

The Costs of Housing Regulation: Evidence From Generative Regulatory Measurement

Alexander W. Bartik (UIUC)

Arpit Gupta (NYU Stern)

Dan Milo (NYU Stern)

July 25, 2024

We Measure Housing Regulations through Novel AI Methods

Research Question: What are the key features and determinants of municipal zoning regulations, and how do they influence housing production and prices?

We Measure Housing Regulations through Novel AI Methods

Research Question: What are the key features and determinants of municipal zoning regulations, and how do they influence housing production and prices?

- We propose a novel general purpose method to parse and understand these rules at scale: *generative regulatory measurement*
 - Takes advantage of recent developments in Large Language Models (LLMs) and embedding algorithms applied to zoning codes covering 63% of municipal population
 - We assess LLM performance in dataset creation for complex laws: accuracy 96% (binary), 0.90 (correlation, continuous for min lot sizes)
 - Cross-validated against existing hand-classification (MA Pioneer Data, Glaeser Ward 09) and surveys (Wharton Regulatory Index, Gyourko Saiz Summers 08, Gyourko Hartley Kimmel 21)

We Measure Housing Regulations through Novel AI Methods

Research Question: What are the key features and determinants of municipal zoning regulations, and how do they influence housing production and prices?

- We propose a novel general purpose method to parse and understand these rules at scale: *generative regulatory measurement*
- Create dataset on US zoning regulations to establish 5 facts:
 1. Housing production disproportionately occurs in unincorporated areas w/o mun. zoning
 2. Density is broadly limited by zoning
 3. Zoning follows monocentric pattern, w/ suburban regulations strict in bulk regulations
 4. Housing regulations cluster into two main principal components, the first corresponds to zoning complexity and can be interpreted as extracting value in high demand environments
 5. The second principal component associates with exclusionary zoning

Data, Methodology, and Model Validation

US Zoning Regulations and LLM Application

Advances in AI enable new comprehensive analysis of regulatory texts

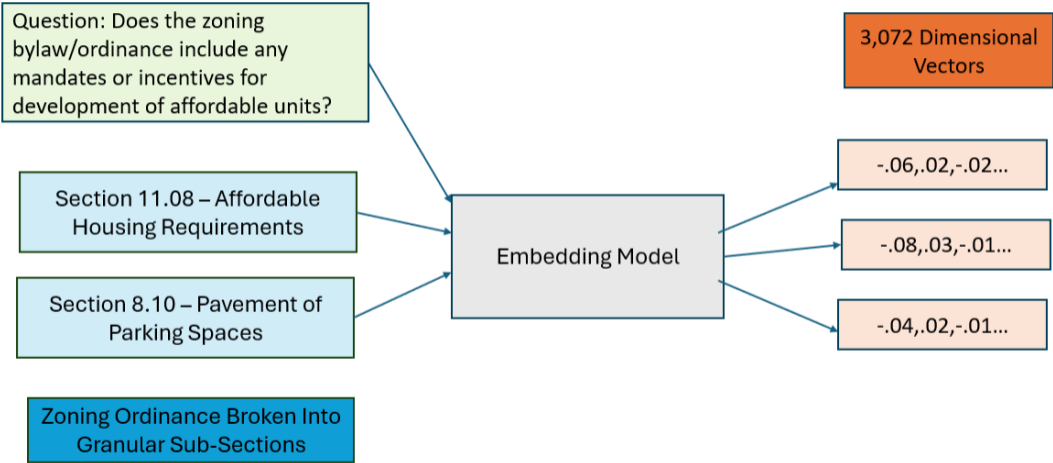
- Collect data on broad range of US housing regulations
 - Cover land use (permitted activities) and bulk regulations (building size, density, placement)
 - Data sources: American Legal Publishing, Municode, Ordinance.com
 - Coverage: Significant portion of US population [Source Coverage](#) [Overall Metrics](#)
- Use of LLMs for regulatory analysis:
 - Advantages:
 - Scalable analysis of large textual documents (thousands of ordinances)
 - Auditable, replicable reasoning
 - Updatable with new information/improved models
 - Challenges:
 - Potential for inaccuracies and classification errors
 - Limitations in context window and training content

Model Estimation, Training, and Testing

We build on frontier approaches in AI research and pre-existing hand-classifications

- Use Retrieval Augmented Generation (RAG): [Details:](#)
 - Embeddings of zoning question and municipal ordinances to find relevant sections
 - Feed relevant sections into LLM (baseline: Chat GPT 4.0 Turbo)
- Pioneer Institute data (Glaeser Ward 09) for training and testing: [Pioneer Details](#)
 - Trained model on 107 municipalities
 - Tested model on 30 municipalities (only once; 50 reserved for fine-tuning)
 - Included additional questions for housing process (public hearing requirements, wait times)
- Training involves:
 - **Multi-step processing**
 - Subtasks
 - Double-checking
 - Prompt engineering

Example: First, We Embed Text and a Question For Arlington, MA



Examples of Relevant and Irrelevant Text

Relevant

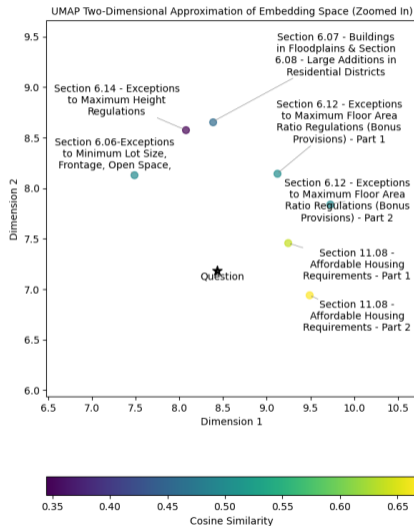
- Section 11.08 - Affordable Housing Requirements Part 1: ...1. Fifteen percent (15%) of the Residential Units in new Projects shall be Affordable Units...
- Section 11.08 - Affordable Housing Requirements Part 2: where more than 50% of the units are affordable to households ... the number of parking spaces may be reduced to 50% of the requirements

Irrelevant

- Section 8.10 - Pavement of Parking Spaces: ...Parking areas with five (5) spaces or less shall be surfaced with a permanent material or binder such as bituminous cement...
- Section 7.06 - Signs permitted in any B, I or PUD District: ...a. One wall sign for each street or parking lot frontage of each establishment. Unless further limited by the provisions...

Relevant Text Close in Space to Question

- We measure the distance from the question vector to the text vector using normalized cosine-similarity (in n-dimensional space)
- Relevant sections on affordable housing and exceptions to lot size and floor area requirements are near the question vector
- We also use a **re-ranking** algorithm on high cosine-similarity text



We Provide the LLM With Question Background Information

Inclusionary zoning requires or encourages developers to include affordable dwelling units within new developments of market rate homes. Some municipalities call it “incentive zoning” - when provision of affordable units is voluntary. The affordable units are typically located on site, but some municipalities also allow off-site development under certain circumstances. Often, payments may be made to a trust fund in lieu of building housing. Housing designated as “affordable” must be restricted by deed or covenant, usually for a period of 30 or more years, to residents with low or moderate incomes. The deed restrictions also limit sales prices and rents as the units are vacated, sold or leased to new tenants.

Do not include provisions for entirely affordable, subsidized housing development by public or non-profit corporations. Also do not include provisions under “rate of development” headings that exempt affordable units from project phasing and growth caps.

Relevant Text Enables A Correct Answer

GPT-4 Turbo Output: The zoning bylaw/ordinance provided does indeed include mandates and incentives for the development of affordable units. Here's a breakdown of the evidence supporting this conclusion:

1. ****Mandates for Affordable Housing Development****: The ordinance mandates that 15% of the residential units in new projects be affordable units (Section 11.08, Part_1, d. REQUIREMENTS, 1.). This requirement applies to all new residential projects, including phased or segmented developments, with six or more units subject to Environmental Design Review (Section 11.08, Part_1, b. APPLICATION). The affordable units must conform to specific affordability criteria, ensuring they are accessible to households earning no more than 60% of the median income for rental units and no more than 70% of the median income for homeownership units (Section 11.08, Part_1, c. DEFINITIONS).

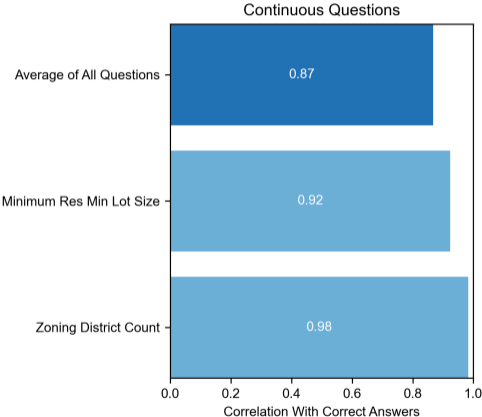
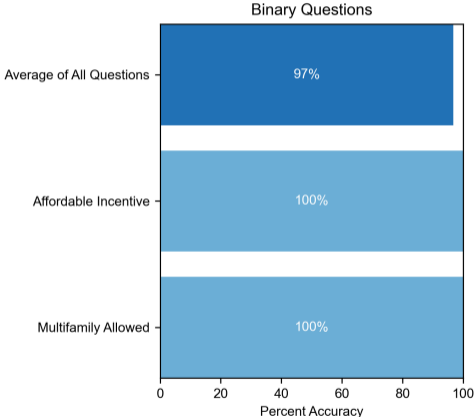
(other evidence omitted for brevity)

Given the evidence from the zoning bylaw/ordinance, it is clear that the town has both mandates and incentives in place for the development of affordable housing units.

ANSWER: YES

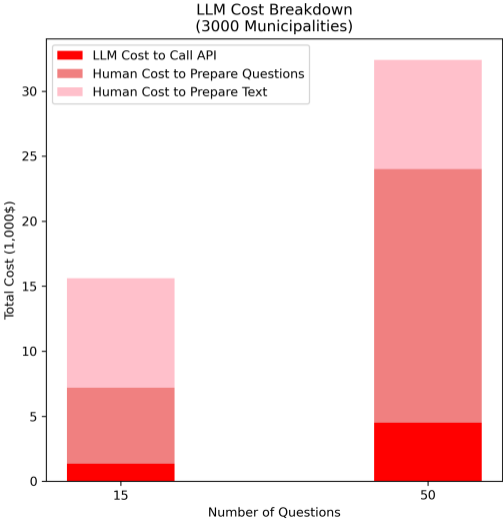
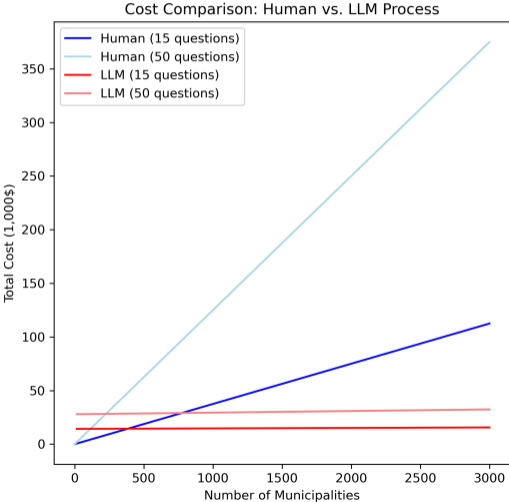
High Accuracy on Binary Questions and Continuous Measures

Measuring model accuracy: AI vs. Pioneer hand-classification



Human Code Processing Costs vs. LLM Processing Costs

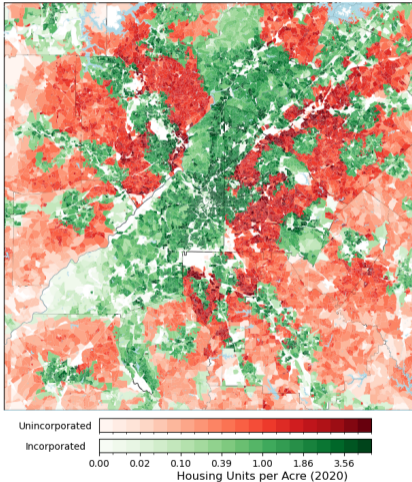
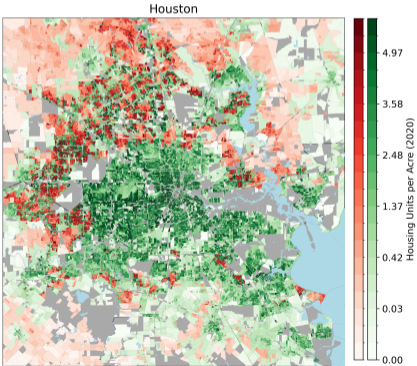
LLM cost effective after ~200–500 municipalities; order of magnitude less expensive for use case



5 Facts About US Zoning

Fact 1. Housing Production Higher in Unincorporated Areas More Cities

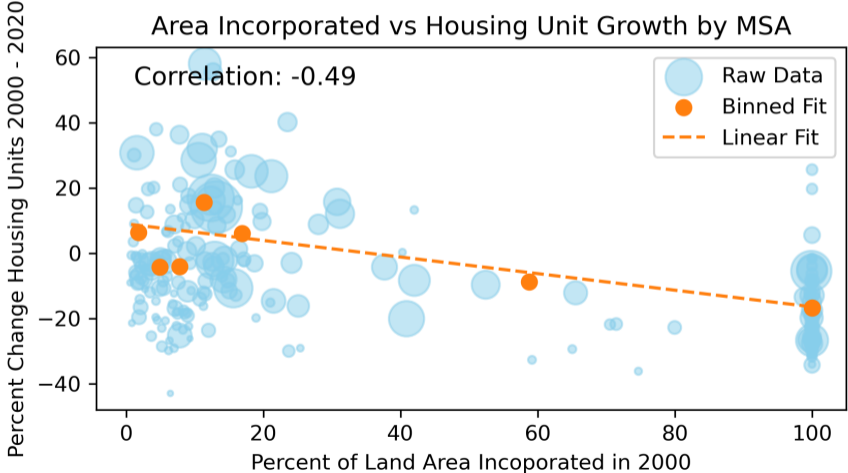
Housing production in greenfield fringes of sunbelt metros



Green: incorporated areas; **Red:** unincorporated areas, shaded by density

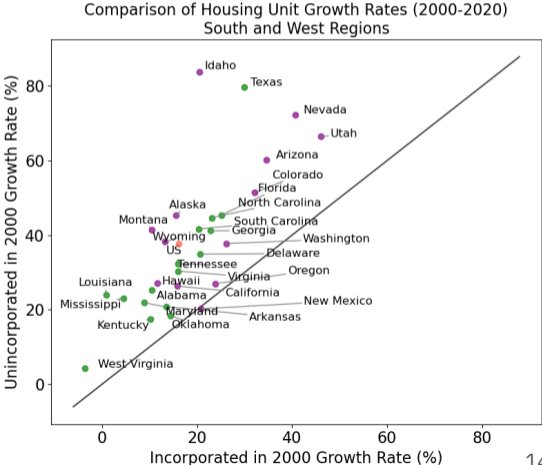
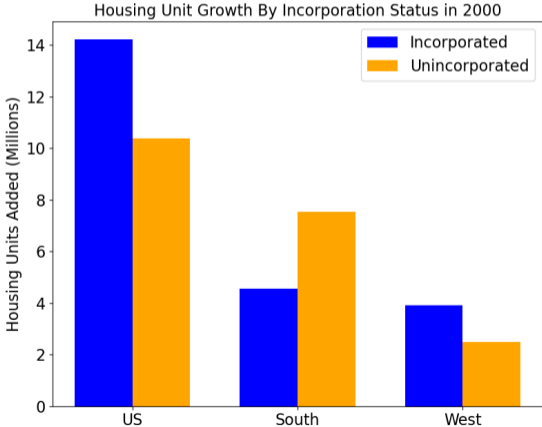
Fact 1. Housing Production Higher in Unincorporated Areas

US housing growth concentrated in low incorporation areas



Fact 1. Housing Production Higher in Unincorporated Areas

42% of nationwide housing produced in unincorporated areas which account for 23% of population and are far from jobs/amenities



Fact 2. Density is Broadly Limited by Zoning

Restrictions on multi-family housing, mixed use, attached single-family units, and ADUs

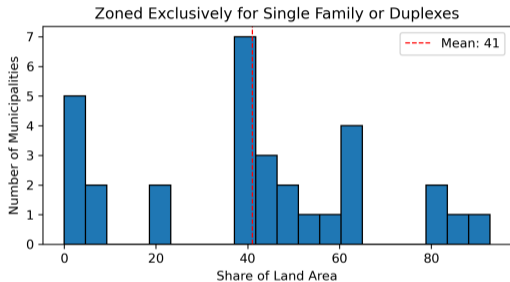
Select Questions on Bulk Regulations	[gray]0.9	National	Income Tercile			[gray]0.9	Urban/Rural		
	Mean	Weight	Count	Low	Mid	High	Rural	Mix	Urban
Is multi-family housing allowed, either by right or special permit (including through overlays or cluster zoning)?	95	98	5,686	99	97	90	95	96	93
Are apartments above commercial (mixed use) allowed in any district?	62	70	5,708	64	67	56	55	66	61
Is multi-family housing listed as allowed through conversion (of either single family homes or non residential buildings)?	14	20	5,766	13	14	14	10	15	13
Are attached single family houses (townhouses, 3+ units) listed as an allowed use (by right or special permit)?	80	89	5,788	80	82	78	65	84	83
Are accessory or in-law apartments allowed (by right or special permit) in any district?	33	38	5,771	27	33	39	23	40	22

All Binary Regs

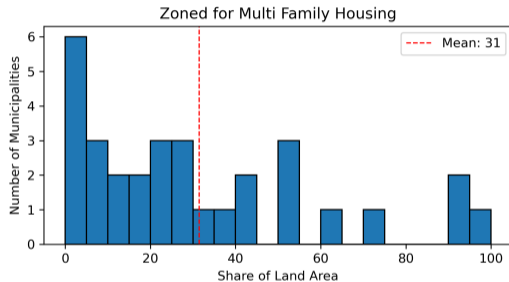
All Continuous Regs

Fact 2. Density is Broadly Limited by Zoning

Even in jurisdictions which allow multi-family housing; land use regulations restrict how much



Single Family Zoning

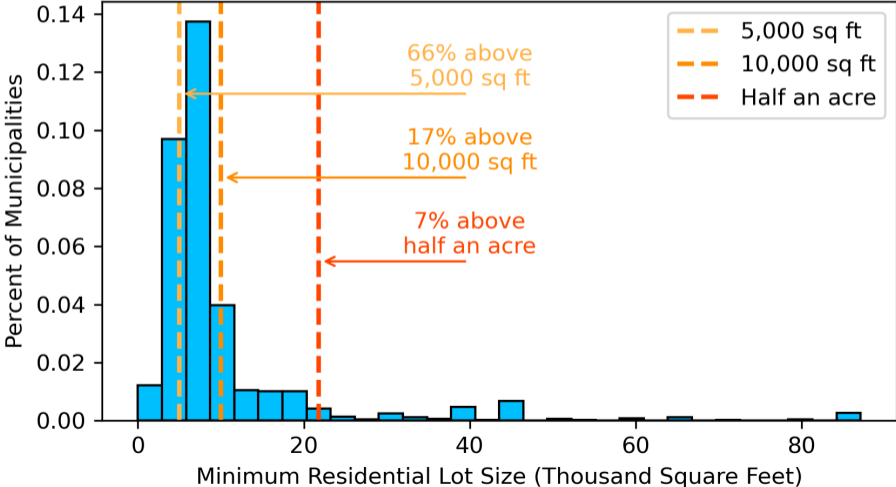


Multi-Family Zoning

Based on merge of zoning district restrictions with zoning maps for a sample of 31 large municipalities covering 18.2 million people, (including Chicago, Seattle, Kansas City, Detroit, San Francisco, Austin, San Antonio, Tampa, Los Angeles, San Diego)

Fact 2. Density is broadly limited by zoning

Density restrictions also apply to single-family zoning. Avg new house has ~2,140 sq ft of floor space

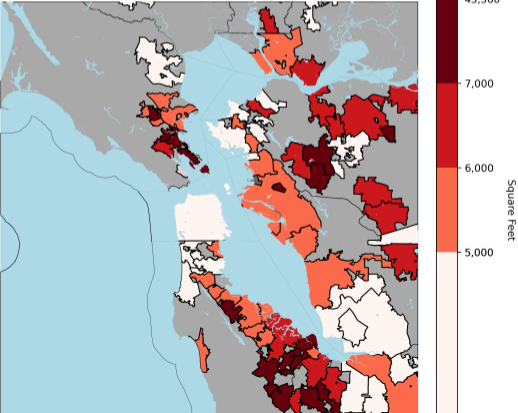


Fact 3. Monocentric Zoning w/ Strict Suburban Bulk Regulations

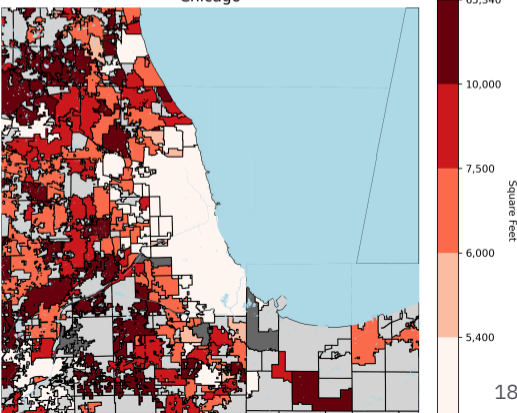
More Cities

High minimum lot size requirements in suburban fringes of cities

Question: Minimum minimum lot size
San Francisco

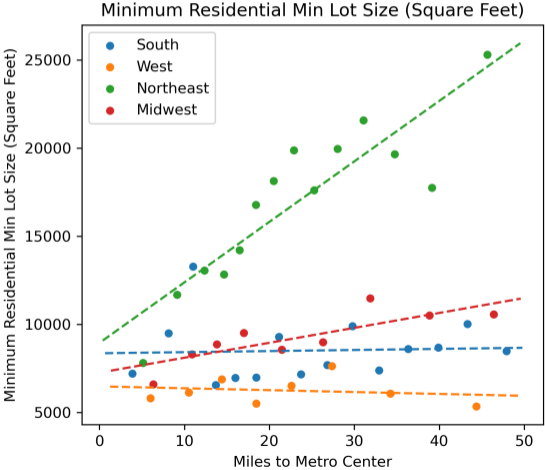
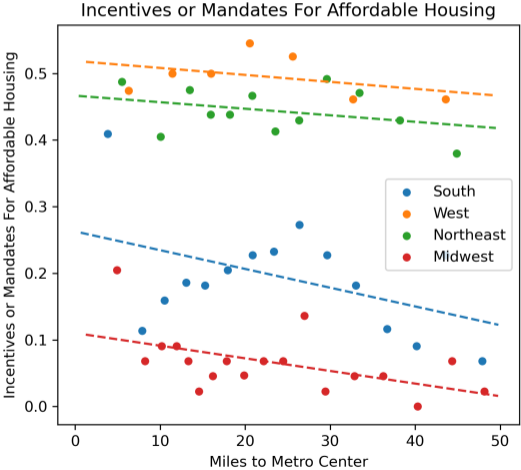


Question: Minimum minimum lot size
Chicago



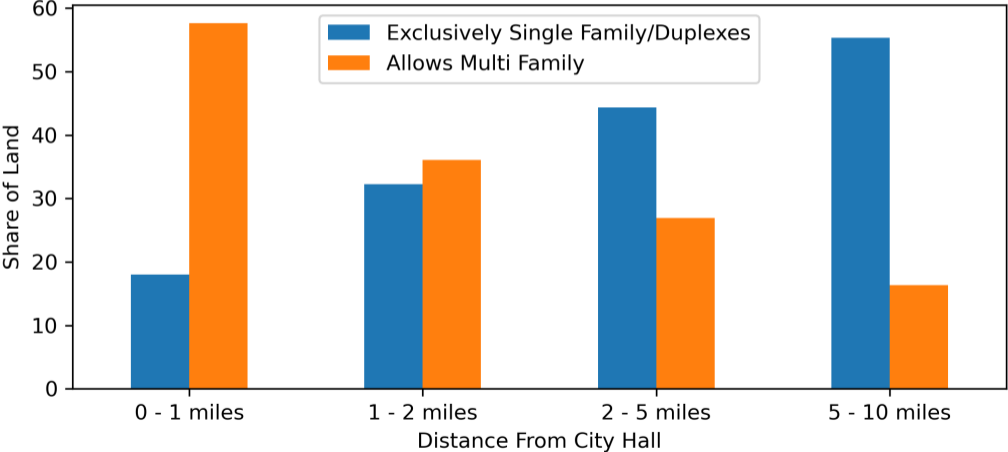
Fact 3. Monocentric Zoning w/ Strict Suburban Bulk Regulations

Trend towards higher minimum lot sizes in suburbs particularly pronounced in the Northeast



Fact 3. Monocentric Zoning w/ Strict Suburban Bulk Regulations

Single-family zoning increases with distance from city center



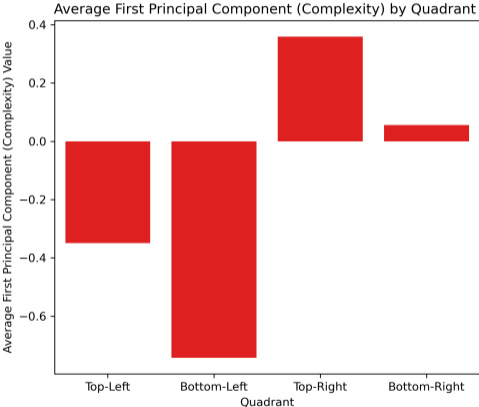
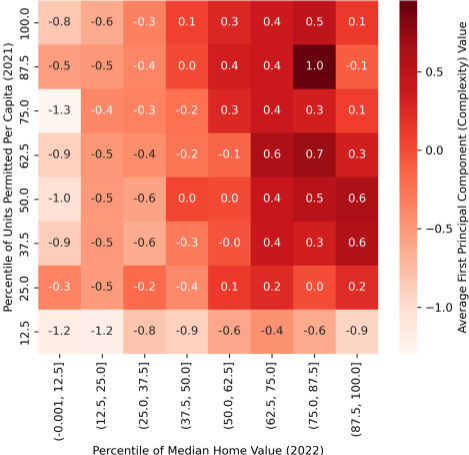
Principal Components of Zoning Codes State Maps All Loadings

We construct the first two principal components of the zoning data

- Loadings for Principal Component 1:
 - (biggest) Affordable housing mandates/subsidies (+)
 - Age restricted housing (+)
 - Number of zoning districts in municipality (+)
 - Public hearing requirements for multi-family (+)
 - Maximum potential waiting time for development review (+)
- Loadings for Principal Component 2:
 - (biggest) Minimum of residential minimum lot sizes (+)
 - Maximum of residential minimum lot sizes (+)
 - Longest frontage requirement (+)
 - Multi-family housing banned. (+)
 - Attached single family houses not an allowed use. (+)

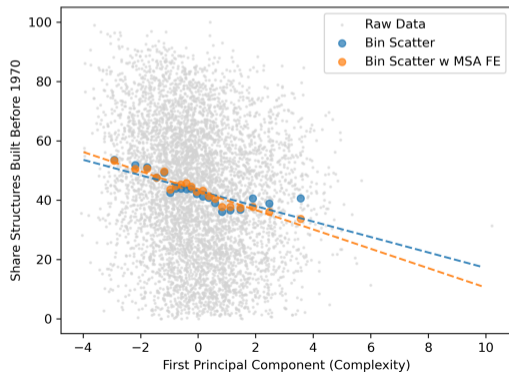
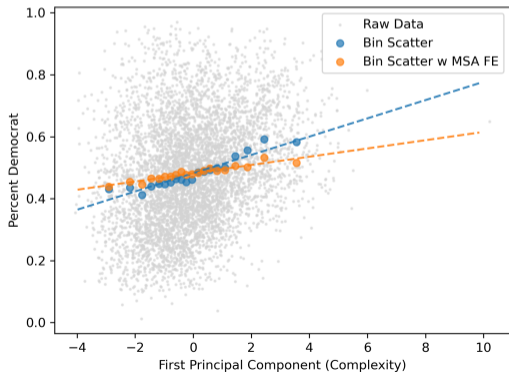
Facts 4. PC1 Corresponds to Zoning Complexity

Can be interpreted as extracting value in high demand environments



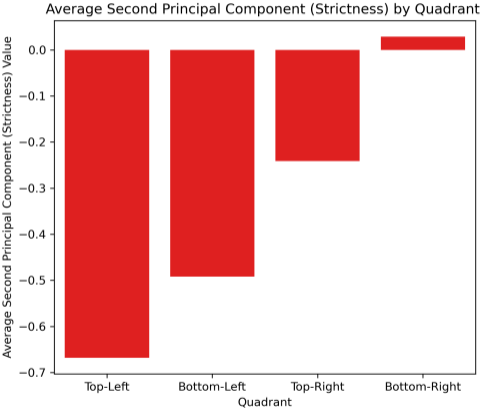
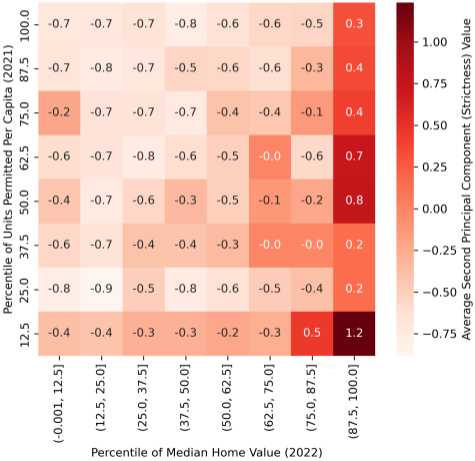
PC1 Correlates: Democratic Vote Share and New Housing Construction

Areas with higher values of PC1 have a higher Democratic vote share and levels of new housing construction



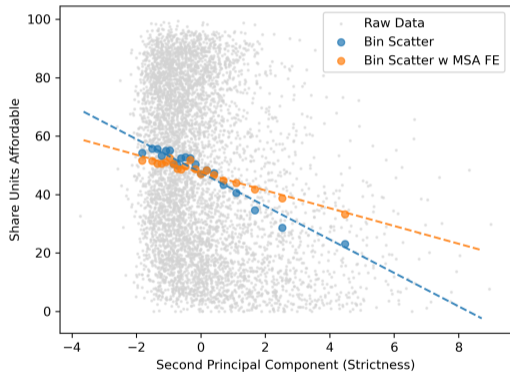
Facts 5. PC2 captures exclusionary zoning

Can be interpreted as enforcing minimum quantity requirements to limit low-income residents

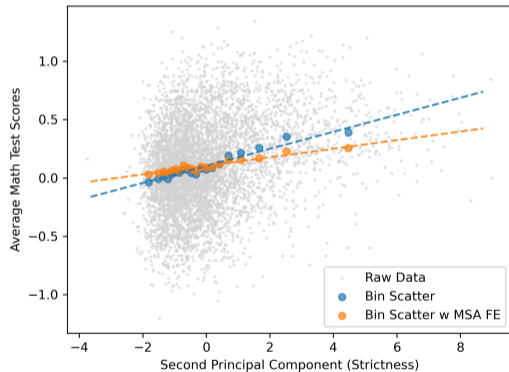


PC2 Correlates: Affordable Housing and Test Scores

Areas with higher values of PC2 have less affordable housing and higher test scores



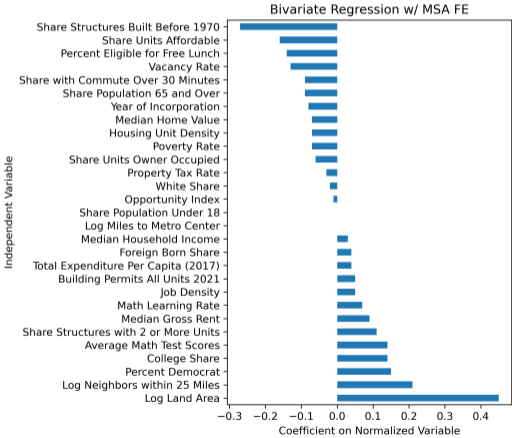
Affordable Housing (30% Income)



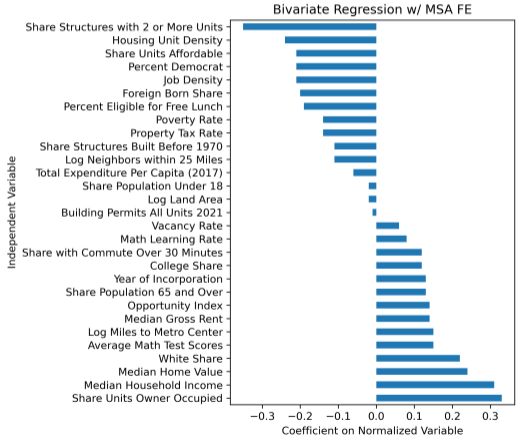
Test Scores

Additional Correlates For PC1 and PC2

Other correlates consistent with our preferred interpretation of PC1 and PC2



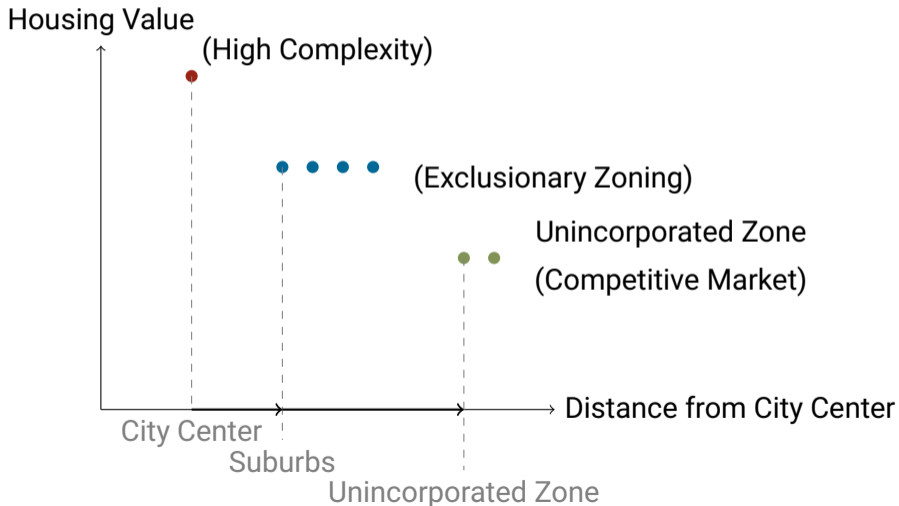
First Principal Component



Second Principal Component

Framework for Results: Monocentric City Model

Most prevalent zoning regime varies by distance from city center



Conclusion

We present a novel approach to systematically categorize regulatory standards, with application to housing regulation

- *Generative regulatory measurement*, through LLMs/RAGs enables interpretation of big text corpus, opening up a new research frontier
 - Cost-effective and scalable approach to classification of regulatory statutes
 - High accuracy in classifying zoning regulations benchmarking against existing regulatory classifications
 - Code and data available at <https://github.com/dmilo75/ai-zoning>
- We use generated data to find: Zoning restricts housing production and density through rent extraction and exclusion

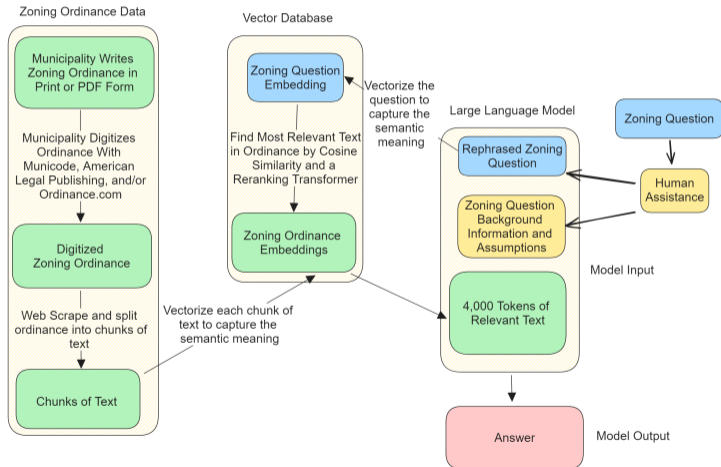
Thanks!

Appendix

Zoning Regulations	Median Home Value			Total Building Permits			Median Gross Rent			Housing Un	
	XGBoost	LASSO	Bivariate	XGBoost	LASSO	Bivariate	XGBoost	LASSO	Bivariate	XGBoost	LASSO
Multifamily Not Allowed	100	0.18	0.24***	35		0.00	100	0.14	0.16***	37	-0.0
Minimum Res Min Lot Size	53	0.02	0.12***	58		0.01	58	0.03	0.08***	84	-0.7
Max Res Min Lot Size	46	0.02	0.09***	40		0.02	71	0.02	0.07***	86	-0.7
Longest Frontage Requirement	40		0.06***	58		0.01	61	0.01	0.06***	100	-0.7
Parking Requirement	53	0.02	0.06***	52		0.03*	77	0.08	0.09***	47	-0.0
Multi 1000sqft Parking Spots	50		-0.05***	39		0.04**	60	0.01	-0.00	51	
Wetlands Restricted in Lot Size Calc	42		0.04***	100		0.01	57	0.02	0.04***	31	-0.0
Affordable Mandate	75	0.02	0.05***	36		-0.00	75	0.06	0.09***	40	-0.0
Townhouses Not Allowed	56	0.03	0.12***	38		-0.03**	95	-0.01	-0.01	22	-0.0
Zoning District Count	50		-0.04***	33	0.00	0.06***	62	0.05	0.06***	39	0.0
Public Hearing Requirements	56		-0.04***	13		0.04**	68		-0.01	47	0.0
Multi 600sqft Parking Spots	63		-0.04***	50		-0.01	47	-0.06	-0.06***	33	-0.0
Age-Restricted Provisions	43		-0.07***	25		0.01	73		0.02	33	
Max Review Waiting Time	47		-0.00	75		0.02	37		0.01	30	-0.0
Single Family Parking Spots	42		-0.00	26		0.04***	72	0.05	0.04***	21	
Permit Cap Or Phasing	29		-0.04***	28		0.03**	52		0.01	59	-0.0
Flexible Zoning By Permit	40		0.08***	59		-0.05***	38		-0.01	45	0.0
Affordable Incentive	40		0.01	19		0.02	68	0.03	0.08***	33	
Garage Requirement	55		-0.05***	39		0.00	31		-0.00	21	0.0
Mandatory Approval Steps	52		0.03**	27		0.03*	58	0.01	0.03**	21	
No Mixed-Use Buildings	46		0.07***	31		-0.02	42	0.03	0.04***	27	-0.0
No Conversion to Multifamily	34		0.02*	19		0.02	63		0.02	36	-0.0
Distinct Approval Bodies	38		0.02	31		0.01	49	0.01	0.03**	20	-0.0

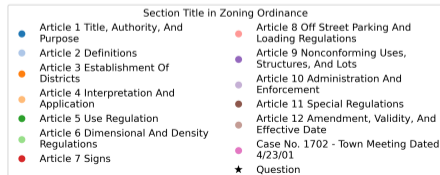
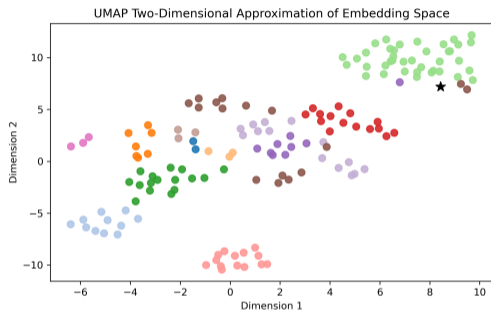
Processing Municipal Codes Using LLMs [Back](#)

Retrieval Augmented Generation (RAG)



Embedding Space Clusters Similar Text

- UMAP (Uniform Manifold Approximation and Projection for Dimension Reduction) approximates the embeddings space in two dimensions
- Sections of text cluster together in the embeddings space
- The question vector (black star) is located near sections on dimensional and density regulations (light green) and special regulations (dark brown).



Related Literature in Regulatory and Textual Interpretation

- **Existing Nationwide Approaches:** Wharton Regulatory Index (Gyourko Saiz Summers 08, Gyourko Hartley Kimmel 21); Huang and Tang 12; Mayer Somerville 00, Saks 08
More comprehensive, detailed, and broader scope of regulatory measurement
- **Narrower Local Approaches:** MA Pioneer Data (Glaeser Ward 09), Shanks 21, Quigley Raphael 05, Jackson 16, Ihlanfeldt 07, CA Turner Housing Data
We automate and scale this approach nationally
- **Existing AI Research:** Sentiment extraction (Hassan et al. 19, Romer Romer 04, Tetlock 07, Lopez-Lira Tang 23), LLMs to textual or regulatory documents (Jha et al. 23, Yang 23, Hansen Kazinnik 23), contractual interpretation (“generative interpretation” Hoffman Arbel 23)
Show LLMs can be used to parse understanding of complicated regulatory documents

Overall Population Coverage

	National	Northeast	Midwest	South	West
Coverage Metrics					
Total Munis	19,488	2,101	8,481	6,587	2,319
% of Munis In Sample	25	32	19	22	48
Total Townships	16,213	4,111	12,102	0	0
% of Townships In Sample	6	23	0	-	-
Total Pop. (Millions)	331	57	69	127	77
% of Pop. Under Local Gov.	76	100	95	55	78

[Return](#)

Percent of Population Coverage by Source

	National	Northeast	Midwest	South	West
Ordinance Aggregator					
American Legal Publishing	11	15	15	6	8
Municode	23	1	19	54	12
Ordinance.com	30	52	12	1	60
Total	63	68	46	61	80

[Return](#)

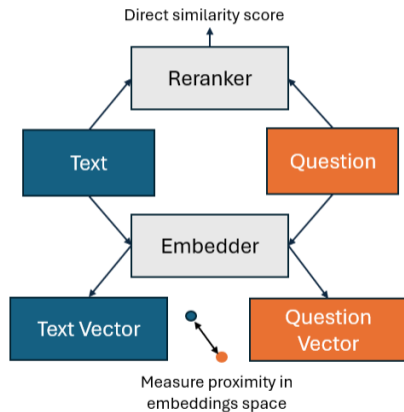
Pioneer Institute Classification of Massachusetts Zoning Codes

- We use the [Housing Regulation Database](#) which is an initiative of the Pioneer Institute for Public Policy Research and Harvard's Rappaport Institute for Greater Boston
- Covers: zoning, subdivision, wetlands, and septic regulations for each municipality in 50 miles of Boston (187 municipalities; half of state)
- Research staff went through municipal zoning documents through Dec 2004
- Data used on research (ie [Glaeser Ward 09](#)) on connection between zoning and housing outcomes

[Return](#)

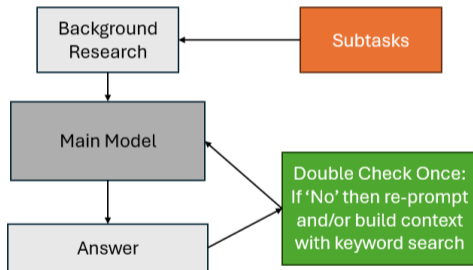
Reranking Algorithm

- Rerankers: jointly encode query-document pairs for accurate, but expensive, similarity scores.
- Two-stage retrieval: first, retrieve the nearest 50 text vectors to the question vector using embeddings; then, apply a reranker.
- Final ranking: convert cosine similarity and reranker scores to z-scores, sum them, and rank the text passages based on the combined score.



Multi-Step Processing

- Subtasks: Some questions require context that is scattered throughout the embedding space. For this, we use subtasks to summarize the necessary context for the LLM.
- Double Checking: A negative answer may mean a lack of context or strong evidence for 'No'. For some questions, we re-prompt the LLM with different context containing highly relevant keywords.

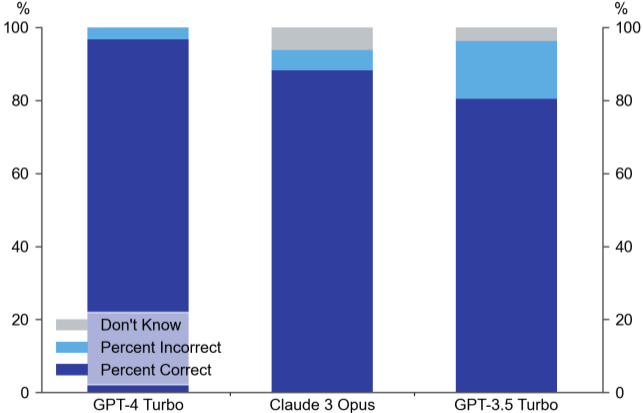


We Estimate High Accuracy on Binary Questions [Return](#)

Question	RSE	% Accuracy
Is multi-family housing allowed, either by right or special permit (including through overlays or cluster zoning)?	0.00	100%
Are apartments above commercial (mixed use) allowed in any district?	0.07	96%
Is multi-family housing listed as allowed through conversion (of either single family houses or non residential buildings)?	0.08	96%
Are attached single family houses (townhouses, 3+ units) listed as an allowed use (by right or special permit)?	0.30	90%
Does zoning include any provisions for housing that is restricted by age?	0.14	96%
Are accessory or in-law apartments allowed (by right or special permit) in any district?	0.09	96%
Is cluster development, planned unit development, open space residential design, or another type of flexible zoning allowed by right?	0.00	100%
Is cluster development, planned unit development, open space residential design, or another type of flexible zoning allowed by special permit?	0.00	100%
Does the zoning bylaw/ordinance include any mandates or incentives for development of affordable units?	0.00	100%
Is there a town-wide annual or biannual cap on residential permits issued, and/or is project phasing required?	0.33	90%
Are there restrictions on counting wetlands, sloped land or easements in lot size calculations?	0.14	96%
Cumulative Average	0.11	96%
Cumulative Median	0.09	96%

We Estimate High Accuracy on Binary Questions

Adjusted Percent Accuracy of Each Model on Testing Sample of 30 Municipalities

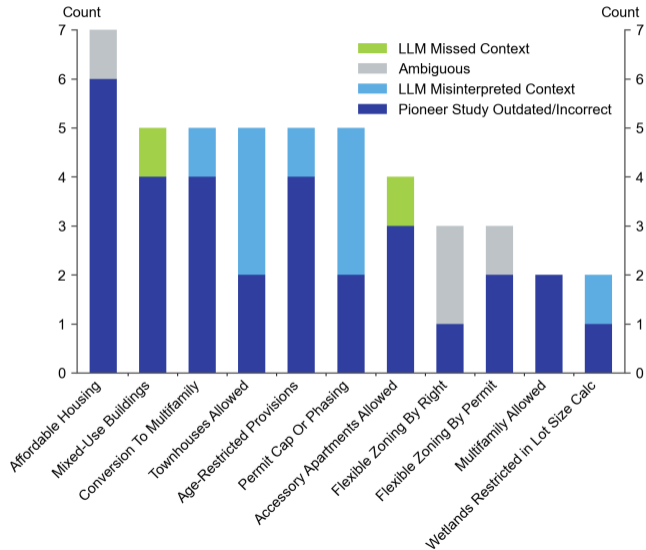


Also High Associations on Continuous Measures

Question	RSE	Correlation
How many zoning districts, including overlays, are in the municipality?	0.06	0.98
What is the longest frontage requirement for single family residential development in any district?	1.16	0.70
Minimum of Min Lot Sizes (Square Feet)	0.73	0.61
Mean of Min Lot Sizes (Square Feet)	14.77	0.39
Minimum of Residential Min Lot Sizes (Square Feet)	0.16	0.92
Mean of Residential Min Lot Sizes (Square Feet)	11.80	0.44
Cumulative Average	4.78	0.67
Cumulative Median	1.16	0.67

[Return](#)

Reasons for Errors [Return](#)



Balance between False Positives and False negatives

Question	True Positive	False Positive	True Negative	False Negative	True Positive Rate	False Positive Rate	Precision
Multifamily Allowed	28	0	2	0	1.00	0.00	1.00
Mixed-Use Buildings	15	0	14	1	0.94	0.00	1.00
Conversion To Multifamily	12	1	17	0	1.00	0.06	0.92
Townhouses Allowed	18	1	9	2	0.90	0.10	0.95
Age-Restricted Provisions	22	0	7	1	0.96	0.00	1.00
Accessory Apartments Allowed	18	0	11	1	0.95	0.00	1.00
Flexible Zoning By Right	1	1	27	0	1.00	0.04	0.50
Flexible Zoning By Permit	26	0	3	0	1.00	0.00	1.00
Affordable Housing	22	0	7	0	1.00	0.00	1.00
Permit Cap Or Phasing	8	2	19	1	0.89	0.10	0.80
Wetlands Restricted in Lot Size Calc	23	1	6	0	1.00	0.14	0.96
Total	193	6	122	6	0.97	0.05	0.97

[Return](#)

Questions from Wharton Regulatory Index [Return](#)

7. Do you have a minimum lot size requirement? a. Yes 1 b. No 2 (If "No," skip to question 8.)

7A. If "Yes," do you have the same minimum lot size requirement across the entire jurisdiction?

a. Yes 1 b. No 2

7B. If you have any minimum size requirement, what is the largest minimum requirement? (Check only one.)

Less than ½ acre 1 ½ to 1 acre 2 1 to under 2 acres 3 2 acres or more 4

9. Do developers have to comply with any of the following requirements to build in your jurisdiction?

	Yes	No
a. Include affordable housing, however defined, in their projects	<input type="checkbox"/> 1	<input type="checkbox"/> 2
b. Supply mandatory dedication of space or open space (or fee in lieu of dedication)	<input type="checkbox"/> 1	<input type="checkbox"/> 2
c. Pay impact fees (allocable share of costs of infrastructure improvement)	<input type="checkbox"/> 1	<input type="checkbox"/> 2

Correlation Against Wharton Regulatory Responses

Question		Wharton Average	Our Average	Correlation
Affordable Housing		0.20	0.06	0.38
Minimum Lot Size	Less than 1/2 acre	0.50	0.49	0.37
	1/2 to 1 acre	0.17	0.13	0.18
	1 to under 2 acres	0.12	0.17	0.26
	2 acres or more	0.22	0.16	0.27

[Return](#)

Correlates of Being An Unincorporated Area

	Bivariate	Metro FE	Distance FE	Metro and Distance FE
Median Home Value	-6.0*** (0.1)	-2.6*** (0.1)	-1.9*** (0.1)	-0.3*** (0.1)
Median Year Built	13.4*** (0.1)	7.2*** (0.1)	11.9*** (0.1)	5.6*** (0.1)
Median Gross Rent	-98.2*** (3.0)	-81.1*** (2.7)	-8.8*** (2.8)	-37.4*** (2.6)
Vacancy Rate	2.7*** (0.0)	2.2*** (0.0)	1.9*** (0.0)	1.6*** (0.0)
Rental Rate	-12.6*** (0.1)	-15.1*** (0.1)	-9.9*** (0.1)	-12.5*** (0.1)
Percent Commute Over 60	1.2*** (0.0)	2.9*** (0.0)	1.6*** (0.0)	2.8*** (0.0)
Percent Over 65	2.0*** (0.0)	2.5*** (0.0)	1.3*** (0.0)	1.7*** (0.0)

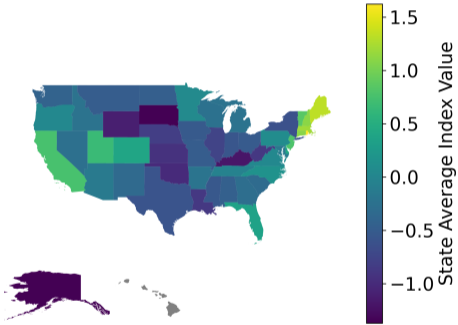
National Sample Question Means: Binary Questions [Return](#)

Question	[gray]0.9	National			Income Tercile			[gray]0.9	Urban/Rural	
	Mean	Weight	Count	Low	Mid	High	Rural	Mix	Urban	
Is multi-family housing allowed, either by right or special permit (including through overlays or cluster zoning)?	95	99	5,703	99	97	90	95	96	92	
Are apartments above commercial (mixed use) allowed in any district?	63	71	5,717	65	67	57	55	66	61	
Is multi-family housing listed as allowed through conversion (of either single family homes or non residential buildings)?	14	20	5,766	13	14	15	10	15	13	
Are attached single family houses (townhouses, 3+ units) listed as an allowed use (by right or special permit)?	80	89	5,795	80	82	79	65	84	83	
Does zoning include any provisions for housing that is restricted by age?	45	60	5,129	34	43	58	24	50	52	
Are accessory or in-law apartments allowed (by right or special permit) in any district?	33	39	5,781	27	33	39	23	41	22	
Is cluster development, planned unit development, open space residential design, or another type of flexible zoning allowed by right?	9	10	5,797	8	8	10	5	10	8	
Is cluster development, planned unit development, open space residential design, or another type of flexible zoning allowed by special permit?	80	80	5,679	79	81	80	69	86	73	
Does the zoning bylaw/ordinance include any mandates or incentives for development of affordable units?	24	50	5,540	10	22	41	9	28	27	
Is there a town-wide annual or biannual cap on residential permits issued, and/or is project phasing required?	17	18	5,803	11	18	21	10	19	16	
Are there restrictions on counting wetlands, sloped land or easements in lot size calculations?	10	7	4,617	4	9	17	7	12	7	
Do developers have to comply with the requirement to include affordable housing, however defined, in their projects?	7	10	5,784	1	4	16	2	7	10	
Are there townwide requirements for public hearings on any type of multi-family residential projects?	30	32	5,709	23	31	37	27	30	32	
Does your jurisdiction require garages for single-family detached development?	24	34	5,780	16	26	32	13	25	34	
Do you have a parking minimum in any portion of your jurisdiction?	98	98	5,788	97	98	98	95	98	98	

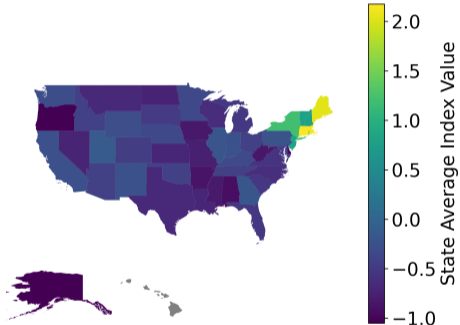
National Sample Question Means: Continuous Questions

Question	National			Income Tercile			Urban/Rural		
	Mean	Weight	Count	Low	Mid	High	Rural	Mix	Urban
How many zoning districts, including overlays, are in the municipality?	14	19	5,471	13	14	14	10	16	13
What is the longest frontage requirement for single family residential development in any district?	92	69	5,213	74	86	117	93	97	79
Mean of Residential Min Lot Sizes	24639	17527	5,424	17071	21802	34965	31039	25746	15539
Min of Residential Min Lot Sizes	10104	5894	5,440	6974	8982	14305	12416	10057	7987
How many mandatory steps are involved in the approval process for a typical new multi-family building?	4.5	4.3	5,791	4.4	4.5	4.6	4.5	4.5	4.5
For a typical new multi-family building project in this jurisdiction, how many distinct governing bodies or agencies must give mandatory approval before construction can begin?	3.1	3.0	5,759	3.2	3.1	3.1	3.1	3.2	3.1
What is the maximum potential waiting time (in days) for government review of a typical new multi-family building?	218	211	5,109	195	223	236	200	222	226
How many parking spots are required for a single family lot?	1.9	1.7	5,374	1.8	1.9	2.0	1.8	1.9	1.9
How many parking spots are required for a unit 600 SF or below	1.6	1.2	5,398	1.5	1.6	1.6	1.6	1.6	1.6
How many parking spots are required for a unit of at least	1.8	1.5	5,407	1.7	1.8	1.9	1.7	1.8	1.9

Principal Components of Zoning by State



PC1 (Complexity)



PC2 (Exclusionary Zoning)

[Return](#)

Full loadings on principal components [Return](#)

	First PC	Second PC
Does the zoning bylaw/ordinance include any mandates or incentives for development of affordable units?	0.41	0.11
Do developers have to comply with the requirement to include affordable housing, however defined, in their projects?	0.31	0.11
Does zoning include any provisions for housing that is restricted by age?	0.31	0.01
How many zoning districts, including overlays, are in the municipality?	0.30	-0.19
Is there a town-wide annual or biannual cap on residential permits issued, and/or is project phasing required?	0.22	0.03
Are there restrictions on counting wetlands, sloped land or easements in lot size calculations?	0.22	0.21
Maximum of Residential Min Lot Sizes	0.18	0.38
Are there townwide requirements for public hearings on any type of multi-family residential projects?	0.15	0.12
What is the longest frontage requirement for single family residential development in any district?	0.15	0.41
What is the maximum potential waiting time (in days) for government review of a typical new multi-family building?	0.12	0.03
Minimum of Residential Min Lot Sizes	0.04	0.47
For a typical new multi-family building project in this jurisdiction, how many distinct governing bodies or agencies must give mandatory approval before construction can begin?	0.02	0.02
How many mandatory steps are involved in the approval process for a typical new multi-family building?	0.02	0.10
Is multi-family housing listed as allowed through conversion (of either single family homes or non residential buildings)?	-0.10	-0.00
Is cluster development, planned unit development, open space residential design, or another type of flexible zoning allowed by right?	-0.14	0.03
Is multi-family housing allowed, either by right or special permit (including through overlays or cluster zoning)?	-0.16	0.34
Are apartments above commercial (mixed use) allowed in any district?	-0.22	0.28
Are attached single family houses (townhouses, 3+ units) listed as an allowed use (by right or special permit)?	-0.24	0.32
Are accessory or in-law apartments allowed (by right or special permit) in any district?	-0.30	-0.03
Is cluster development, planned unit development, open space residential design, or another type of flexible zoning allowed by special permit?	-0.32	0.19

[para,flushleft]

Note: Each variable is expressed in terms of its expected univariate association with stricter zoning policies