

# Mapping Invisible Threads: Unveiling Economic Landscapes through Micro-Level, High-Frequency 19th- Century Postal Data

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POST OFFICES—*Illinois*.

Post office.	County.	Postmaster.	Compensation.	Balance due U. S.
Fieldon .....	Jersey.....	James A. Earles.....	\$55 40	\$73 03
		J. H. Gamble.....	50 00	49 82
Fillmore .....	Montgomery.....	Jonathan B. Lane.....	22 44	36 76
Fishhook .....	Pike.....	Jesse Phillips.....	47 61	23 76
Fitt's Hill.....	Franklin.....	E. Ross.....	47 81	15 83
Fitz Henry.....	Ogle.....	J. S. Preston.....	18 65	34 90
Flat Rock.....	Crawford.....	G. H. Maxwell.....	21 55	25 54
Flint.....	Pike.....	David Hamilton.....	36 10	35 09
Flora.....	Clay.....	A. K. Kemmer.....	390 64	685 31
Floraville.....	St. Clair.....	C. C. Horn.....	40 44	39 45
Florence.....	Pike.....	Peter Ellis.....	25 29	40 23
Florence Station.....	Stephenson.....	G. R. Goss.....	25 94	17 01
Forkville.....	Lake.....	George J. Tower, to April 7.....	79 33	102 68
		Hy. Rogers, from April 8.....	23 08	26 42
Foreston .....	Ogle.....	Matthew Blair.....	304 98	464 53
		Sam. Rockwood.....	90 00	175 52
Fort Hill .....	Lake.....	G. Thompson.....	21 41	20 08
Poster's .....	Marion.....	Thomas S. Jones.....	13 94	17 95
Posterburgh.....	Madison.....	C. F. Lobbig.....	69 32	106 80
Florid.....	Putnam.....	A. G. Meacham.....	70 64	106 58
Forest City.....	Mason.....	Alexander Cross.....	62 84	72 10
Forest Station.....	Livingston.....	J. J. Kraek.....	30 74	42 42
		J. H. D... ..	198 74	180 76
Fountain Green.....	Hancock.....	J. H. Emrich.....	138 74	180 76
Four Mile Grove.....	La Salle.....	F. Lindsay.....	92 30	102 49
Powder's Station.....	Adams.....	James Knox.....	92 30	102 49
Fox Lake .....	Lake.....	M. L. Galagar.....	58 14	39 23
Frankfort .....	Franklin.....	William M. Horrell.....	97 92	106 02
Franklin.....	Morgan.....	A. C. Woods.....	182 20	202 83
Franklin Grove.....	Lee.....	G. W. Brayton.....	449 92	672 31
Fransonia.....	Richland.....	J. ... ..	37 11	44 14
Fredericksville.....	Schuyler.....	G. ... ..	129 59	150 35
Fredonia.....	Williamson.....	C. Davis.....	39 24	27 43
Freeburgh.....	St. Clair.....	E. ... ..	13 10	13 10
		W. ... ..	96 80	124 76
Freedom .....	La Salle.....	R. Wright.....	118 13	139 01
Freecland .....	De Kalb.....	A. ... ..	60 05	59 77
Freemantton.....	Wabash.....	... ..	49 29	88 09
		Shout.....	14 00	9 91
Fremont Centre.....	Lake.....	Ira Hoyt.....	37 32	38 32
Freeport.....	Stephenson.....	C. K. Judson.....	2,500 00	7,984 09
French Village.....	St. Clair.....	Bernard Palletier.....	43 65	40 40
Friend Grove.....	Wabash.....	Thomas L. Deputy.....	6 36	6 35
		A. M. Maxwell.....	18 00	2 23
Friendship.....	McDonough.....	John B. Eukle.....	12 76	11 43
Friendville.....	Wabash.....	William Birkett.....	101 23	140 85

Table 3.1 A Typical Row from the Official Register

Name of the Post Office	County	State	Postmaster Name	Annual Postmaster Compensation
Clingman	Wikes	North Carolina	J.C. Greene	100.54

Germanstown.....	Clinton.....	John Niemeier.....	91 24	128 85
Gilou.....	Knox.....	James Moore.....	57 79	64 16
		James Ickes.....	55 00	82 05
Gilead.....	Calhoun.....	D. T. Simpson.....	21 88	36 99
Gilgol.....	Pike.....	Nicholas Crenshaw.....	8 88	1 27
Gillespie.....	Macoupin.....	William Rice.....	210 42	236 60
Gilman.....	Iroquois.....	Albert Dickerson.....	145 73	237 44
Gilmer.....	Lake.....	W. H. Morse.....	22 95	25 37

# The Official Register of the United States (OR)

- ◆ 12 Volumes of Official Register
- ◆ 191,891 Records of Postmaster Compensation
- ◆ All 47 states
- ◆ Covers 1849 - 1871
- ◆ Biannual
- ◆ Linked to Postal Revenue through a national formula
- ◆ Superior to Alternative Sources:
  - ◆ Census Data (decadal frequency)
  - ◆ Tax Records (inconsistencies across regions)
  - ◆ Local Newspapers (no clear quantitative metric)
  - ◆ ...

# Agenda

- ◇ Context
- ◇ Machine Vision Techniques
- ◇ Sensitivity analysis
- ◇ Hotspot Analysis

# From Postmaster Compensation to Town-Level Postal Volume

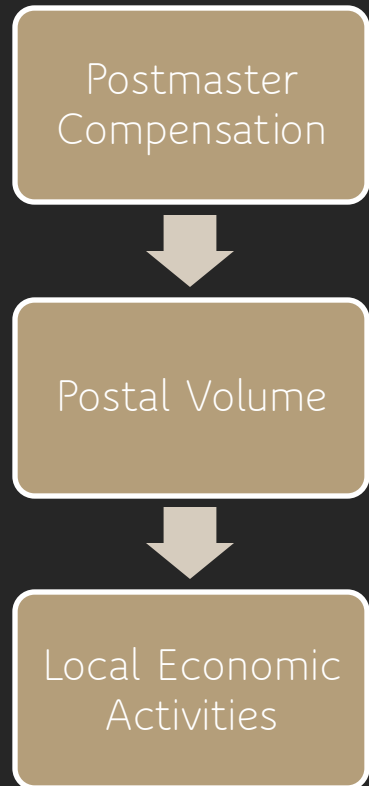
“For the year 1853, a postmaster takes 50 per cent on an amount not exceeding 100 dollars, 40 per cent on an amount over 100 dollars and not exceeding 400 dollars, 35 percent on an amount over 400 dollars but not exceeding 2400 dollars and 15% on an amount over 2400 dollars.”

-- The Record of the Thirty-Second Congress (Act of March 1)



*Postmaster Compensation*  
 $= a\%$   
 $\times$  *Annual Postal Revenue*

where  $a = 50$  when Annual Postal Revenue  $\leq 100$ ,  
 $a = 40$  when  $100 < \text{Annual Postal Revenue} \leq 400$ ,  
 $a = 35$  where  $400 < \text{Annual Postal Revenue} \leq 2400$ ,  
 $a = 15$  where Annual Postal Revenue  $> 2400$



The US Federal Government maintained monopoly status over letter and packet delivery up to the year 1882.

- ◆ **Primary Revenue Sources:** The main revenue sources were “letter postage, including foreign postage, and stamps sold” and “newspaper and pamphlet postage.” The remaining revenue was from non-postal activities. (96% in 1850 and 92% in 1871)
- ◆ **Monopoly statutes** prohibited private express delivery of letters and packets but allowed delivery of packages containing non-letter items (Johnston 1968, p. 389).
- ◆ **Package Delivery Exclusion:** The U.S. postal system did not deliver packages before 1913, when Parcel Post was introduced (Kielbowicz 1994).



# Methodology



Clean and Link the  
Datasets Using  
Matching Algorithms



Link the OR dataset to  
19 Century Railroad  
and Canal Shapefiles



Explore the Sensitivity  
of the OR Dataset  
through correlation



Delineate the Extent  
of Markets with  
Hotspot Analysis

Blakely	Baldwin	J. H. Stanmyres	
Blake's Ferry	Randolph	J. J. Bradley	\$17 78
Blocker's	Tuscaloosa	William G. Blocker	
Blount Spring	Blount	B. H. Sapp	
Blountsville	Blount	John L. Hopkins	66 38
		H. A. Gillespie	33 81
Blowing Spring	Limestone	J. Martin	
Blue Lick	Franklin	A. T. Bonds	
Blue Mountain	Calhoun	J. W. Dendy	
Blue Pond	Cherokee	A. Poore	20 20
Blue Spring	Morgan	C. Ratliff	65
Bluffport	Sumter	W. H. Sanders	
Bluff Spring	Talladega	M. Street	90 79
Boligee	Greene	S. L. Gwyn	8 85
Bowden	Talladega	J. W. Barton	
Bradford	Coosa	Thomas Harris	25 36
Braggs	Lowndes	R. D. Twombly	
Branchville	St. Clair	S. G. Hurst	32 26

Page Segmentation Result - My Workflow

Blakely	Baldwin	J. H. Stanmyres	
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Page Segmentation Result -- Omnipage

Blakely	Baldwin	J. H. Stanmyres	
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Braggs	Lowndes	R. D. Twombly	
Branchville	St. Clair	S. G. Hurst	32 26
Breckinridge	Conecuh	W. W. Johnson	

Page Segmentation Result - Adobe Acrobat

London	Rusk	St. C. Smith	
Lone Star	Titus	W. Collins	\$123 91
Lone Tree	Collin	John Seaborn	3 60
Long Branch	Panola	E. Nix	
Long Point	Washington	M. Rutherford	
Long Prairie	Fayette	R. Gapij	12 35
Lookout	Leon	C. D. Dutton	2 48
Lynchburgh	Harris	William H. Bryan	
Lynes	Fayette	J. W. Gishburn	78 39
McKinney	Collin	C. A. Gwyn	137 47
McMillans	Panola	W. McMillan	
Macomb	Grayson	E. McKinley	22 08
Madisonville	Madison	J. S. Colford	
Magnolia	Anderson	William A. Hefood	14 87
Magnolia Spring	Jasper	R. W. Walker	18 92
McNomer	Burnett	George Alter	3 23
Malekoll	Henderson	J. W. Mitchano	
Manfield	Parrant	J. Field	46 66
Manning	Collin	E. B. Rollins	38 70

Page Segmentation Result - Tesseract

# OCR Output - Customized Tool v.s. Adobe Acrobat

Table 1. OCR Output – Customized Tool

1	Post Office	County	Postmaster	Compensation
2	Blake's Ferry	Randolph	J J Bradley	\$17 78
3	Blocker's	Tuscaloosa	William G Blocker	
4	Blount Spring	Blount	B. H Sapp	
5	Blountsville	Blount	John L. Hopkins	66 38
6			H. A Gillespie	33 81
7	Blowing Spring	Limestone	J Martin	
8	Blue Lick	Franklin	A T Bonds	
9	Blue Mountain.	Calhoun	J W Dendy	
10	Blue Pond	Cherokee	A Poore	20 20
11	Blue Spring	Morgan.	C Ratliff	65
12	Bluffport	Sumter	W H Sanders	

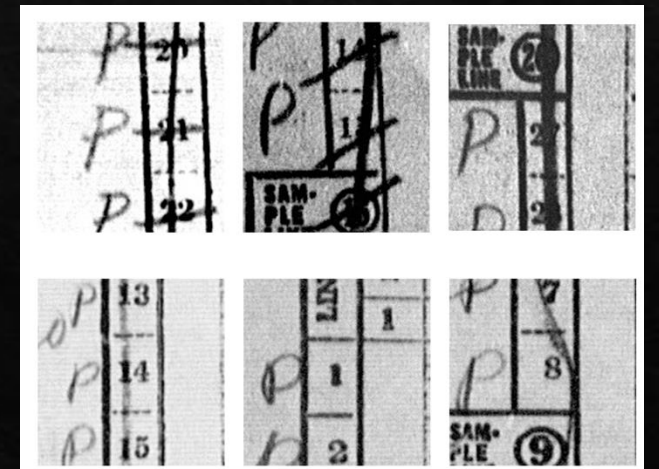
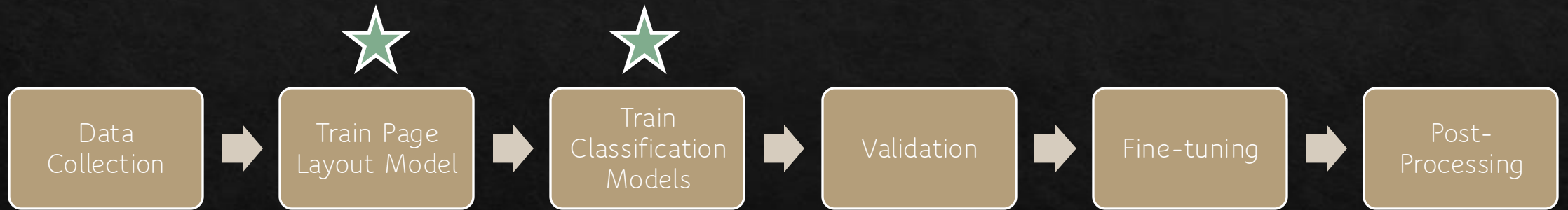
Table 3. OCR output – Adobe Acrobat

P ost office. County. P o~tmaJl te r.
B!ak I> ]y .... • . • . . Bald win ... .. J. II . Stanmyre~
Blake'~ F erry. . Randolph . . . . . J. J. Bradley
B locker'~ . . . . . Tu6c11!008u .. , Yilliu111 G. B
lock<;ir ..
B loun t Spring. Blount. B. H. Supp .....
Bloumsv ill!! --' ' - - - - Blount .. J ohu L. Hopk ius ..
Blon·in~ S pring ...
B lue Lick . .*. ....
B lue Mooutnin ..
Blue Pond . . . . .
Blul' Spring . .
Blulfpor t .... . . .
Bluff Spring



# Machine Learning Iteration Process

**Rebuilding Trust in Historical Records: Leveraging Deep Learning and Generative AI for Enhanced Data Accuracy and Comprehensive Dataset Collection**



# Data View

Table 3.1 A Typical Row from the Official Register

Name of the Post Office	County	State	First and Last Name of the Postmaster	Annual Postmaster Compensation
Clingman	Wikes	North Carolina	J.C. Greene	100.54



Table 3.2 County Level Data

County	State	Postal Revenue	Total Manufacturing Output	Total Farming Output	Population
A	North Carolina	35200.00	356096.00	89703.30	100,100

Table 3.3 Town-Level Data

Name of the Post Office	County	State	Postmaster Name	Postal Revenue	Longitude	Latitude
Clingman	Wikes	North Carolina	J.C. Greene	250	36.1784613	-80.9636877

# Correlation Between Postal Revenue and Other Economic Indicators

- Low R-squared: Postal revenue reflects a variety of activities beyond manufacturing and farming.
- Manufacturing and Farming: Both correlated with postal revenue.
- Only Manufacturing Significant with Population Control: Manufacturing shows a distinct, independent impact.

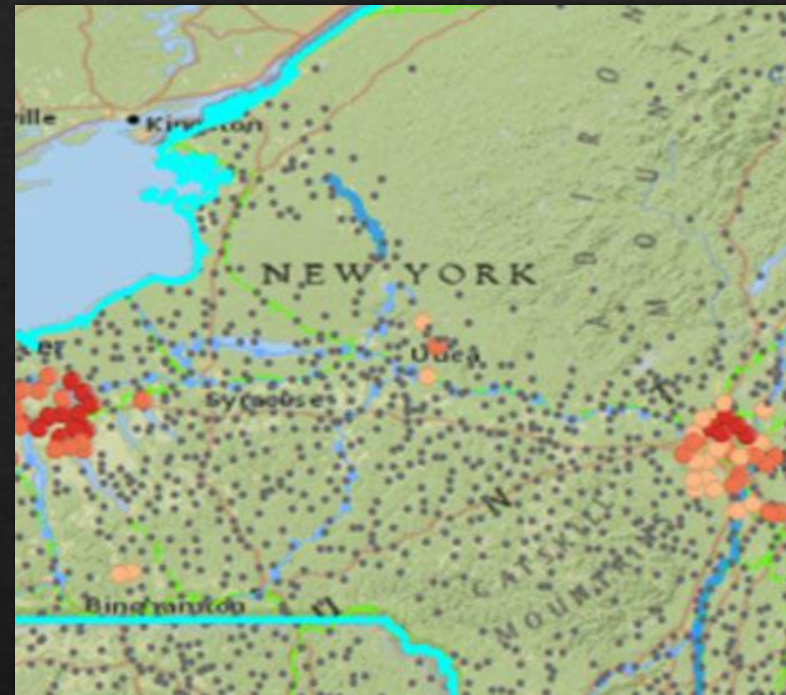
Table 1.1 Regression of Postal Revenue on Manufacturing Output, Farm Output, Population and Total Output Per Capita

	Dependent Variables					
	Revenue					
	(1)	(2)	(3)	(4)	(5)	(6)
Manufacturing Output	0.001*** (0.00004)				0.0002* * (0.0001)	
Farm Output		0.002*** (0.0003)				-0.0003 (0.0003)
Population			0.20*** (0.010)		0.16*** (0.021)	0.204*** (0.011)
Total Output				114.71		

Control For Population	No	No	NO	NO	YES	YES
State Fixed Effect	YES	YES	YES	YES	YES	YES
Year Fixed Effect	YES	YES	YES	YES	YES	YES
Observations	70,504	71,741	71,863	70,442	70,502	71,714
R2	0.021	0.018	0.022	0.020	0.021	0.023
Residual Standard Error	89,207.98 (df = 70455)	88,605.83 (df = 71691)	88,370.25 (df = 71813)	89,222.83 (df = 70393)	89,171.66 (df = 70452)	88,408.89 (df = 71690)

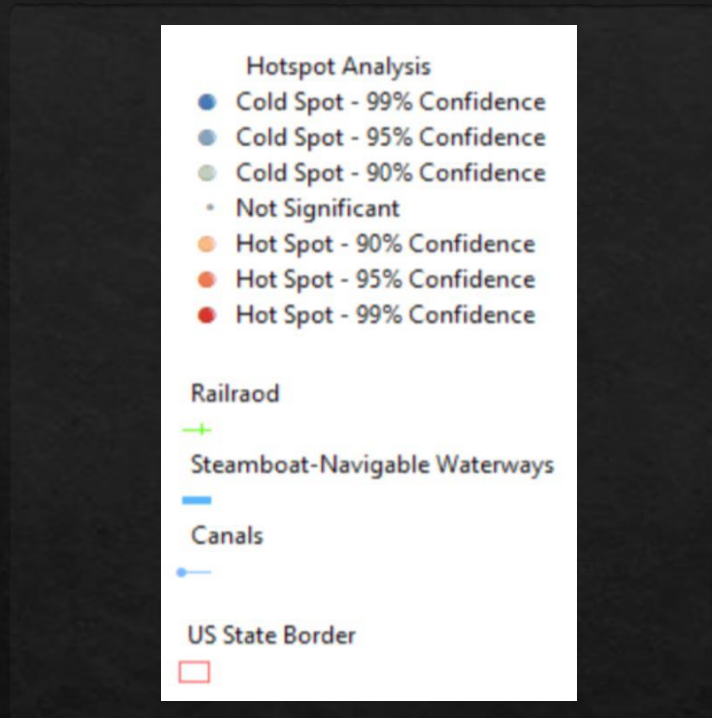
\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

\*\*\*\* Total Output Per Capita = (Manufacturing Output + Farm Output)/ Population



# Fixed-Bandwidth Hotspot Analysis

The small neighbors are important.



# Legend

# Chicago (1849 – 1871)

- Illinois and Michigan Canal
- Chicago, Rock Island and Pacific Railroad
- Rock Island Line in 1857
- Joliet



Figure A9.1. Hotspot Analysis for Illinois (1849)

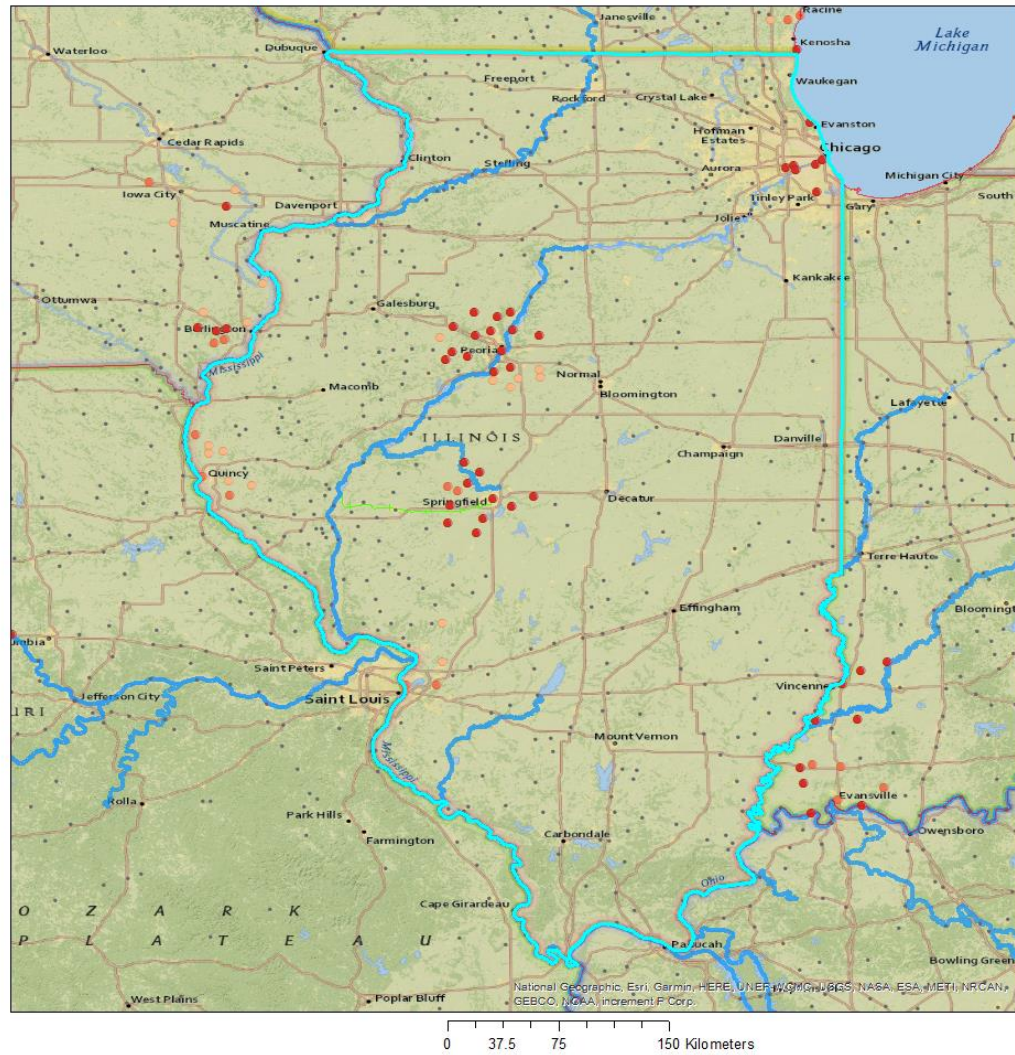
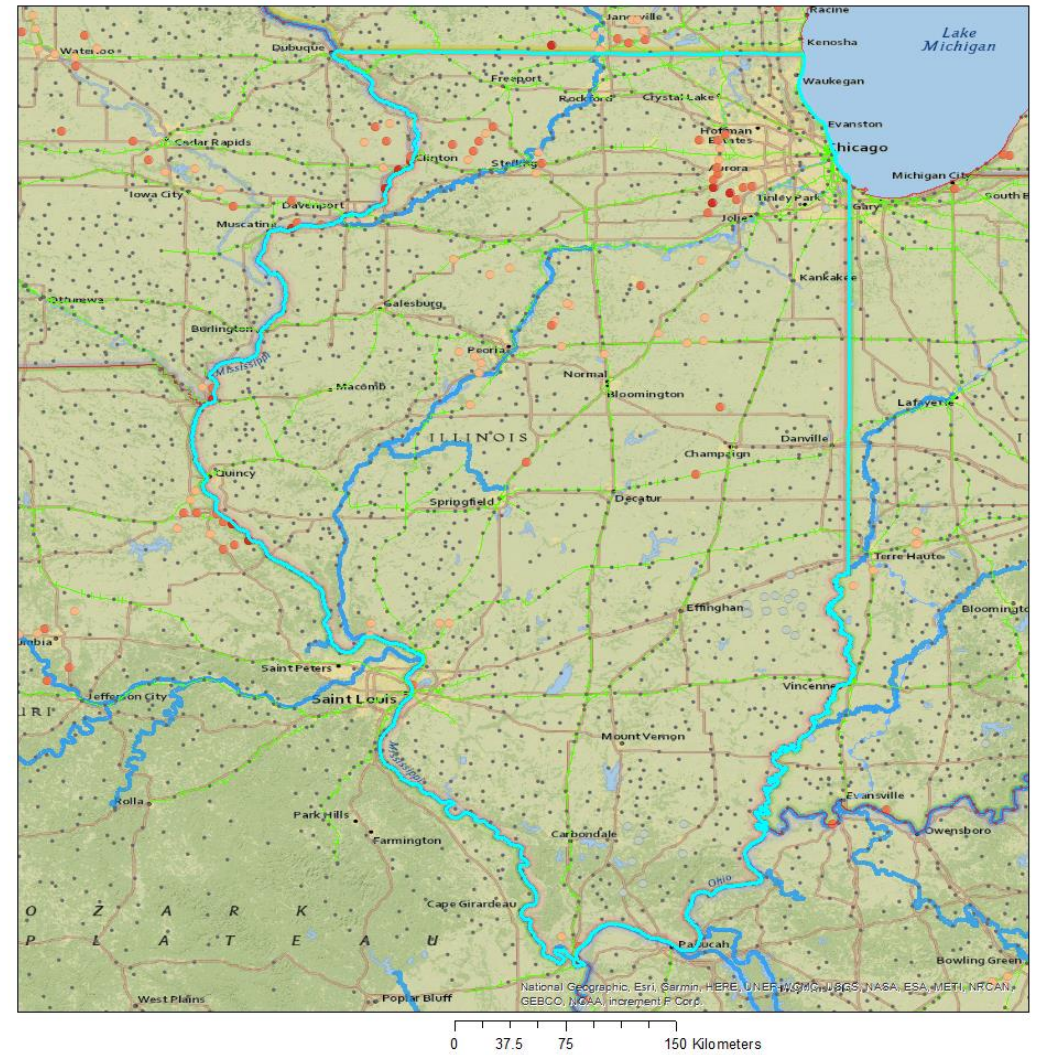


Figure A9.12. Hotspot Analysis for Illinois (1871)



Chicago, Springfield and Illinois, St. Louis Border Area

# Maine (1847-1871)

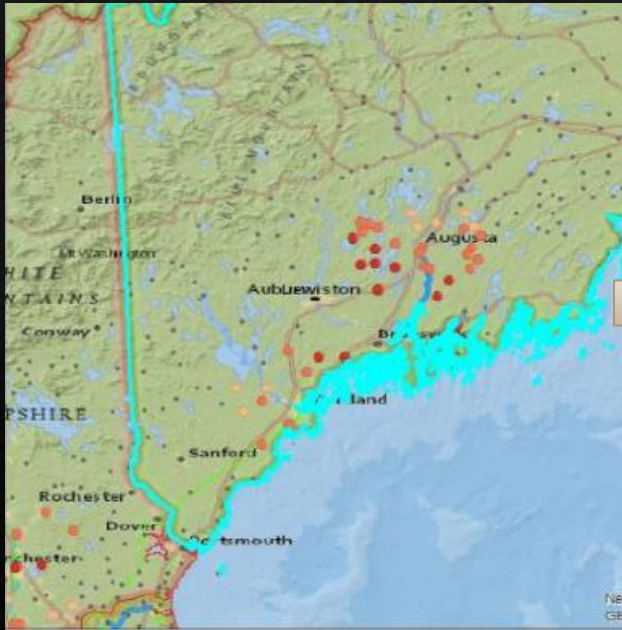
Figure A4.12. Hotspot Analysis for Maine (1871)





# What Happens When the Railroad Arrive in Town?

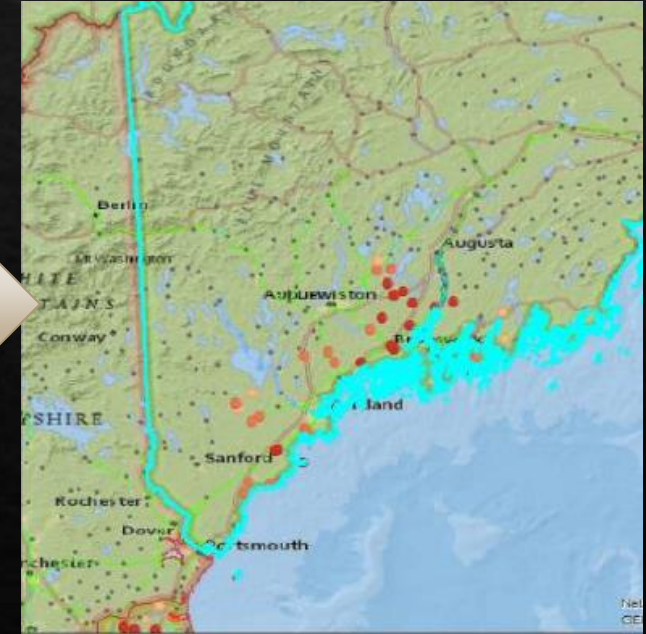
Clustering (1849)



Diffusion (1855)



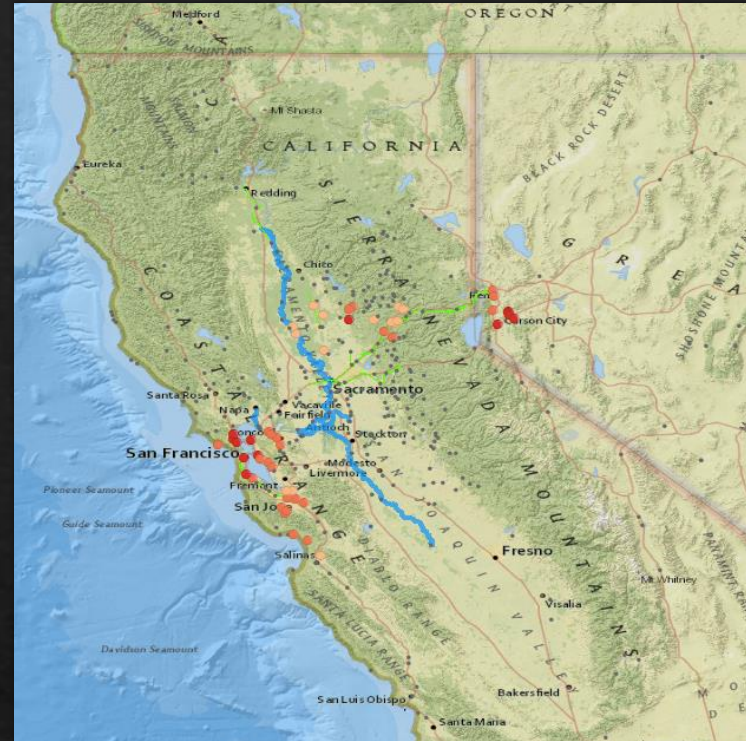
Merge (1871)



# California (1857-1871)

Figure A11.12. Hotspot Analysis for California (1871)





# Postal Revenue of California (1857 vs. 1865)

- \* **Bay Area Cluster** (war, national market, transportation system)
- \* **Virginia and Truckee Railroad** – connects to Carson City silver mine (new transportation corridors)

# Postal Revenue of Postal Office Within 30km from San Francisco (1847 v.s. 1871)

1847

Post Office	County	Postal Revenue
San Leandro	Alameda	8,248
Alameda	Alameda	4,342
San Pablo	Contra Costa	1,855
San Rafael	Marin	1,120
Mill Valley Air Force Station	Calaveras	595
Oakland	Alameda	0

1871

Post Office	County	Postal Revenue
Oakland	Alameda	486,384
San Rafael	Marin	24,673
San Leandro	Alameda	22,673
San Mateo	San Mateo	11,340
San Quentin	Marin	5,003
Alameda	Alameda	4,342
San Pablo	Contra Costa	4,102
Millbrae	San Mateo	400

# Summary

- postal revenue data, with its high spatial granularity, is a valuable indicator of economic activity
- Diffusion Pattern: initially centered in key economic hubs, postal revenue patterns reveal a distinct diffusion as transportation infrastructure, such as railroads and canals, expands.

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Forest Station	Livingston	J. J. Krueck	20 74	42 42
Fontain Green	Hancock	J. H. Emrich	138 74	180 76
Four Mile Grove	La Salle	F. Lindsey		No returns
Fowler's Station	Adams	James Knox	92 30	105 49
Fox Lake	Lake	M. L. Galagar	58 14	39 23
Frankfort	Franklin	William M. Horrell	97 92	106 02
Franklin	Morgan	A. C. Woods	188 20	202 83
Franklin Grove	Lee	G. W. Brayton	410 92	672 31
Franconia	Richland	J. Bunting, Jr.	37 11	44 14
Fredericksville	Schuyler	Grove Cunningham	129 59	150 35
Freedom	Williamson	Gilbert Davis	39 34	27 43
Freeburgh	St. Clair	Edmond Unfred, to August 29	13 10	
		Wm. Krauss, from August 29	96 80	124 76
Freedom	La Salle	Robert Wright	118 13	130 01
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		A. M. Maxwell	18 00	2 23
Friendship	McDonough	John B. Eskle	12 76	11 43
Friendsville	Wabash	William Brackett	101 23	140 85
Fullersburg	Du Page	D. S. Estabrook	65 02	100 22
Fuller's Point	Coles	J. Keller	10 38	8 62
		M. K. Phillips	11 50	13 23
Pulton	Whitesides	W. C. Snyder	861 78	1,451 10
Gage's Lake	Lake	H. J. Wright	21 44	20 66
Galena	Jo Daviess	Warren W. Huntington	2,900 00	5,341 43
Galesburg	Knox	Clark E. Carr	2,500 00	6,377 36
Gallatin	Saline	J. E. Odum	110 54	91 00
Galloway	La Salle	G. R. Bellford	30 59	38 98
Gallum	Perry	Michael Harshaw	29 09	33 01
Galva	Henry	Geo. R. Wiley, to April 17	701 49	941 29
		A. F. Miller, from April 18	178 91	310 24
Gap Grove	Jo Daviess	Thomas Shurrer	52 71	53 47
Garden Plain	Whitesides	James A. Sweet	14	12 48
Garden Prairie	Boone	D. H. Sackett	97 83	104 31
Gardner	Grundy	W. H. Schoenmaker, to December 5	111 22	96 88
		E. A. Atkinson, from December 6	142 66	277 13
Gard's Point	Wabash	B. P. Baker	24 57	7 93
Geneva	Kane	John J. Chambers, to May 25	690 84	618 27
		Samuel Penneck, from May 26	65 28	34 21
Geneseo	Henry	W. T. Allen, to May 15	1,310 43	2,060 31
		G. A. Hobbs, from May 16	189 57	221 38
Geneseo Grove	Whitesides	Ephraim Brookfield	62 97	106 50
Genou	De Kalb	H. N. Perkins	113 13	151 81
Georgetown	Vernon	Josiah Thompson	285 02	303 46
Germanatown	Clinton	John Newlin	92 50	94 32
Gilson	Knox	John Neumeyer	91 24	128 85
		James Moore	57 79	64 16
Gilend	Calhoun	Johns Ickes	55 00	82 05
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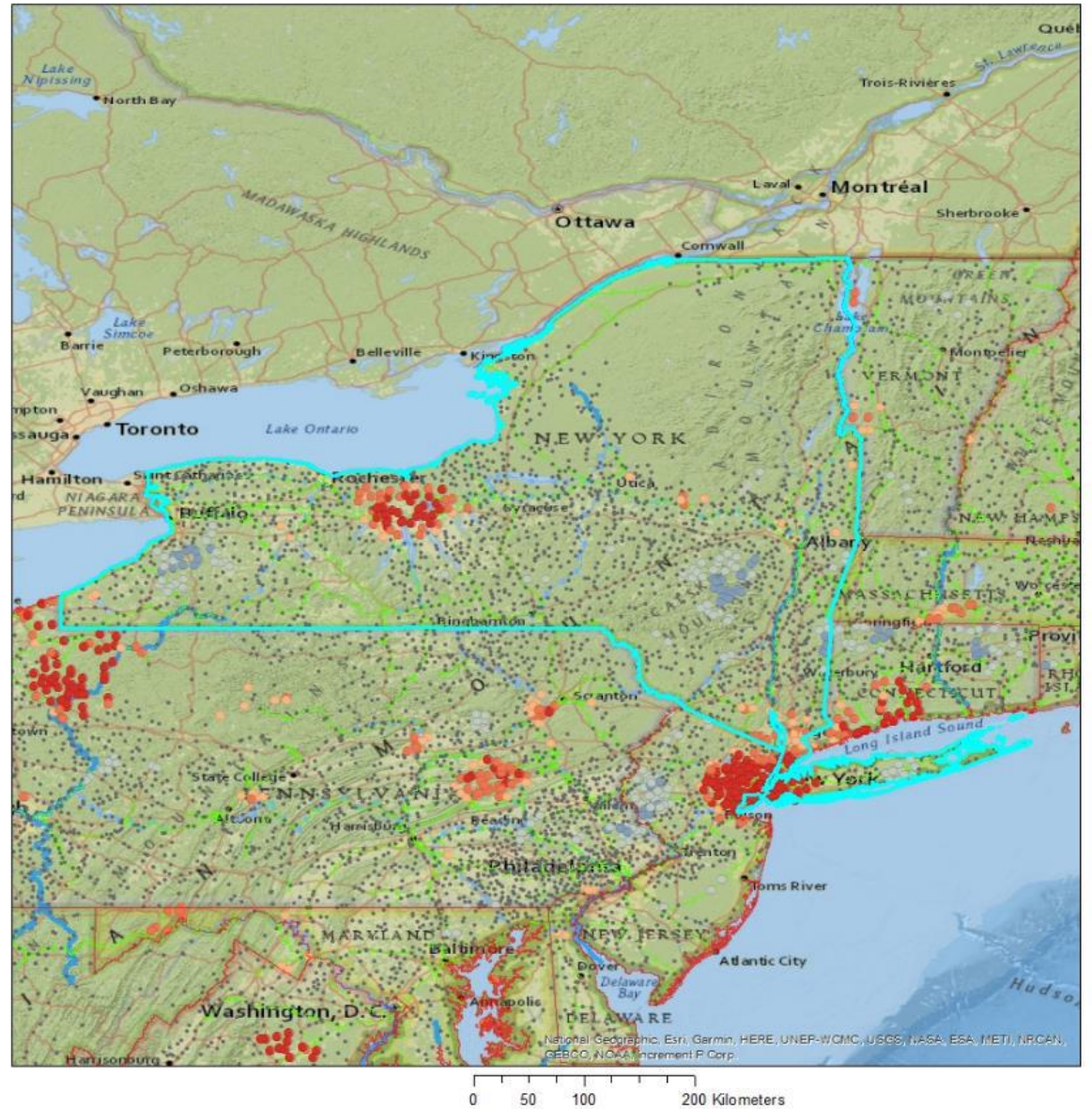
Table 2.1 Summary Statistics- the Entire Dataset

Number of Records	Mean	Minimum	Maximum	Standard Deviation
191,891	16755.52	0	1146151	77485.72

25 <sup>th</sup> percentile	Median (50 <sup>th</sup> percentile )	75 <sup>th</sup> percentile	90 <sup>th</sup> percentile	99 <sup>th</sup> percentile
424	1266.00	4169	15563.00	66426.80

# New York (1849 – 1871)

Figure A6.12. Hotspot Analysis for New York (1871)



# Oregon (1849 – 1871)

Figure A12.12. Hotspot Analysis for Oregon (1871)

