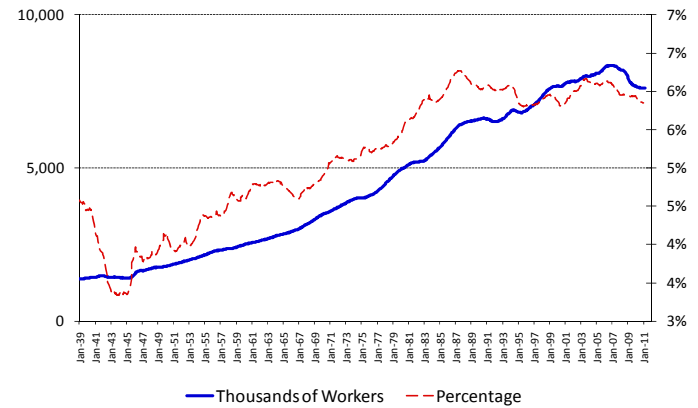


Estimating employment that drives a particular property type

- Example: office employment.
- One approach: BEA provides annual national, and local, employment by industry (NAICS codes)
 - Common to use FIRE employment as a proxy. Can do better.
- Another approach: buy from a data provider.
- Third approach: “grow your own.”
 - Every so often, BLS provides a national matrix of employment by industry and occupational group.
 - See spreadsheet “Occupations by Industries.xlsm”

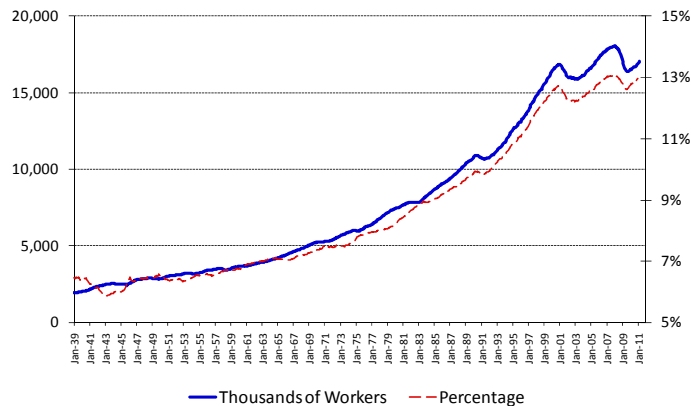
42

FIRE Employment



43

Professional & Business Services Employment

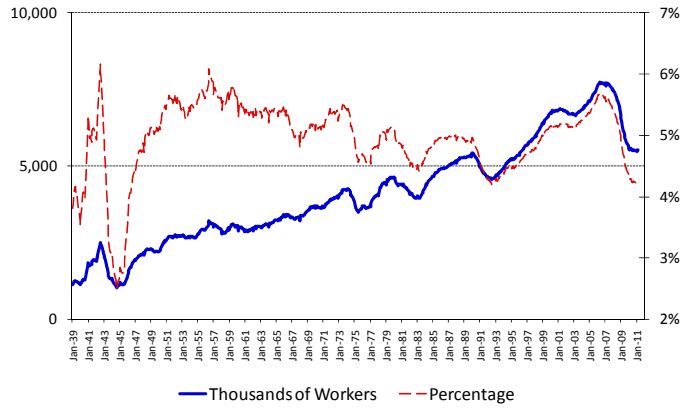


44

Let's look at some other employment categories, tied to specific property types.

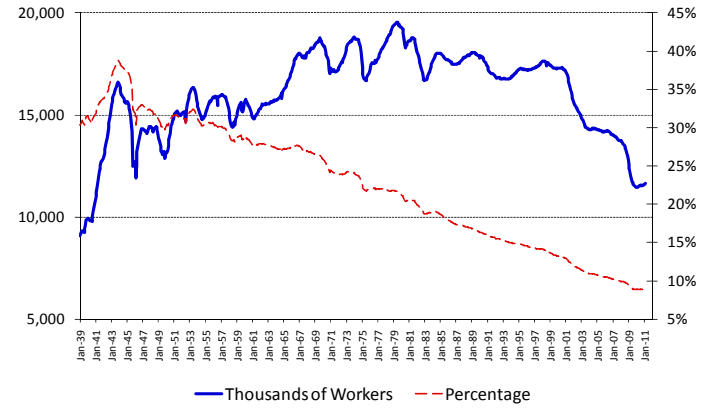
45

Construction Employment



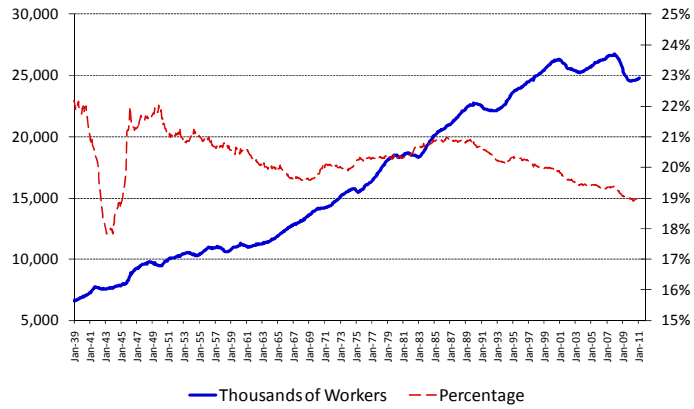
46

Manufacturing Employment



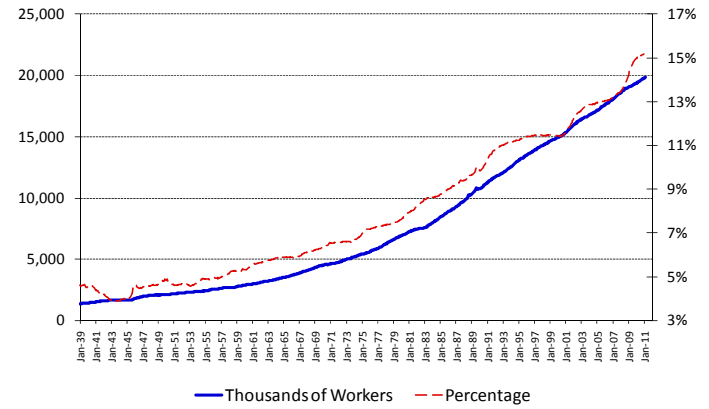
47

Trade, Transport & Utilities Employment



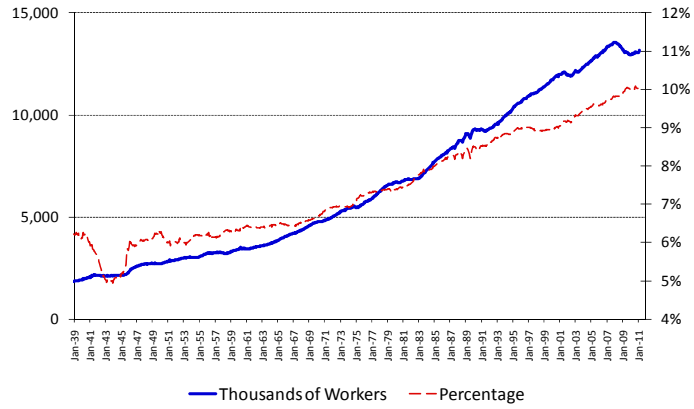
48

Education and Health Employment



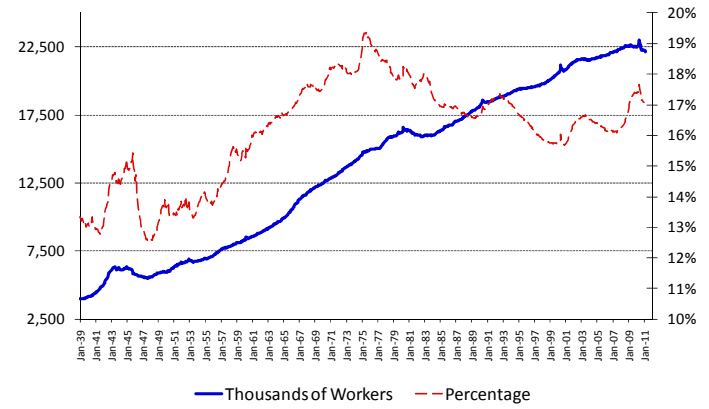
49

Leisure & Hospitality Employment



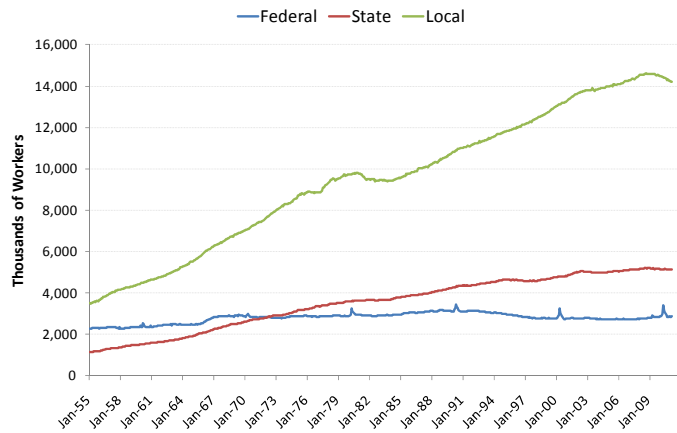
50

Government Employment



51

Government Employment by Level Including Education; Seasonally Adjusted

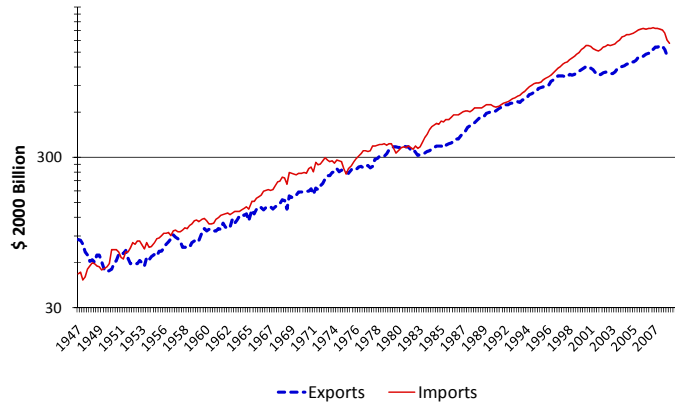


52

Some other demand drivers

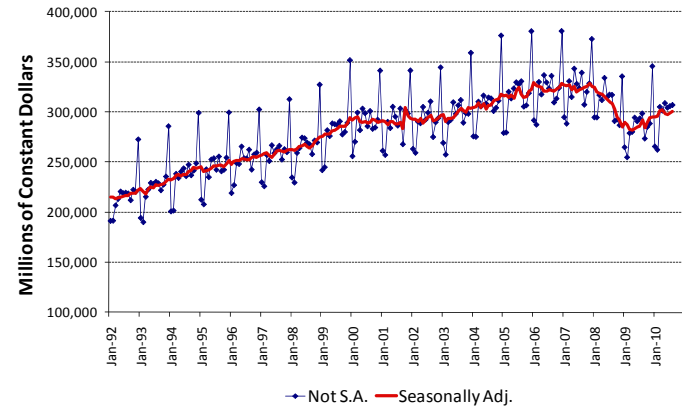
53

Real International Trade, (X-M)



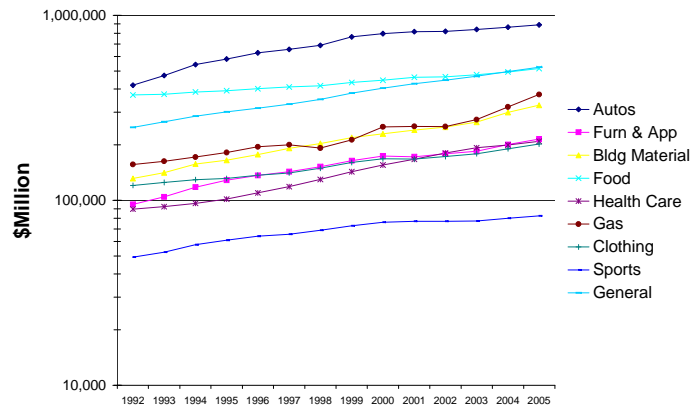
54

Total Retail Sales, 2006 Dollars



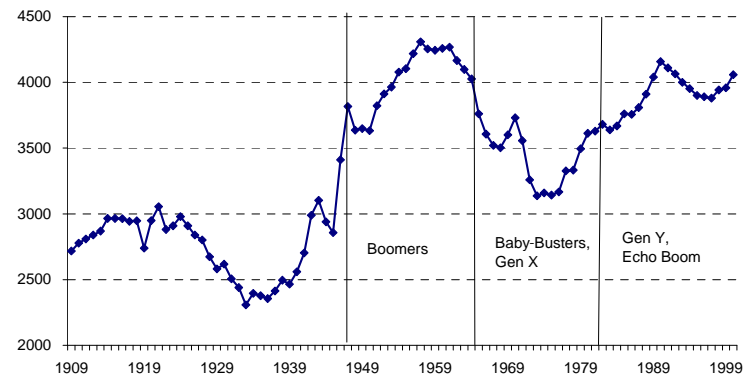
55

Selected Annual U.S. Retail Sales



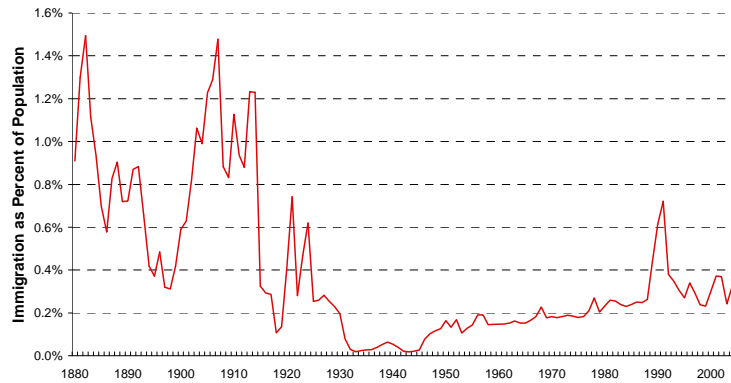
56

U.S. Live Births (1000s)



57

U.S. Legal Immigration



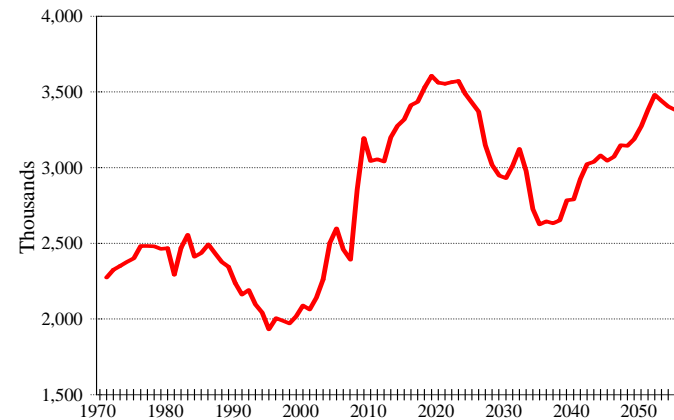
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Calibrating Quadrant II

- Rely on commercial real estate depreciation estimates from Charles Hulten and Frank Wykoff, "Economic Depreciation and the Taxation of Structures in the United States," in Dan Usher (ed.), *The Measurement of Capital* (University of Chicago Press, 1980).
- Housing: See S. Malpezzi, L. Ozanne and T. Thibodeau, "Microeconomic Estimates of Housing Depreciation," *Land Economics*, 63(4), 1987, pp. 373-85.

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U.S. Native Born Population Turning 62 Estimated Using Current Mortality



Preferred estimates

Table 2: Hulten and Wykoff Estimates of Gross Depreciation for Commercial Real Estate

Class	Direct Geometric Estimates		Box-Cox Approximations	
	Transformed	Untransformed	Transformed	Untransformed
Apartment	3.90	1.46	3.36	2.22
Bank	3.48	2.15	5.07	1.12
Factory	4.09	1.45	3.61	1.28
Hotel	3.93	0.26		0.95
Machine shop	2.02	1.40		
Medical building	3.65	1.55	8.48	7.05
Motel	4.44	1.39	4.92	0.26
Office	2.97	1.26	2.47	1.05
Recreational	6.31	2.42	4.87	3.19
Repair Garage	3.28	2.07	4.00	2.54
Restaurant/bar	3.36	1.32	4.34	0.88
Retail trade	2.73	1.11	2.20	0.82
Service station	4.01	2.67	10.80	9.55
Shopping center	2.14	0.40	3.36	1.24
Terminal	2.43	1.31	5.63	1.70
Warehouse	2.95	1.76	2.73	1.22

Source: Hulten and Wykoff, Table 2.1, p. 89

"Transformed" means adjusted for removals from stock.

Geometric is constant percentage decline.

"Box-Cox" is from an alternate, flexible form.

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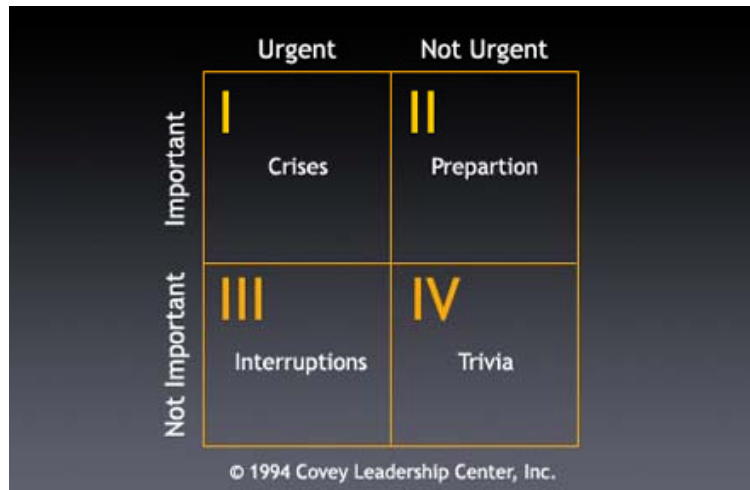
Depreciation for housing

- Malpezzi, Ozanne and Thibodeau (1987) find the average depreciation rate for 30 year old owner occupied units is 0.6 percent per annum.
- MOT do not account for units which completely drop out of the stock. Hulten and Wykoff argue that this selectivity seriously biases depreciation rates.
- H&W adjust their 16 categories using Winfrey (1935). The median ratio between adjusted and unadjusted numbers is 2.4.
- 0.6 times 2.4 yields estimated residential depreciation of 1.5 percent.

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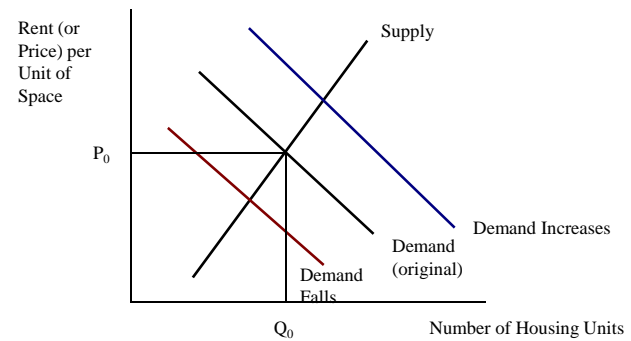
More research on depreciation of commercial real estate is needed.

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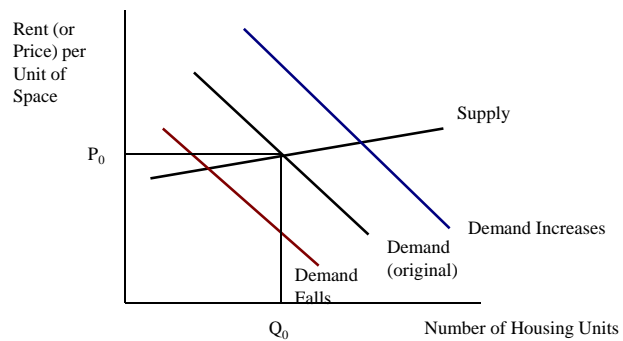
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Demand Shocks with Inelastic Supply



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Demand Shocks with Elastic Supply



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Elasticity

- Economic jargon for "responsiveness." The proportionate change in output given a proportionate change in price.
- Mathematical representation of price elasticity of supply:

$$\epsilon_S^P = \frac{\Delta Q_S / Q_S}{\Delta P / P}$$

- There are many elasticities, e.g. supply vs. demand elasticities; w.r.t. price, income, population...
- Be familiar with this and with the corresponding graphical representation.
- Be familiar with how elasticity varies with, *inter alia*, time, and the extent (size) of the market.

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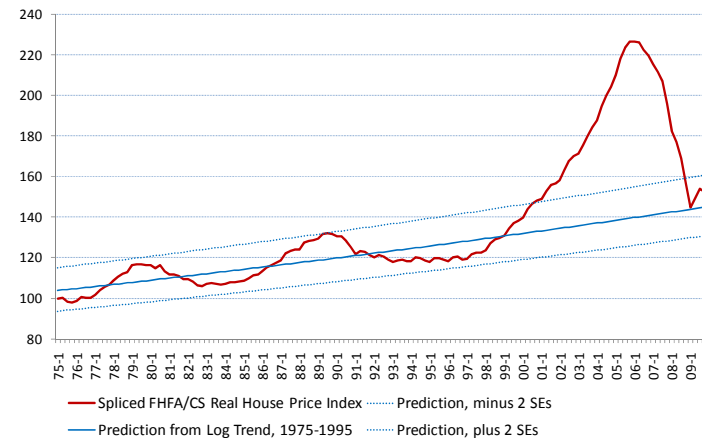
Calibrating Quadrant III: empirical estimates of the supply determinants of commercial real estate are scarce!

- There are now a few dozen good studies of (e.g.) the price elasticity of supply of housing.
 - See Malpezzi and Maclennan (2001), and references therein.
- It's hard to think of a single good estimate of the price elasticity of supply of, say, office space.
 - How steep is the supply curve?
- We'll look at housing first; then nonresidential supply.

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Spliced Real House Price Index

FHFA Index 1975 to 1980; Case-Shiller 1980-2009



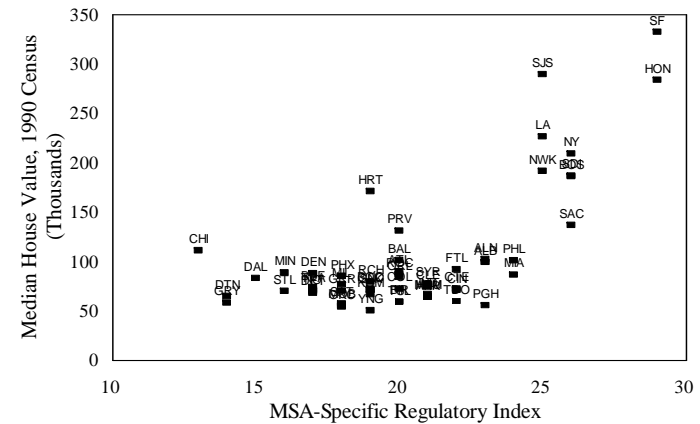
What does it mean to look at a national price index, anyway?

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What does it mean to measure “regulation?”

- Building permit caps, sewer moratoria, large lot zoning, minimum lot sizes, floor area ratio, setback requirements, height limits, subdivision codes, environmental impact reviews, transferable development rights, retention ponds, rent controls, land use controls, impact fees, building codes, minimum street widths, curb and gutter requirements, traffic mitigation...
- Malpezzi and Ball, Malpezzi (1996), Gyourko, Saez and Summers (2006): regulations are correlated.
 - Implies that omitted regulations will be “picked up” by included regulations.
 - Implies that we can’t take the partial derivative of an element of a regulatory index.
- How do we interpret MSA indexes of regulation when many sub-MSA jurisdictions have regulatory authority?

House Prices & Regulation



Source: Malpezzi, J. Hsg Research, 1996
Summarized in Primer, pp. 146-56

What's this?

Measuring Regulation by MSA

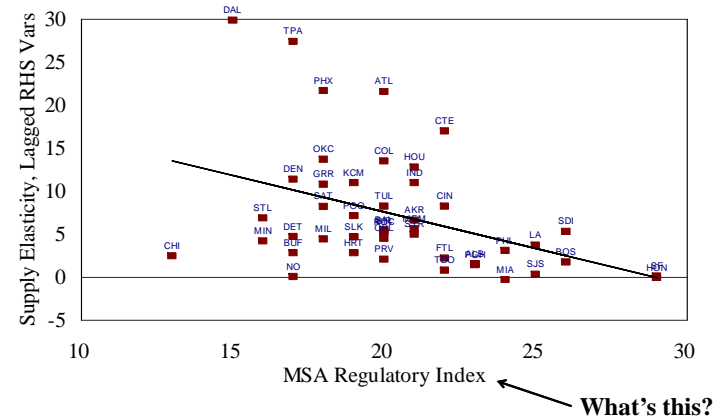
- Index based on answers to the following:
 - Recent changes in approval time for single family housing development
 - Time required for rezoning and permitting for a small residential subdivision
 - Ditto, for a large subdivision
 - Single family zoning, compared to demand
 - Multifamily zoning, compared to demand
 - Percent of zoning changes approved
 - Index of adequate infrastructure (roads and sewers)
- Index values range from 7 (permissive) to 35 (most stringent)
- Other indexes constructed for state regulations, rent control.

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Supply from new construction: divergent views

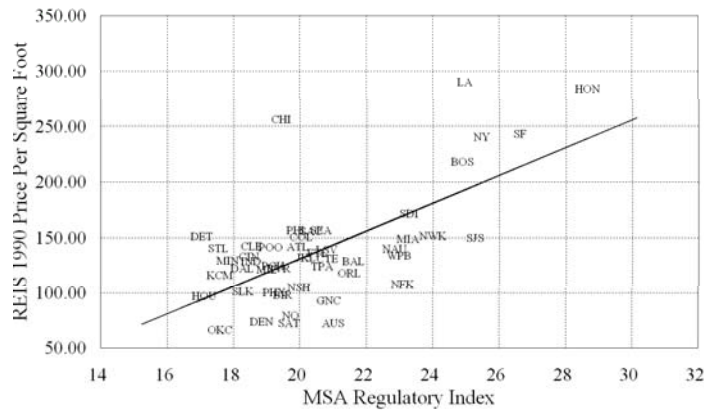
- Studies by Richard Muth, Jim Follain: the long run price elasticity of supply of housing from new construction is high (10, 20 or more).
- Studies by Jim Poterba, Topel and Rosen: the price elasticity of supply is more like 2 or 3.
- Malpezzi and Maclennan: the U.S. elasticity is high; Poterba and Topel and Rosen don't use enough data. But the long run is, well, *long*.
- Green, Malpezzi and Mayo, and Tsur Somerville and Chris Mayer: the supply elasticity varies a lot by MSA. Appears to be related to regulation.

Housing Supply Elasticities and Development Regulation



Source: Green, Malpezzi & Mayo. (Linear Fit)

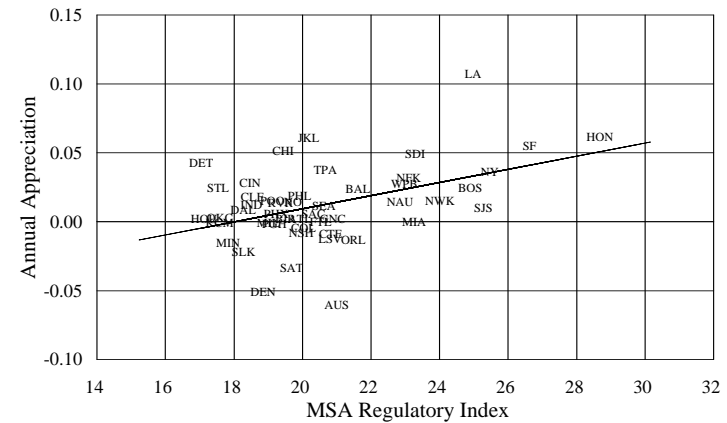
Office Price PSF and Regulation



(Linear Fit)

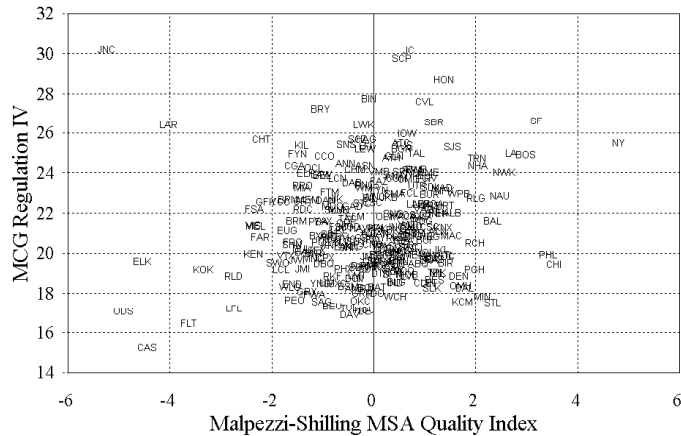
Office Appreciation and Regulation

1989 to 1996



(Linear Fit)

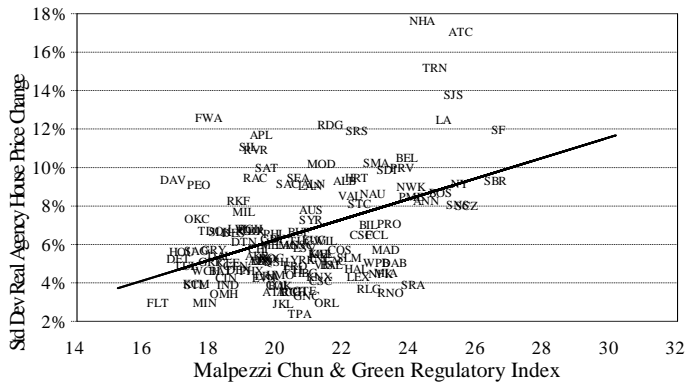
Long Run Supply-Demand Environment



Regulation raises real estate prices; is that a good thing for investors?

- What's the other thing that accompanies high returns?

Std Dev of Real Avg House Price Change (1979-96) and Regulation (1989)



Exploratory Regression, Explaining Standard Deviation of Annual Agency Housing Price Changes, U.S. Metro Areas

	Standardized Coefficient	t-Statistic	Prob > t
Std Dev of Real Changes in Income Per Capita	-0.10	-1.1	.2877
Std Dev of Annual Changes in Employment	0.26	2.7	.0073
M-C-G Regulatory Index	0.42	5.3	.0001
Intercept	-0.00	-2.9	.0046

Adjusted R-squared: 0.21
Degrees of freedom: 125

Supply elasticities are even more difficult to measure for commercial real estate

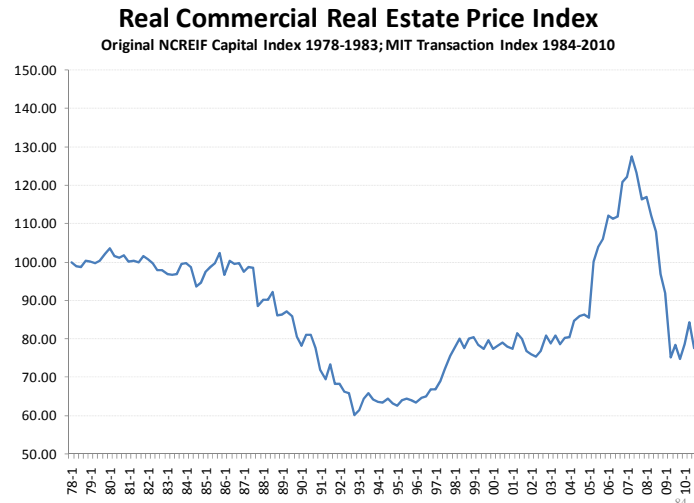
- Data
- “Identifying restrictions:” we don’t know as much about demand for office space as we know about the demand for housing
- Still, a fertile field, given some time?
- A quick test: what can we infer about supply elasticities, if asset prices are rising? Flat? Falling?

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Commercial Real Estate Price Indexes based on NCREIF data

- National Council of Real Estate Investment Fiduciaries tracks “institutional” prices back to 1978.
 - Problems with sample selection, and “appraisal smoothing.”
- Fisher, Geltner and Pollakowski, *Journal of Real Estate Finance and Economics*, 2007: Get NCREIF’s raw data, base the index on transactions.
 - Lose a lot of data, but the data you have is much better. Should reduce “smoothing bias.”
 - Still subject to sample selection bias!!!
 - Updated data available from MIT’s website.
- Next slide splices the original index for early years with the more recent transaction index. Serious problems remain but the best we have over any long time frame.

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Supply elasticity of commercial real estate

- At least in the aggregate, until (say) 2005 or 2006, CRE prices were broadly consistent with fairly elastic supply.
- While scale/timing was different, CRE asset prices saw a boom and bust cycle post 2005 that was broadly parallel to housing’s. (Housing prices peaked early in 2006, CRE prices peaked about a year later).
- Boom and bust in recent years: evidence of inelastic supply, or something else?
- Note: nobody’s yet estimated supply elasticities of CRE directly, by market; or looked at determinants of same.

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Back to the lab, again...

- We need a lot more work on supply elasticities
 - By market
 - By property type
 - Understanding dynamics (the time path of adjustment)
 - Understanding the role of expectations



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