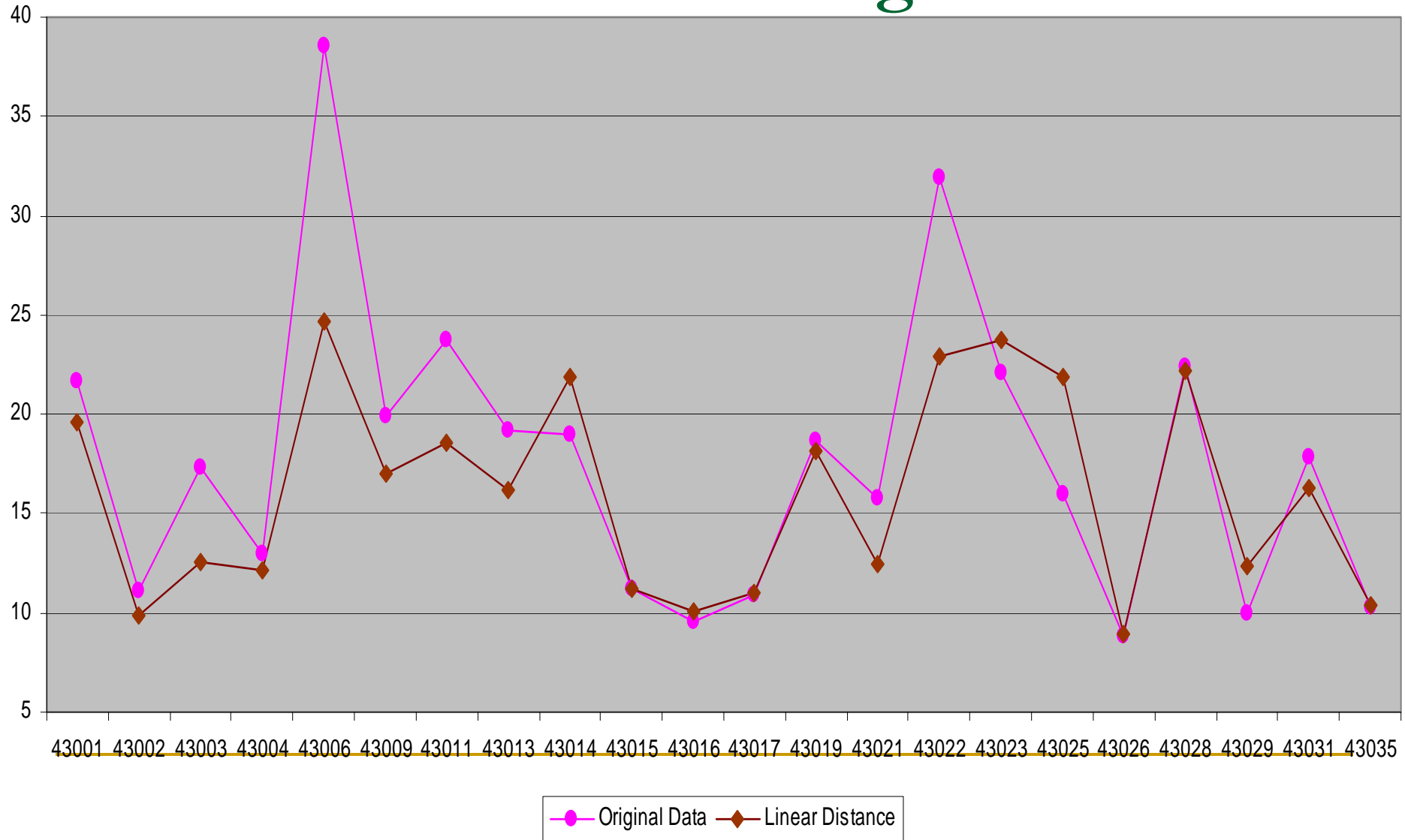
Smoothing Impact



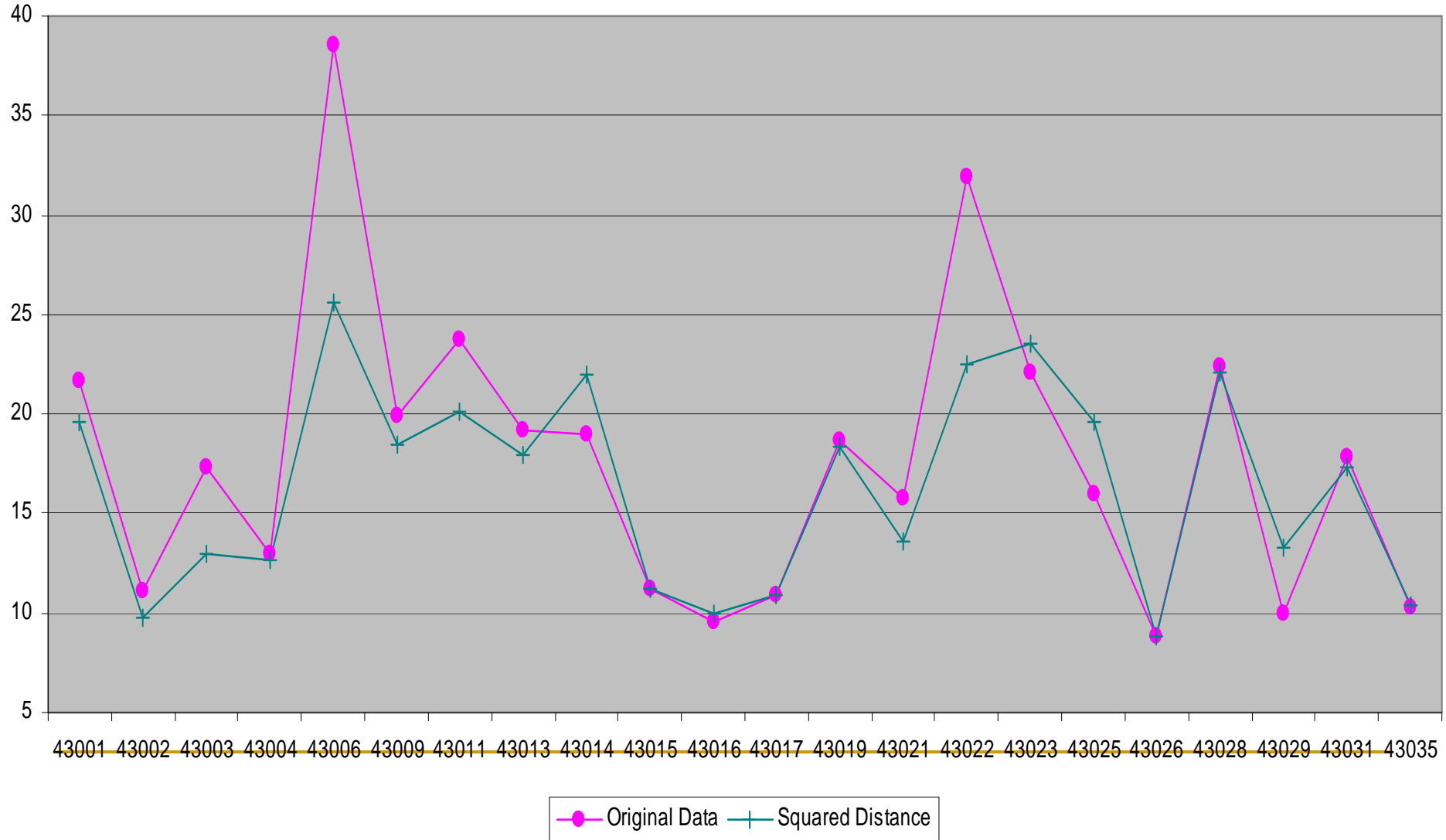
Comparison of Smoothing Example Exposure Weighted



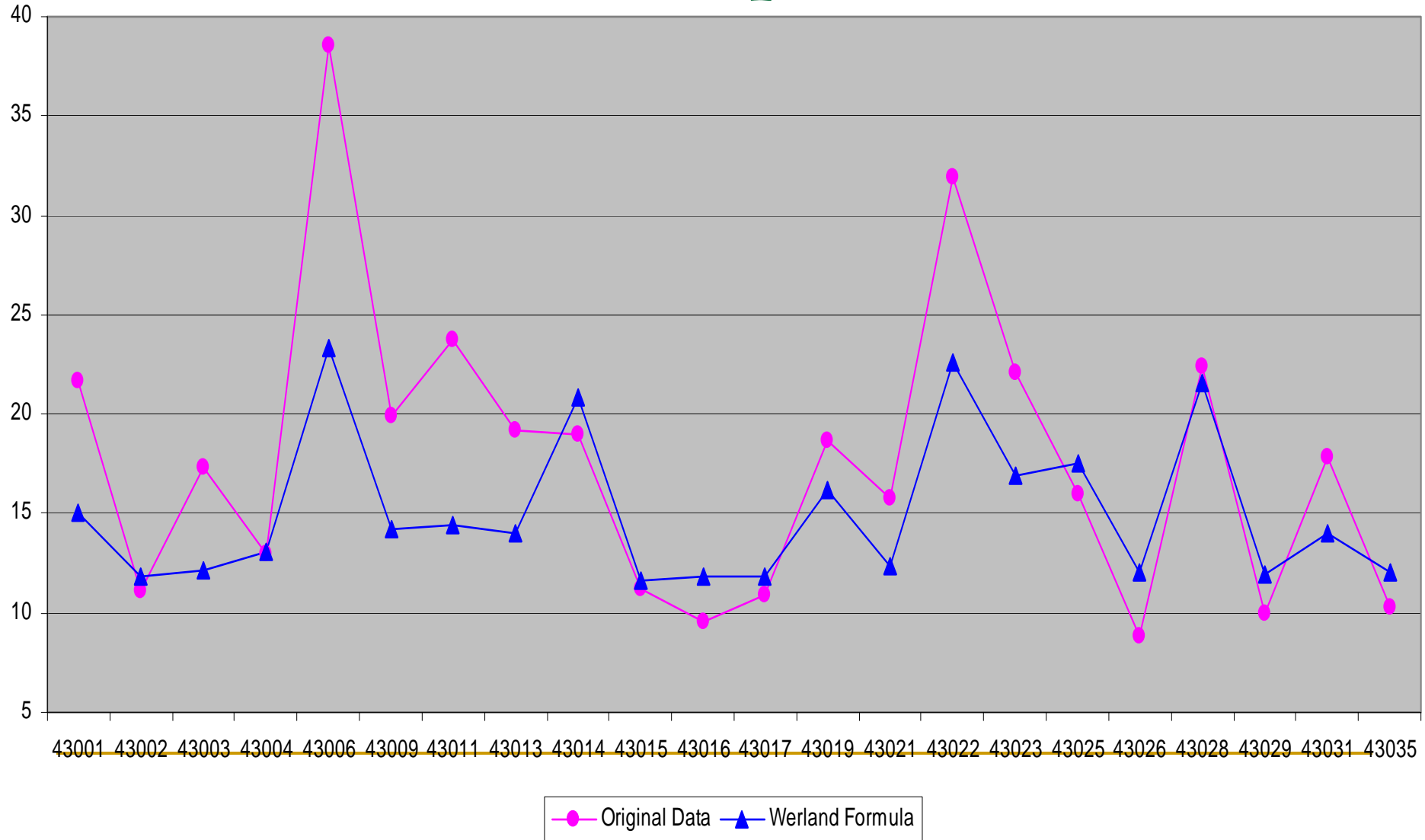
Comparison of Smoothing Example Linear Distance Weighted



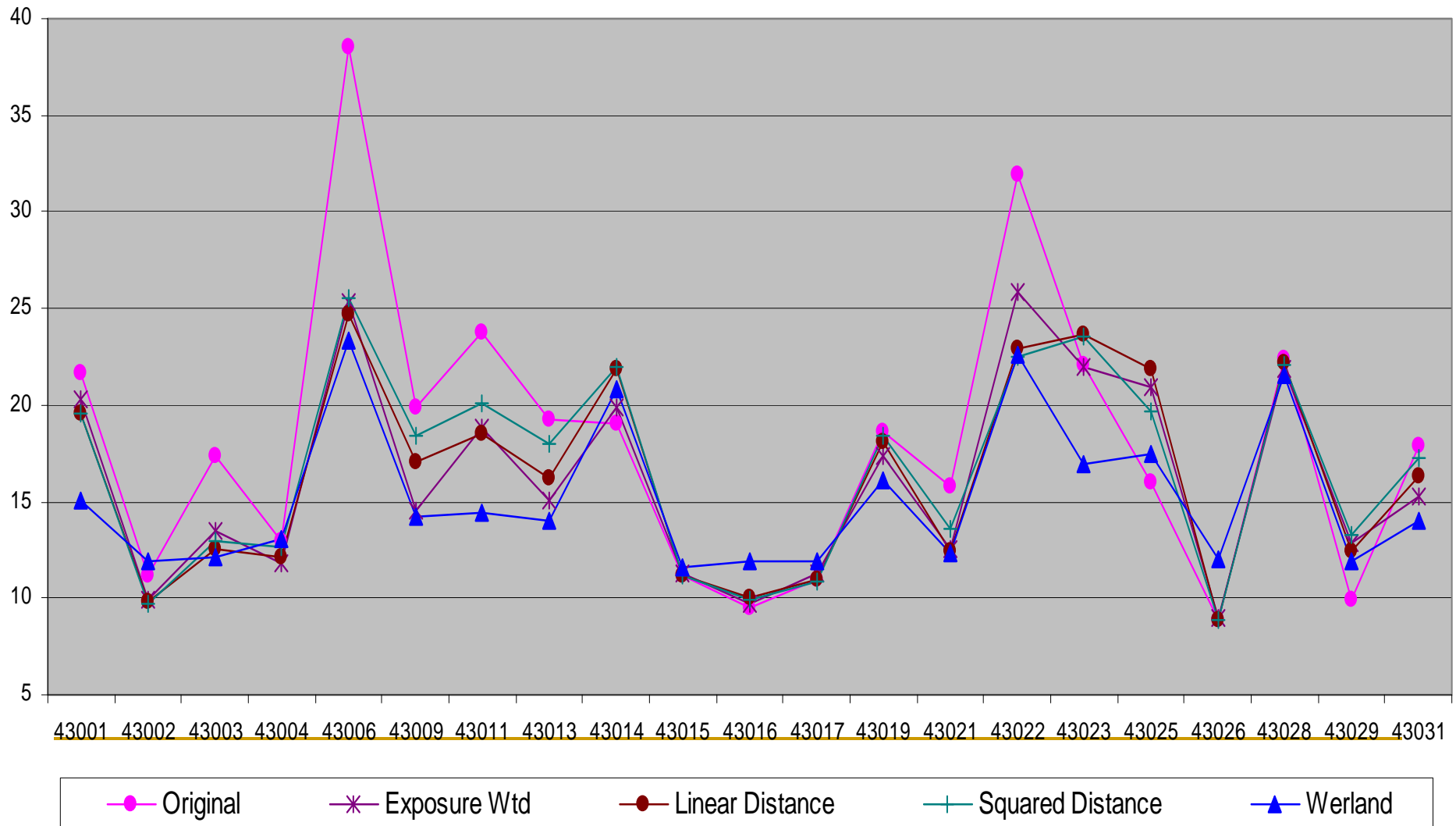
Comparison of Smoothing Example Squared Distance Weighted



Comparison of Smoothing Example Werland Christopherson Method

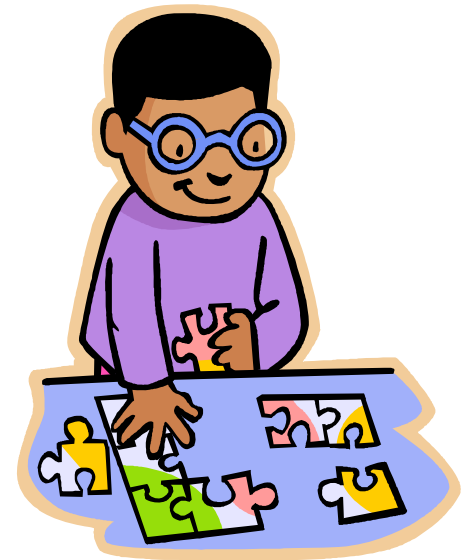


Comparison of Smoothing Method Examples



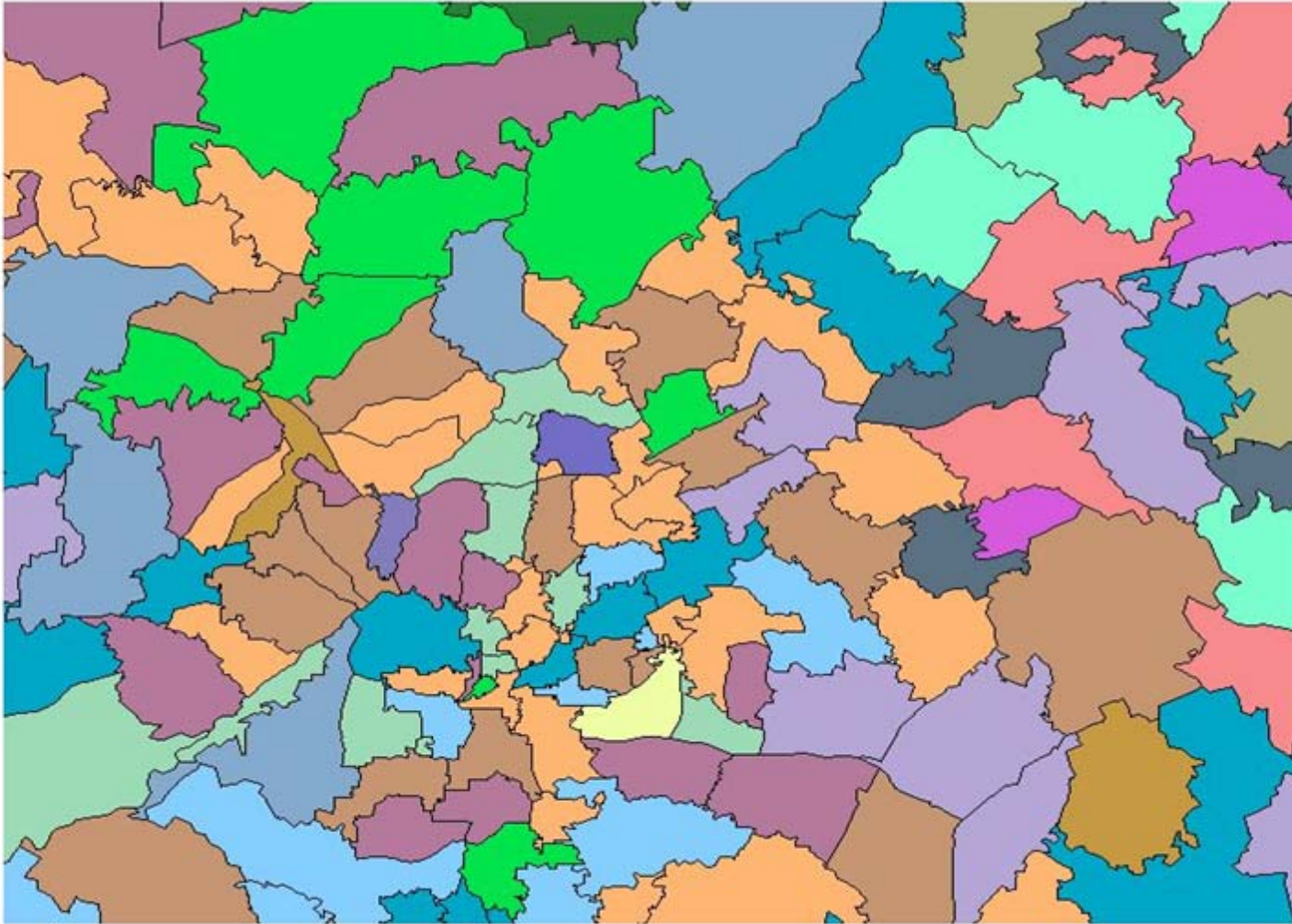
Clustering Process

- Grouping of areas based on similarity of statistics
- Begin with most detailed data and combine – bottom up approach
- Rank order data from high to low and combined two closest
- Comparison can be based on percentage or value differences
- Contiguity can be a constraint



Non-Contiguous Mapping

Noncontiguous Clustering

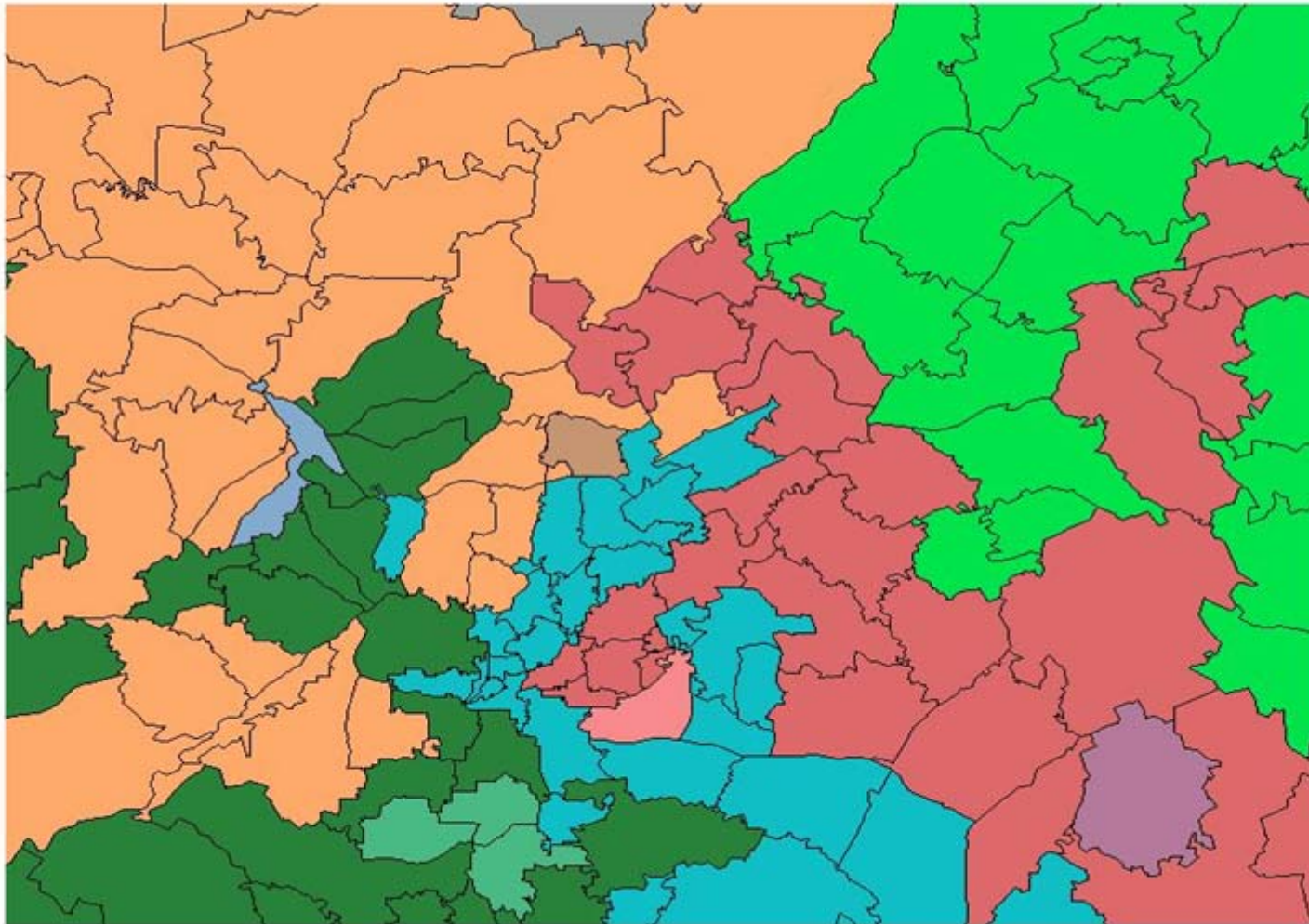


Information Needed for Contiguous Area Identification

ZIP CODE	ADJACENT ZIP
44004	44030
44004	44048
44082	44030
44048	44030
44047	44004
44082	44048
44047	44048
44010	44004

Traditional Contiguous Mapping

Contiguous Clustering



Key Statistic in Cluster Selection

■ Variance

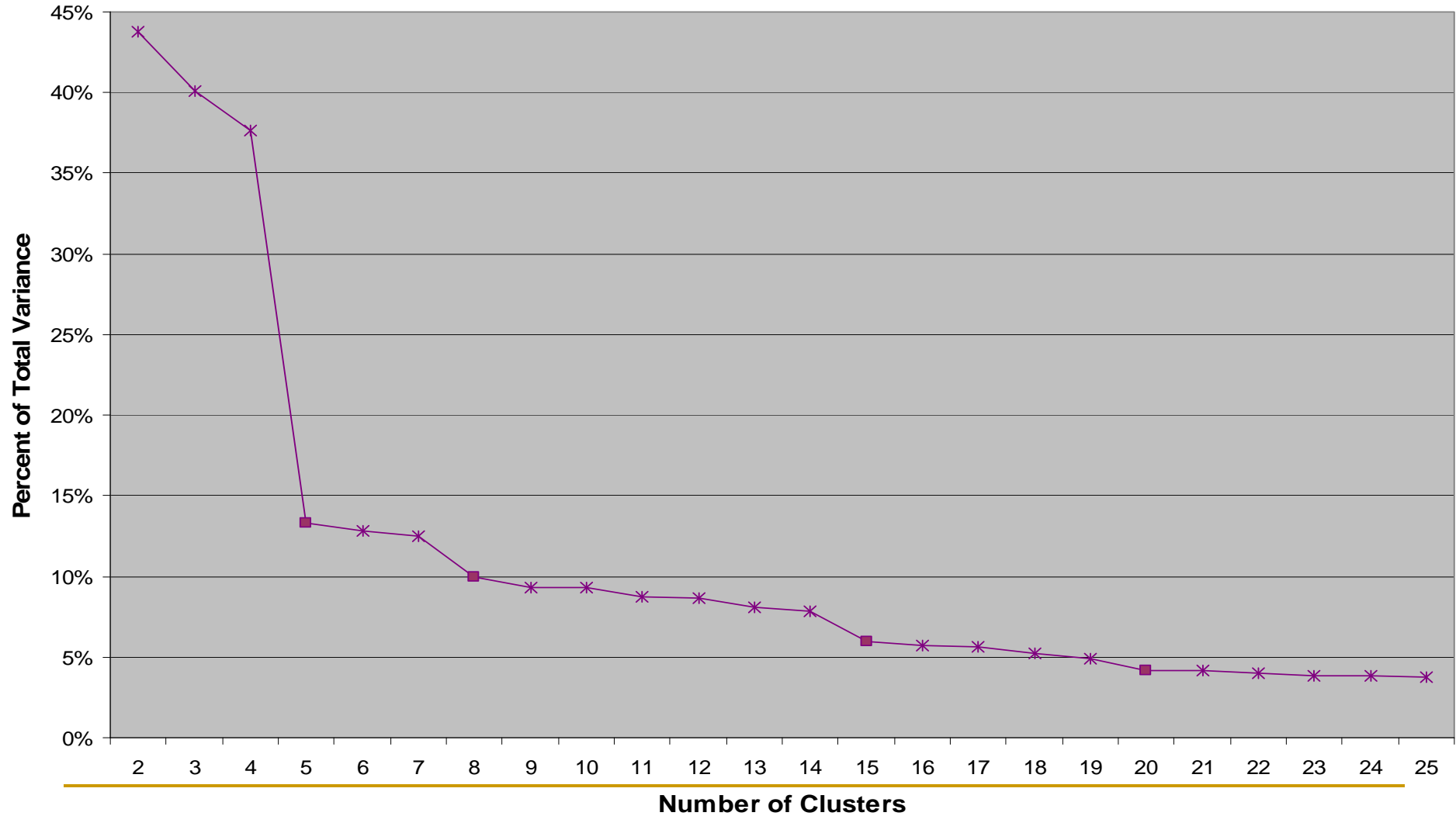
- Between Cluster Variance – High
- Within Cluster Variance – Lower

- Total Variance = Between Variance + Within Variance

■ Ratio of Within to Total Variance



Within Variance to Total Variance



Impact Analysis

- Review impact of various clustering scenarios with Current rates and Competitor rates by zip code
- Calculate the dollar and/or percentage change distribution by zip code



Rate Change Distribution

Percentage Change Range			Exposure	Distribution
More than - 50%			103	0.0%
-25%	to	- 50%	256	0.1%
-20%	to	- 25%	3,469	0.9%
-15%	to	- 20%	12,901	3.5%
-10%	to	- 15%	35,664	9.7%
-5%	to	- 10%	59,727	16.2%
0%	to	- 5%	64,928	17.6%
No Change			14,375	3.9%
0%	to	5%	68,962	18.7%
5%	to	10%	50,759	13.8%
10%	to	15%	40,246	10.9%
15%	to	20%	15,039	4.1%
20%	to	25%	2,264	0.6%
25%	to	50%	165	0.0%
More than + 50%			126	0.0%

Territories by Coverage and Peril

- Since geographical location influence may not uniformly impact coverage or peril indications, separate definition sets by coverage or peril provide more optimal rate classification and factors.
 - Similar process for frequency/severity separate analysis
 - There are ways to develop territory sets by coverage or peril and combine the sets into one consolidated set.
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Basic Example of Combination of Territories

Area	Liability	Comp	Collision	Combined
A	1	1	1	1
B	1	1	2	2
C	2	1	1	3
D	2	2	2	4
E	3	3	3	5
F	3	2	3	6
G	4	3	2	7
H	4	3	1	8