

Zoning and the American Suburb

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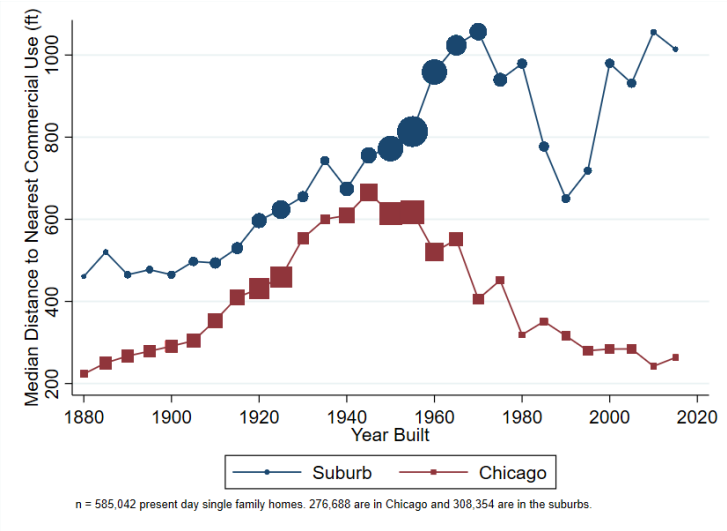
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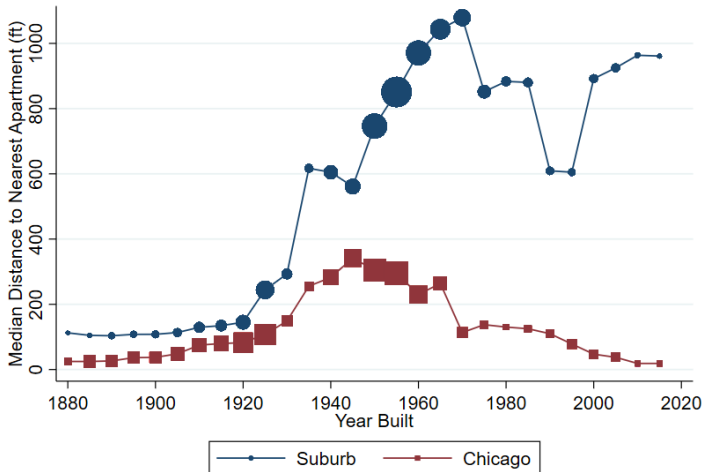
Introduction

- The 20th century saw a radical transformation in urban form in the United States.
- Compact, mixed-use development in cities gave way to almost purely residential, low-density suburbs as the main source of new housing supply.
- Walkable neighborhoods largely disappeared from the urban frontier.

Evolution of access to stores

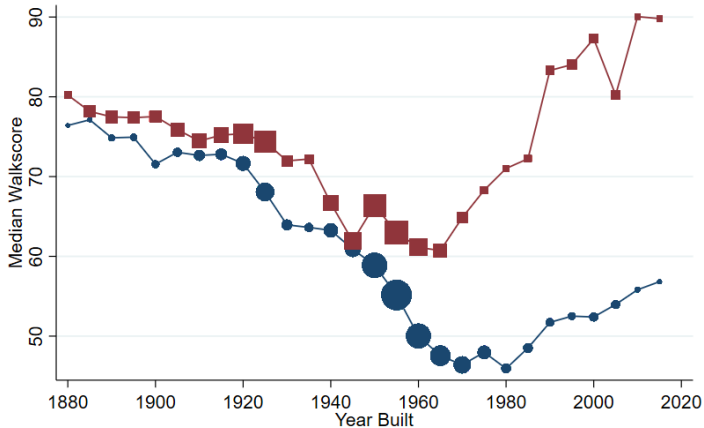


Evolution of proximity to nearest apartment building



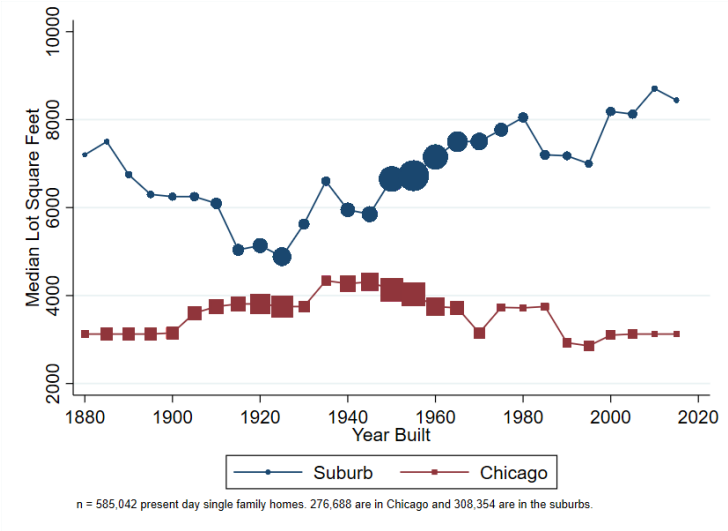
n = 585,042 present day single family homes. 276,688 are in Chicago and 308,354 are in the suburbs.

Evolution of walkability

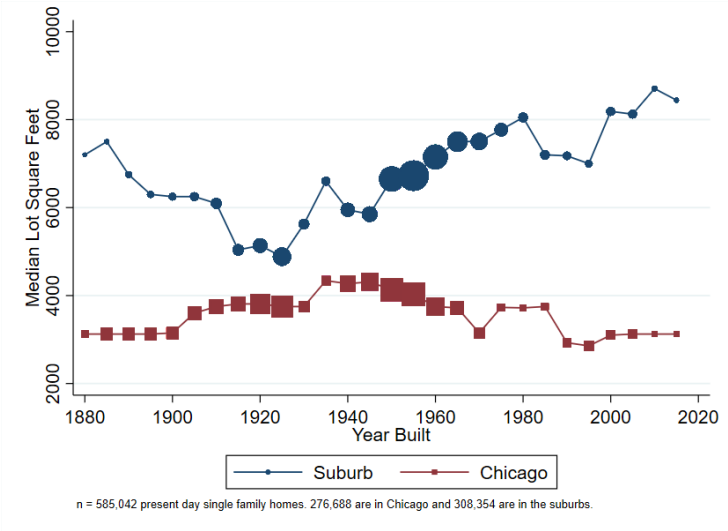


n = 581,979 present day single family homes. 276,130 are in Chicago and 305,849 are in the suburbs.

Evolution of lot size



Evolution of lot size



Levittown, PA



Introduction

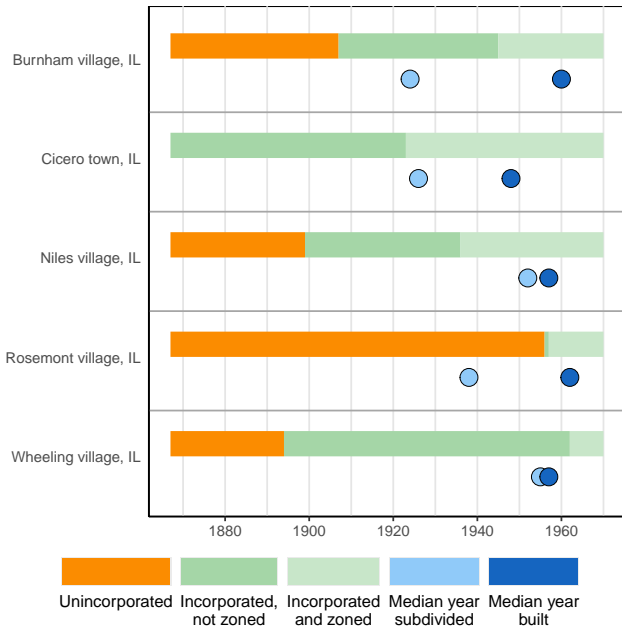
- Our question: Why?
- One possibility: Zoning.
- Clearly a constraint on current (re)development, especially in central cities.
- Most of the suburbs were built decades ago - is zoning responsible for the urban form we've inherited?

Introduction

- Another possibility: Developers responding to market demand.
- AMM model predicts lot sizes should rise as incomes increase and development moves farther from downtown.
- Automobiles reduce demand for dispersed businesses.

Our paper

- To understand how zoning shaped the suburbs, we need to know what zoning looked like when they were first developed.
- Construct the first *spatial* panel dataset of zoning regulations from the original ordinances for over 100 suburban municipalities.
- We focus on the suburbs of Chicago in Cook county between 1940 and 1970, when much of the existing housing stock was built.
- We observe the the exact regulatory environment of suburban blocks at the time they were subdivided and later developed.



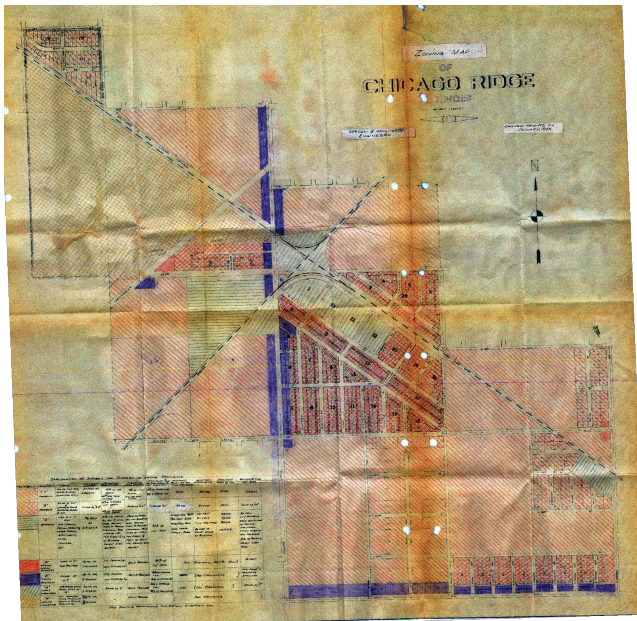
Our goals

- Understand the history of suburban zoning.
- Provide causal evidence on the role of land use regulation on the development of the suburbs.
- Inform efforts to impute historical regulations from the built environment today.

Data

- ① Obtained and digitized zoning ordinances and associated bylaws for (almost) all incorporated suburban municipalities in Cook county in 1940, 1950, and 1960 (1970 in progress).
- ② Importantly, we obtain subdivision date for parcels from the Cook County GIS office.
- ③ Contemporary land use from CMAP (Chicago Metropolitan Agency for Planning). Walkscore.com for walkability scores.
- ④ Spatial data on historical railroads, commuter rail, water bodies, PLSS survey grid.

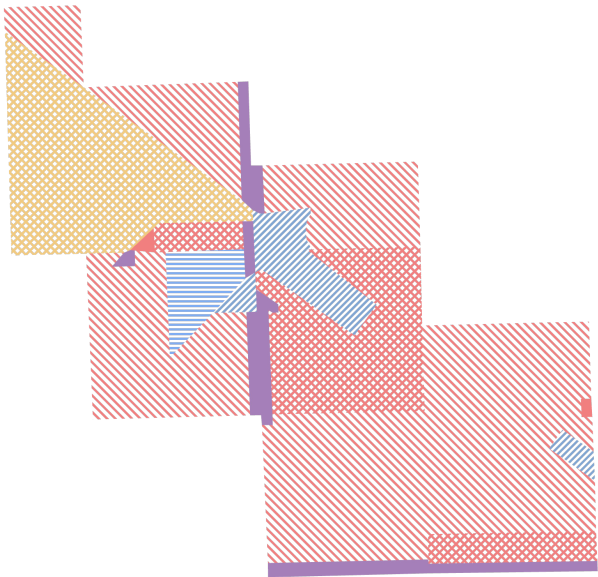
Spatial data - Chicago Ridge zoning map from 1945



With street file



Zoning area shape file



Associated bylaws

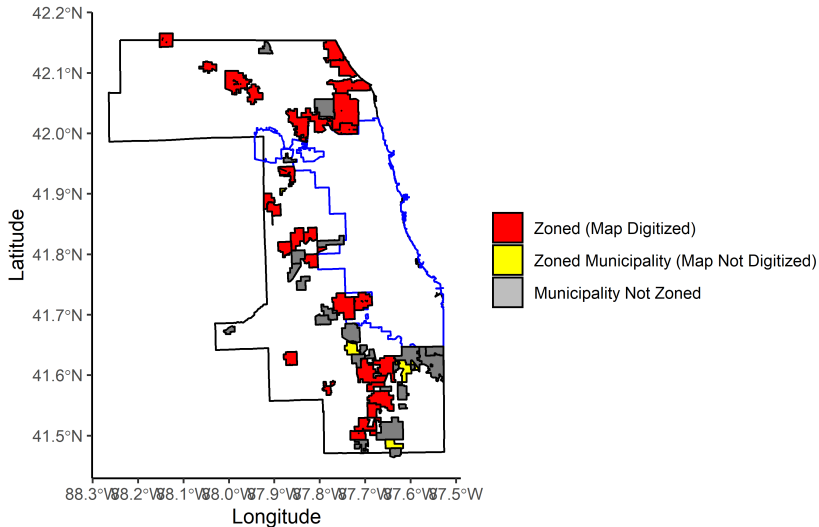
EXPLANATION OF SYMBOLS AND SUMMARY OF ZONING ORDINANCE										
SYMBOL	DISTRICT	USES	MAXIMUM HEIGHT	MINIMUM REAR YARD	MINIMUM SIDE YARD	MAXIMUM % OF LOT AREA TO BE OCCUPIED	MINIMUM 30 FT. OF LOT AREA PER FAMILY	MINIMUM WIDTH OF LOT	MINIMUM AREA OF LOT	BUILDING-LINE SET-BACK
A	"A"	ONE OR TWO FAM. GRADE SCHOOLS, CHURCHES ETC.	40 FEET OR 3 STORIES	20% OF LOT DEPTH OR LESS THAN 10 FEET	10% OF LOT WIDTH. NOT LESS THAN 5 FEET	35% OF INTERIOR LOT	7500	60 FEET	7500	30 FEET
	"A"	SAME AS "A" & LODGING HOUSES, BUILDING HOUSES & ETC.	SAME AS "A"	5% OF INTERIOR LOT DEPTH 10% OF CORNER LOT DEPTH	SAME AS "A"	SAME AS "A"	5000	50 FEET	5000	SAME AS "A"
C	"C"	USES AS IN "A" ALSO	96 FEET	5% LOT DEPTH. BUT ANY BUILDING OVER 40 FEET HIGH, TO PROVIDE ADDITIONAL REAR YARD OF 1 FT. FOR EVERY 1/2 FT. OF BUILDING HEIGHT OVER 40 FEET.	10% OF LOT WIDTH. BUT ANY BUILDING OVER 40 FEET HIGH, TO PROVIDE ADDITIONAL REAR YARD OF 1 FOOT FOR EVERY 1/2 FOOT OF BUILDING HEIGHT OVER 40 FEET.	35% OF LOT AREA	SINGLE FAM. 7500 TWO FAM. 3750 THREE FAM. 3000 OVER THREE FAMILY, 2000	60 FEET 60 FEET TWICE BLDG. HEIGHT 80 FEET OR TWICE HEIGHT OF BUILDING	7500 7500 9000 10,000	30 FEET ANY BUILDING OVER 40 FT. HIGH TO PROVIDE ADDITIONAL FRONT YARD OF 1 FT. FOR EVERY 1/2 FT. OF BUILDING HEIGHT OVER 40 FT.
	"C"	TWO FAMILY, DUPLEX DWELLING, THREE FAMILY, APARTMENTS, CLUBS, COLLEGES, ETC.	OR 8 STORIES							
D	"D"	USES IN "C" ALSO BUSINESS	40 FT. OR 3 STORIES	5 FT. CORNER LOT 10 FT. INTERIOR LOT	5 FT. IF PROVIDED	80% OF LOT AREA	SEE ORDINANCE, ART. 6, SEC. 3			10 FEET
E	"E"	SAME AS IN "C"	40 FT. OR 3 STORIES	5 FT. CORNER 10 FT. INTERIOR LOT	5 FT. IF PROVIDED	80% OF INTERIOR LOT 85% OF CORNER LOT	(SEE ORDINANCE)			NONE, EXCEPT AS REQUIRED BY ORDINANCE
G	"G"	MATERIAL YARD, LIGHT INDUSTRIES	40 FT. OR 3 STORIES	SAME AS "E"	5 FT. IF PROVIDED	80% OF INTERIOR LOT 85% OF CORNER LOT	700	(SEE ORDINANCE)		SAME AS "G"
H	"H"	ANY MANUFACTURING PLANT, AS SHOWN IN ZONING ORDINANCE.	96 FT. OR 8 STORIES	-	5 FT. IF PROVIDED	(SEE ORDINANCE)		

SEE ZONING ORDINANCE FOR DETAILS, EXCEPTIONS, ETC.

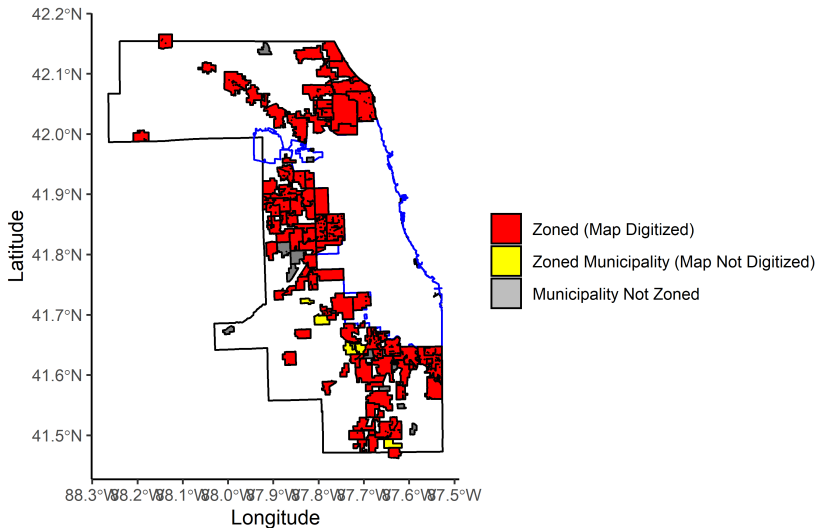




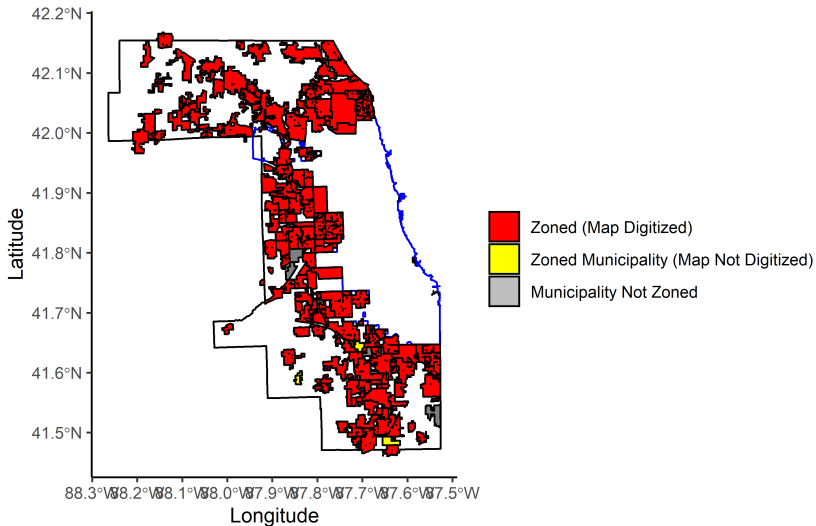
Suburban zoning - 1940



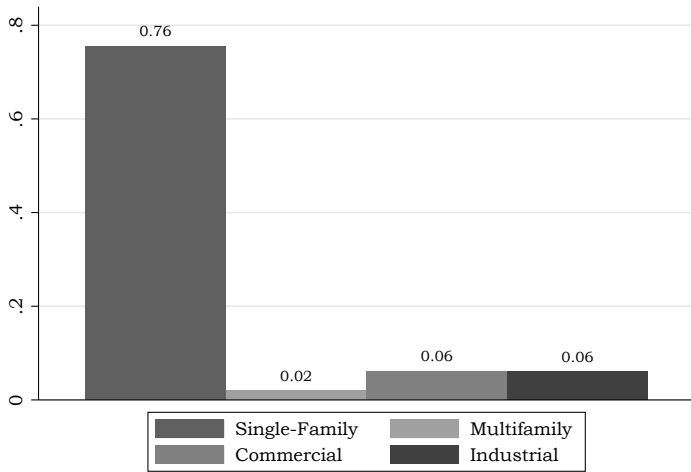
Suburban zoning - 1950



Suburban zoning - 1960

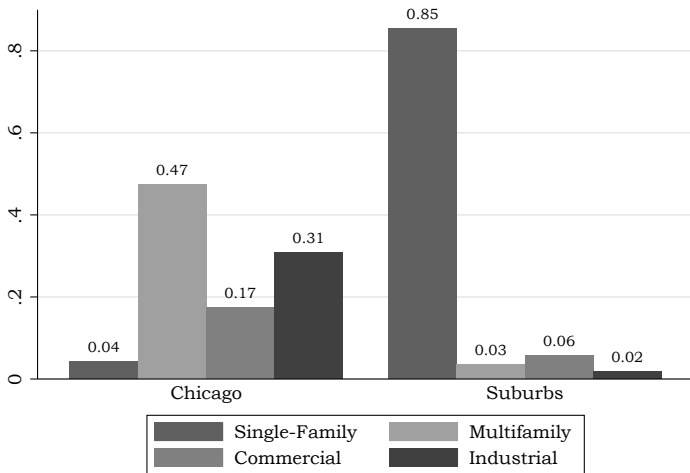


Use shares for median municipality (earliest observed)



106 cities

Use shares show startling break (zoned before 1940)

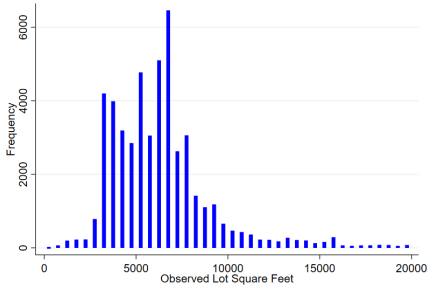


57 cities

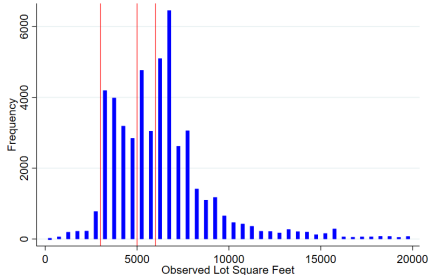
Empirical results

- **What can we learn about historical regulations from the built environment?**
- Was the built environment of the suburbs different if developed under regulation or not?
- What was the causal impact of more restrictive zoning?

Lots sizes in 1950s



n = 48,764 parcels subdivided before they were zoned and built in the 1950s.



n = 48,764 parcels subdivided before they were zoned and built in the 1950s.
Red lines represent 4 common MLS values = 3000, 5000, and 6000

What can we learn about historical regulations from the built environment?

- Substantial interest in using automated methods to impute zoning regulations from data on the built environment, particularly lot size.
- We find:
 - ① Subdivision often occurred decades before construction.
 - ② Developers preferred orderly and uniform suburban lots prior to the introduction of zoning.
 - ③ Uniform parcel sizes of 5000 or 6000 sq ft were not uncommon, so "bunching" is not necessarily evidence of zoning.
 - ④ MLS imposed after development mimicked existing lot sizes.

Empirical results

- What can we learn about historical regulations from the built environment?
- **Was the built environment of the suburbs different if developed under regulation or not?**
- What was the causal impact of more restrictive zoning?

Development before and after zoning

	Subdivided after zoning	Subdivided before zoning	Subdivided & built before zoning
<u>Actual lot size:</u>			
▷ Average	10,635	8,325	7,273
▷ Median	8,640	6,700	5,275
<u>CV of lot size:</u>			
▷ Average	0.11	0.22	0.16
▷ Median	0.09	0.20	0.13
<u>Dist. to commercial use:</u>			
▷ Average	0.22	0.15	0.12
▷ Median	0.19	0.12	0.09
<u>Dist. to apartments:</u>			
▷ Average	0.25	0.13	0.07
▷ Median	0.20	0.07	0.02
<u>Walkscore:</u>			
▷ Average	51	63	71
▷ Median	52	65	76
Total number	4,853	2,928	682

Unit of analysis is a subdivision; includes subdivisions from all years.

Subdivision-level analysis controlling for year

	Avg. lot size (1)	CV lot size (2)	Avg. dist. to commercial (3)	Avg. dist. to apt (4)	Avg. Walkscore (5)
Subdivided after zoning	2,366.02*** (416.087)	-0.04*** (0.007)	0.08*** (0.014)	0.04*** (0.013)	-4.00*** (1.123)
Distance controls	Yes	Yes	Yes	Yes	Yes
1943 land values	Yes	Yes	Yes	Yes	Yes
Year subdivided indicators	Yes	Yes	Yes	Yes	Yes
Observations	2,546	2,332	2,546	2,546	2,541
Adjusted R^2	0.259	0.165	0.125	0.266	0.229

Subdivisions between 1921 and 1960.

Accounting for year of development and locational factors, still see sizable differences associated with zoning.

IV approach

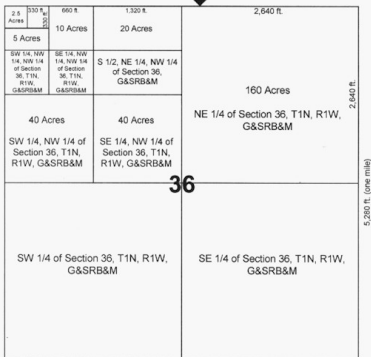
- Controlling for development year does not necessarily address endogeneity of zoning adoption.
- Ideally, we want "random" variation in zoning.
- To generate this variation, we use property divisions induced by the Public Land Survey System.
- The survey's grid is often associated with property (and thus zoning) boundaries.
- We make a grid of half-mile diameter circles across Cook county based on the first division of townships.

EXAMPLE 3

SECTION DETAIL

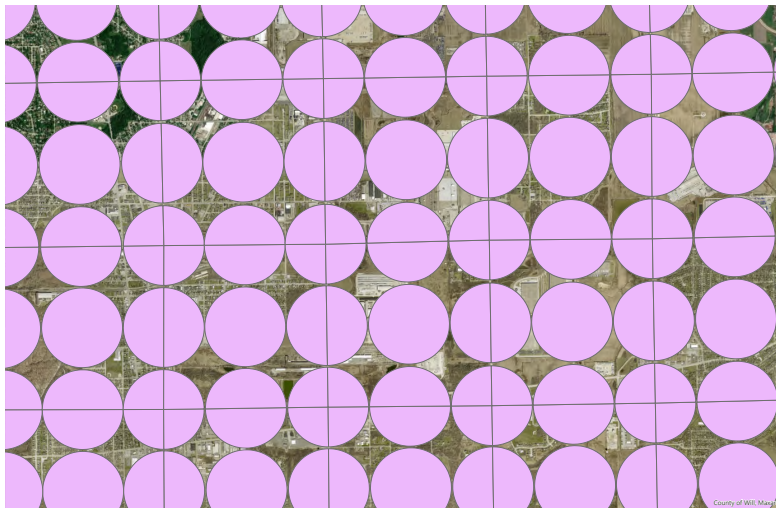
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

TOWNSHIP 1 NORTH, RANGE 1 WEST,
GILA & SALT RIVER BASELINE & MERIDIAN

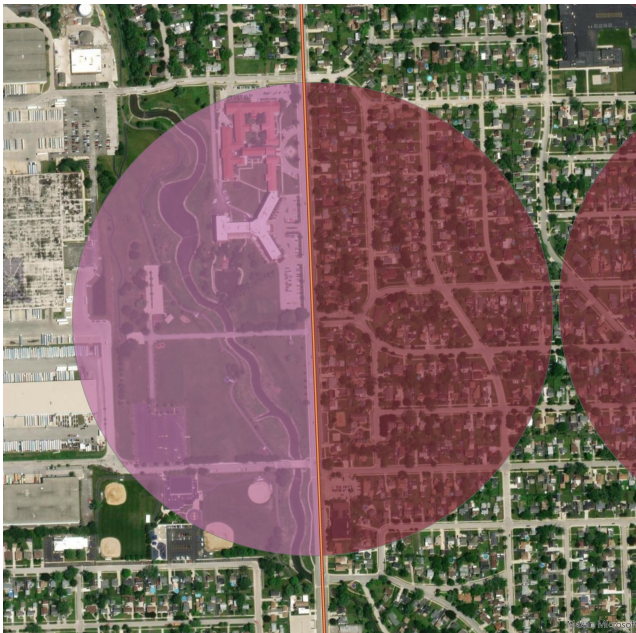


5,280 ft. (one mile)

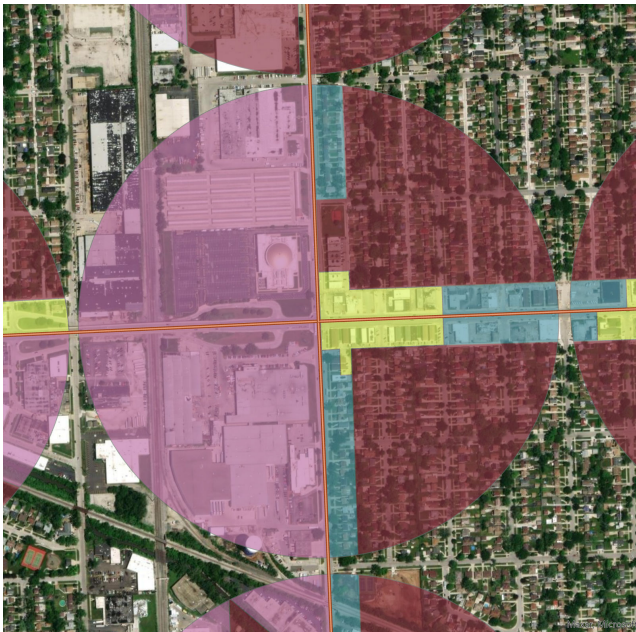
Geography of analysis



Visualization of PLSS IV (ind vs. res)



Visualization of PLSS IV (ind vs. com/apt/res)



Visualization of PLSS IV (high/low MLS)



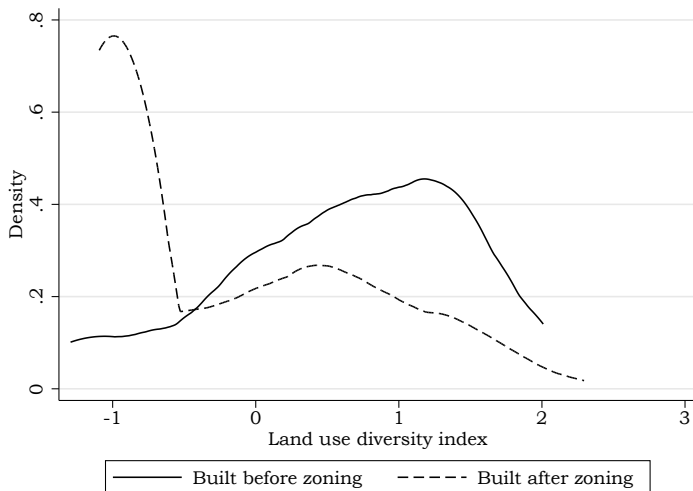
Measuring zoning diversity

- To measure diversity of land uses and zoning, we use an entropy index.
- For each neighborhood, we calculated shares zoned for different uses in each decade, and the shares devoted to actual uses today.
- Diversity is given by

$$\sum_{i=1}^N s_i \ln\left(\frac{1}{s_i}\right)$$

where N is the number of categories and s_i is the share of land devoted to land use/zone i .

Land use diversity before and after zoning



Empirical Work

- Focus on circles where almost all development occurred after zoning.
- Simple regressions with controls for decade of development and distance to nearest river, railroad, CBD, Lake Michigan, and various land use areas of Chicago.
- Use grid of half-mile diameter circles as the unit of analysis.
- 2SLS uses number of sections that each circle was divided into by PLSS boundaries (1, 2, or 4).

OLS: Contemporary land use on historic zoning diversity

	Land use diversity	% apartments	% commercial	Walkscore
	(1)	(2)	(3)	(4)
Zoning diversity, 1940-60	0.70*** (0.053)	0.04*** (0.007)	0.10*** (0.014)	6.15*** (0.916)
90% of parcels subdivided after zoning	Yes	Yes	Yes	Yes
Decade of development indicators	Yes	Yes	Yes	Yes
Observations	429	429	429	427
Adjusted R^2	0.332	0.128	0.225	0.250
Zoning diversity, 1940-60	0.60*** (0.033)	0.03*** (0.004)	0.08*** (0.008)	5.77*** (0.579)
90% of parcels built up after zoning	Yes	Yes	Yes	Yes
Decade of development indicators	Yes	Yes	Yes	Yes
Observations	859	859	859	858
Adjusted R^2	0.327	0.105	0.162	0.340

HC3 standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

2SLS: Contemporary land use on historic zoning diversity

	Land use diversity	% apartments	% commercial	Walkscore
	(1)	(2)	(3)	(4)
Zoning diversity, 1940-60	1.11*** (0.412)	0.06 (0.042)	0.26** (0.119)	6.80 (7.531)
90% of parcels subdivided after zoning	Yes	Yes	Yes	Yes
Decade of development indicators	Yes	Yes	Yes	Yes
Observations	429	429	429	427
Zoning diversity, 1940-60	1.07*** (0.224)	0.06*** (0.020)	0.27*** (0.060)	7.21** (3.667)
90% of parcels built up after zoning	Yes	Yes	Yes	Yes
Decade of development indicators	Yes	Yes	Yes	Yes
Observations	859	859	859	858

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Montiel-Pflueger robust F -statistic ranges from 2.3-7.5 depending on sample size

Possible violation of exclusion restriction

- Roads sometimes follow PLSS boundaries, presumably due to convenient rights-of-way.
- Roads may have lead to more land use diversity on their own.
- We rerun the 2SLS on the set of circles that were at least 50% developed at the time zoning was adopted.

2SLS: Falsification test (areas developed before zoning)

	Land use diversity	% apartments	% commercial	Walkscore
	(1)	(2)	(3)	(4)
Zoning diversity, 1940-60	-0.92 (3.968)	0.41 (0.861)	-0.81 (2.015)	23.99 (49.195)
50% of parcels built up before zoning	Yes	Yes	Yes	Yes
Decade of development indicators	Yes	Yes	Yes	Yes
Observations	118	118	118	118

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Montiel-Pflueger robust F -statistic is 0.1.

Conclusion

- Zoning explains a lot (but not all!) of the shift towards homogeneous large-lot, SF residential suburbs.
- Zoning was very important for eliminating stores and apartments relative to what the market would provide.
- Next steps:
 - ① Expand sample to include 1920s, 30s, and 70s.
 - ② Regression discontinuity exercise using PLSS boundaries and variation in minimum lot sizes.
 - ③ Follow-up study on the evolution of suburban zoning over time, particularly through the Civil Rights movement.
 - ④ Public release version of Cook County Longitudinal Zoning Database.