Institute of
Business and
Economic Research

Fisher Center for
Real Estate and
Urban Economics

PROGRAM ON HOUSING AND URBAN POLICY

WORKING PAPER SERIES

WORKING PAPER NO. W06-004

**REGULATION AND PROPERTY VALUES:
THE HIGH COST OF MONOPOLY**

By

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August 2006

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A previous version of this paper was presented at the Conference on Land Policies for Urban Development, Lincoln Institute of Land Policy, Cambridge, MA, June 5-6, 2006. Comments and suggestions by Yu-Hong Hong, Gregory Ingram, Katherine Kiel, and Larry Rosenthal are gratefully acknowledged.

I. Introduction: Building Codes and Zoning Rules

The regulation of housing is taken for granted and is often justified on the same basis as the regulation of pharmaceuticals, air travel, and the food supply. Few consumers are well equipped to evaluate the implications of prescription drugs for their own health or the implications of aircraft landing gear for their own safety. But even if consumers were so equipped, the costs of gathering information to evaluate producers' choices of inputs would be quite high, and the adoption of "standards" would appear to be quite natural. In some cases, choices among commodities that are graded according to standards may be efficiently guided by the market (for example, in audio equipment), but few would argue that market processes would efficiently guide choices involving health and safety.

So in housing construction, detailed regulations motivated by consumer protection are readily accepted, at least in principle. For the most part, the regulations adopted by state and local governments governing residential construction are derived from "model codes." These model codes are, in turn, based upon research and professional consensus among insurance underwriters, public health associations, and engineering professionals.[1]

The professional standards applied in developing building codes include the consideration of external effects as well as direct consequences, for example, in the potential for conflagration in the setting of fire protection standards and the consideration of epidemic in the setting of public health standards.

[1] Indeed, as reported by Listokin and Hattis (2005), residential construction regulations adopted by US states are variants of just three models: the International Building Code; the International Residential Code; and the International Fire Code.

Despite this authority, there are lingering suspicions that interest groups may act to increase the construction requirements (and the costs) beyond those that would advance health and safety in the presence of external effects.[2]

Construction regulations and building codes do increase the costs of housing to producers and consumers, but these increases are presumably offset by the benefits in health and safety attributable to the higher standards imposed. Nevertheless, the possibility of "regulatory capture" observed in other regulated markets and the history of resistance to labor saving changes in construction (e.g., the slow diffusion in the permissibility of plastic pipe in residential construction) suggests that the extent of regulation in house building is often not dictated solely by engineering or professional concerns. The potential for the exercise of monopoly power by materials providers or labor interests is quite real.

The avowed motives for the regulation of land use and residential zoning include consideration of the health and safety of residents, as when the minimum lot sizes for single family homes in suburbs are set with reference to the engineering requirements for septic systems. These considerations include those topography, soil, and drainage factors which dictate the maximum number of septic systems per acre. These data, in turn, set the minimum lot size requirement.

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[2] For early claims, see Field and Ventre (1971) and empirical analyses by Oster and Quigley (1977) and Noam (1983). See Hammit, *et al* (1999) for a recent survey.

However, the extent of residential zoning extends far beyond these technical concerns.

The normative theory which underlies the economics of externality zoning was sketched out nearly a half century ago by Martin Baily (1959). An appropriate parable may be the circumstances of two types of firms: "laundries," L, which dry clothes in the open air; and "smokestacks," S, which emit soot into that air. Absent zoning rules, the co-location of L and S firms reduces the economic output of the L firms. A rule which segregates L and S firms geographically increases the output of the L firms (because more clean laundry can be produced from the same resources) without reducing the output of the S firms.

Ever since the Euclid decision of the Supreme Court in 1926, the validity of land use restrictions and zoning to segregate land uses within towns has been recognized. The Euclid decision explicitly concerned the segregation of single family from multifamily dwellings and suggested that apartments might become "nuisances" when constructed amid private houses (272 US at 394-95).

Both building codes and zoning regulations may be used to apply technical expertise in protecting consumers. Both are subject to abuse by monopoly interests. But zoning regulations can also be used to address ill-defined externalities (e.g., "nuisances") which are not based upon science or engineering or professional expertise. This is an important difference. It increases the potential for regulatory capture and for the exercise of monopoly in the conditions governing residential building.

II. Monopoly Zoning

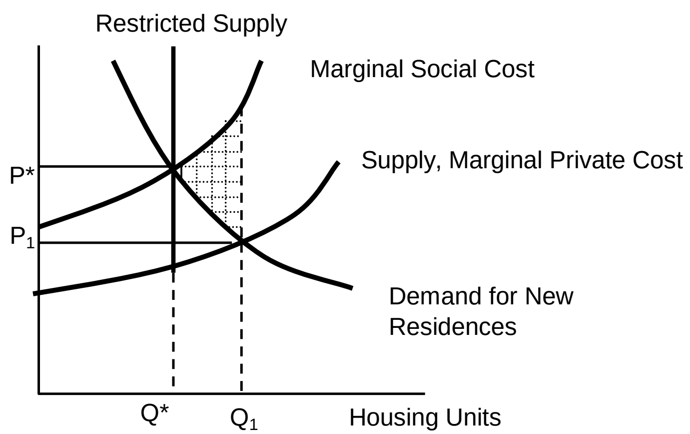
A. Simple Analytics

The theory of zoning sketched above implies that the regulations are imposed to achieve welfare gains. If the social cost of an activity exceeds its private costs , rules limiting the activity will lead to welfare gains as shown in Figure 1A. In an unregulated market, the number of units freely supplied will equate demand to marginal private costs. Appropriate zoning regulations, reducing supply from Q_1 to Q*, equate demand to marginal social costs, thereby providing a welfare gain equal to the shaded area in the figure. Alternatively, absent an externality, market actions already equate demand to marginal social costs. In this instance, as shown in Figure 1B the imposition of zoning rules, reducing supply from Q* to Q_2, leads to an unambiguous decline in economic welfare. The welfare loss is indicated by the shaded area in the figure.

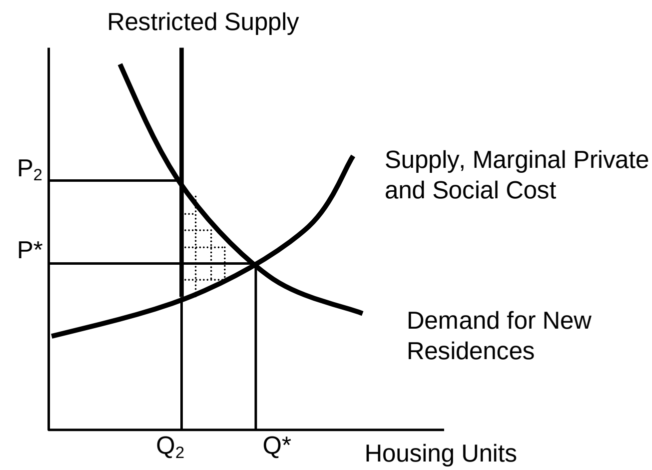
Importantly, in either circumstance restricting the supply of available sites or dwellings also confers a benefit on pre-existing owners, as the values of their dwellings increase. Prices increase from P_1 to P* (in Figure 1A) or from P* to P_2 (in Figure 1B). This simple analysis suggests that owners of existing properties have a monetary interest in restricting growth, even in the absence of external effects which cause marginal social costs to deviate from marginal private costs.

Figure 1
Zoning Regulations and Welfare

A. Zoning Regulation Causing Welfare Gain



B. Zoning Regulation Causing Welfare Loss



Put another way, owners of existing properties have an incentive to "find" external effects in urban land use patterns so that restrictive actions reducing the housing supply will appear to be welfare enhancing rather than welfare reducing. The confusion of externalities with the exercise of monopoly power by pre-existing owners need not be intentional or even conscious. But the owners of pre-existing dwellings will have financial incentives to search very carefully for external effects which can justify actions to reduce the housing supply.

B. A Simple Model

The importance of these effects empirically depends upon the magnitude of the monopoly profits from land use restrictions. Consider a simple urban model of a closed economy of N identical consumers located at various distances x from the city center, paying transport costs of t dollars per mile to their employment locations at the urban center. They consume housing $q(x)$ at price $p(x)$ and a numeraire good. Consumers have preferences over q and c, and they have identical incomes y, leading to identical levels of utility $\bar{u}$.

(1) $U(y - p[x]\,q[x] - tx, q[x]) = \bar{u}$.

In equation (1) the first argument of the utility function is the income remaining to spend on the numeraire after choosing housing and its location. In equilibrium, competition among consumers leads to identical levels of well being. In equilibrium, the marginal rates of substitution between housing and the numeraire good equal their relative prices,

(2) $\dfrac{U_2(y - p[x]\,q[x] - tx, q[x])}{U_1(y - p[x]\,q[x] - tx, q[x])} = p(x)$.

With constant returns to scale, housing suppliers choose an amount of land, $L(x)$ and a capital intensity, $S(x)$, that is, a ratio of capital, $K(x)$, to land to produce housing, $S(x) = K(x)/L(x) = L(x)\,h(S[x])$, according to the production function $h(.)$.

Profit maximization implies

(3) $p(x)h'(S[x]) = i$, and

(4) $p(x)h(S[x]) - iS(x) = r(x)$.

Equation (3) determines the capital intensity for profit maximizing production, given an exogenous capital cost i. Equation (4) represents the zero-profit condition for competitive producers.

The region must be in equilibrium in two senses. First, at the edge of the area, at distance $\bar{x}$, the value of land r must be high enough to bid land away from its alternative use where its price is r_a,

(5) $r(\bar{x}) = r_a$.

Second, the supply of housing must equal the demand within the region as a whole

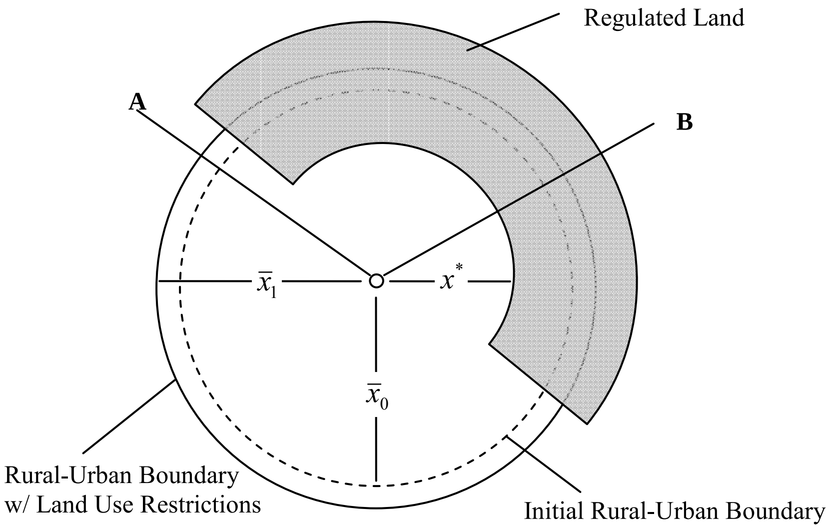
$$(6)\ \int_0^{\bar{x}} 2\pi x \frac{h(S[x])}{q(x)} dx = N,$$

where the left hand side integrates the population density over the entire circular region. Equilibrium in the region is fully characterized by these six equations in six unknowns: $p(x)$, $r(x)$, $q(x)$, $s(x)$, $\bar{u}$ and $\bar{x}$.

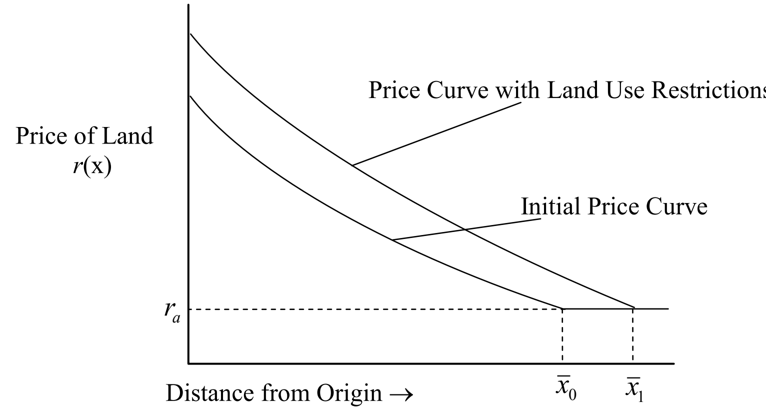
Now suppose some quantity of land is zoned as open space. The amount of land chosen is designated by its distance from the center x^* and the number of radians, k. Figure 3 is a schematic of the stylized metropolitan area indicating the amount of open space (the shaded part of an annulus) reserved by the zoning regulation. Under these conditions, the population must still fit into the built up region which includes $(2\pi\text{-}k)$ radians past distance x^*,

$$(7)\ \int_0^{x^*} 2\pi x \frac{h(S[x])}{q(x)} dx + \int_{x^*}^{\bar{x}} (2\pi - k) x \frac{h(S[x])}{q(x)} dx = N.$$

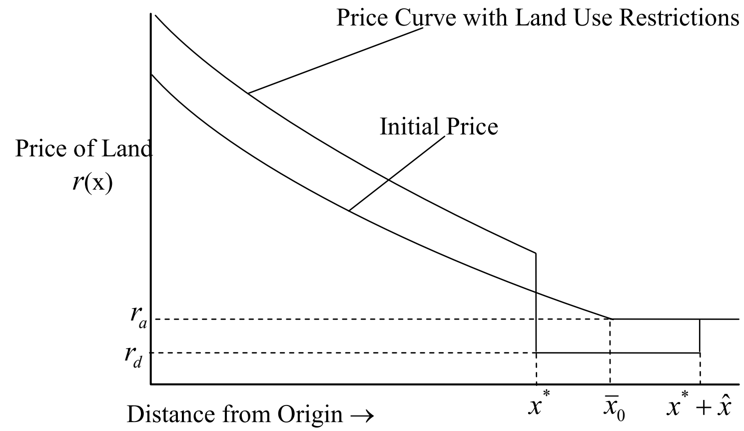
Figure 2. Equilibrium Urban Land Use and Land Prices Under Regulation



A. Land Market Equilibrium with Land Use Restrictions



B. Land Prices Along Ray A



C. Land Prices Along Ray B

The new equilibrium is obtained by substituting (7) for (6) and solving. The amount of land in the region "downzoned" is the annulus described by the zoning rule: x^* and k.

It can be shown that holding x^* constant:

$$(8)\ \frac{\partial p}{\partial k} > 0, \frac{\partial q}{\partial k} < 0, \frac{\partial S}{\partial k} > 0, \frac{\partial r}{\partial k} > 0, \frac{\partial \overline{u}}{\partial k} < 0, \frac{\partial \overline{x}}{\partial k} > 0 .$$

Other things being equal, An increase in k, the amount of land zoned to prohibit or limit development, will cause housing prices to rise everywhere and housing consumption to decrease everywhere, reducing consumer well being. Housing densities increase and land prices increase, causing the city to expand.

Increasing x^* means locating the area zoned to prevent development on less valuable land further from the urban center. It can be shown that:

$$(9)\ \frac{\partial p}{\partial x^*} < 0, \frac{\partial q}{\partial x^*} > 0, \frac{\partial S}{\partial x^*} < 0, \frac{\partial r}{\partial x^*} < 0, \frac{\partial \overline{u}}{\partial x^*} > 0, \frac{\partial \overline{x}}{\partial x^*} < 0 .$$

Holding k constant, increasing x^* (that is, moving the area zoned to prohibit development further from the center) decreases the price of housing throughout the region, increases housing demand, and decreases residential densities in the region. This action also decreases land rents, increases consumer welfare, and reduces the expansion of the urban rural boundary and hence the size of the city. Clearly if x^* is chosen so that it is outside the limit of urban development which would occur from market forces alone (i.e., if $x^* \geq \bar{x}$), the regulation will impose no losses on consumer welfare at all.

Quantitative results can only be obtained by calibrating the model to real or stylized data. Elsewhere, we have solved the model using data that approximates conditions in the Tucson MSA in 2000, using Cobb Douglas functional forms for utility and housing production.[3] The results of this calibration demonstrate that when only a small percentage of the region's land is removed from development by zoning, there are nevertheless substantial increases in the rents and prices of land--land not directly affected by the regulations. These price increases lead to rather large losses to renters and newcomers to the region. The principal distributional effect of these regulations is to reduce the well being of housing consumers, renters, and newcomers, in the region. Existing landowners make large gains in all simulations of the model.

Even when small areas of the stylized region are designated for large-lot development or for "open space," and even when these areas are peripherally located, the numerical results suggest that there are substantial losses to consumers and large gains to landowners.

III. Economic Effects of Real Zoning Rules

[3] We calibrate the utility function so households spend a quarter of their incomes on housing and the production function so that land is thirty percent of the input to housing produced by developers. See Quigley and Swoboda, 2005.

The notion of zoning presented in Section II is highly stylized. Nevertheless, it provides some perspective for reviewing the types of zoning rules actually imposed. Table 1 (simplified from Levine, 1999) presents one taxonomy of land use regulatory categories. For residential development, the taxonomy includes caps on building permits issued, zoning land as open space, and requirements for referenda or special reviews to permit density increases. Other rules on land planning include moratoria on development and the imposition of urban growth boundaries. Rules involving "adequate" public facilities rules raise the possibility of denying new development due to anticipated effects upon road congestion, water supply, or sewage treatment facilities.

Some of these categories are clearly related to the control of externalities in growing metropolitan regions, and they appear to be efficiency enhancing as depicted in Figure 1A. Others, growth boundaries, open space regulations, down zoning, all appear to be consistent with the stylized representation in Figure 1B. They reduce the permitted residential density in the shaded area, increasing land prices (and the values of existing homes) and rents, and decreasing the welfare of renters.

Because zoning and growth regulations are so complex, empirical analyses of their effects upon housing markets are problematic. A detailed review of the early empirical literature was provided by Fischel (1990) in a widely circulated paper published by the Lincoln Institute of Land Policy. A more recent review of some forty empirical studies was produced by Quigley and Rosenthal (2005). Both of these reviews stress the difficulty of drawing general conclusions about the magnitudes of land use regulations on

Table 1. Land use regulatory categories

Residential development	Building permit cap Population cap Floor area ratio limit Downsizing to open Space/agricultural use Reduction in permitted residential density Referendum for density increase Supermajority in legislative body for density increase
Land planning	Growth management element Moratoria Urban growth boundary Tiered development Subdivision cap
Adequate public facilities(APF) requirements	Roads Highways Mass Transit Parking Water supply Water distribution Water purification Sewer collection Sewer treatment Flood control
Service capacity restrictions	Roads Water supply Water distribution Wastewater collection/treatment capacity Wastewater treatment quality Flood control
Development Impact Fee coverage	Administration Traffic mitigation Mass Transit Parking Water: Service Treatment Sewer Flood Control Parks/open space Natural resources Schools Libraries and arts Other development fees

Source: Adapted from Levine, 1999.

prices – in large part because samples are small and the regulations themselves are so hard to characterize quantitatively. For the most part, the empirical studies reviewed about the effects of zoning rules on housing prices are based upon small samples of disparate regulations imposed in a single town or metropolitan area. But one conclusion emerges-- land use restrictions typically result in higher housing prices.

More general conclusions may be drawn from three current research projects which are documented in the next section. Each seeks to capitalize on a more systematic opportunity to observe the importance of zoning regulations upon metropolitan housing prices. Two of these are based on larger scale surveys of the regulatory environment, and the third is based upon the kind of information used routinely upon by engineering firms in projecting the costs of new construction. We consider this more comprehensive evidence in some detail.

IV. Recent Empirical Evidence.

A. Construction Engineering and Cost Data

At least three national firms regularly publish estimates of the costs of supplying commercial and residential real estate. These estimates are often relied upon by construction firms when submitting bids. The methodology recognizes metropolitan and regional variations in production technologies and variations in labor costs to generate estimates of the non-land component of new construction for stylized building projects. Cost information is generated by metropolitan area and type of project over time. Figure

3, adapted from Quigley and Raphael (2004a), illustrates trends in new housing costs as reported by two of these firms over a thirty-year period. It presents the national average cost of high-quality single-family residential construction, net of land, between 1988 and 1998, as estimated by the RS Means Company and Saylor Publications, Inc.[4] The estimates are benchmarked to 1968 and show the steady increase in nominal building costs from about $24,000 in 1968 to over $100,000 in 1998. Also presented in the figure is the nominal price of new single detached housing as reported by the US Department of Housing and Urban Development (HUD) during the same period, also benchmarked to 1968. The three series follow a common trend through about 1986. After this, the cost of new homes diverges from the cost of its non-land inputs, increasing more rapidly in the 1990s. By the end of the period, the average cost of new housing was about thirty percent higher than the average cost of the non-land inputs to produce housing.

[4] These data are compiled from RS Means Building Construction Costs (various years) and Saylor Publications Residential Construction Costs (various years).

Figure 3: Nominal House Prices and Construction Costs

Sources: Quigley and Raphael 2004b.

There are several reasons why the cost of land has increased so much more rapidly than the costs of materials. In growing metropolitan areas, land prices are bid up as more firms and households compete for space. But a prominent reason for the increase in land price is the increasing importance of zoning regulations which cause land to be scarcer in supply.

In a series of recent papers Glaeser, Gyourko and Saks (GGS) have used the kind of engineering data reported above to attempt to disentangle the extent to which land use regulation increases the cost of housing.[5] One piece of evidence, combining observations on the market prices of housing output and engineering estimates of the cost of non-land inputs, comes from building conditions in Manhattan; another comes from aggregate comparisons from other metropolitan areas whose average housing prices can be observed in the American Housing Survey (AHS).

In the analysis of new construction and housing prices in Manhattan, GGS estimate the gap between output prices and the marginal costs of condominiums, which they interpret as the monopoly profits attributable to land use regulation. In the absence of regulation, the number of stories chosen by developers in planning new construction would equate the marginal costs of adding a floor to the output price of the housing produced (and its average cost of production). If the number of stories is reduced artificially by regulation, then output prices and average costs will exceed marginal costs.

[5] See Glaeser and Gyourko (2003) Glaeser, Gyourko and Saks (2005a, 2005b, 2005c).

For Manhattan, the authors assemble construction cost data on condominiums and apartments by geographical area and by the number of stories in buildings. The construction cost estimates they rely upon do not include the price of land and do not make allowances for the fixed costs of site preparation, engineering consulting, architect services, and other "soft costs." The construction cost data thus approximate the marginal cost of adding another story onto the apartments or condominiums at the time they are built.

The calculations confirm that residential construction is quite expensive in Manhattan, largely because labor costs are so much higher than elsewhere. Marginal costs are increasing with the number of stories in construction. The authors compare the cost estimates they obtain with data on the selling prices of condominiums in Manhattan during the period 1984-2002. The ratio of selling prices to construction costs is cyclical, reflecting small variations in the underlying cost series and large variations in the demand for condominiums over the business cycle. However, the ratio of selling prices to supply costs is always well above one. In ten of the years, the ratio is above one and a half, with a minimum of 1.2 (in 1996) and a maximum of 2.1 (in 2002). The authors interpret these as estimates of the added cost of regulatory constraints on production. The estimates are high indeed; sale prices of finished condominiums are about twice the estimated cost of physically producing comparable dwellings. Moreover, these comparisons make no adjustment for the fact that condominium sales observed are for depreciated (used) dwellings while the cost estimates are for undepreciated (new) dwellings.

GGS have extended this work to compare the costs of producing single family housing with the average selling prices of housing across a sample of metropolitan markets. In one analysis (2005b), the authors compare estimates of physical construction costs, derived from RS Means data for single family housing, with AHS survey data on housing prices. These comparisons reveal a substantial cross-sectional variation in the "markup" of construction costs to the selling prices of housing. In about half of the 21 metropolitan comparisons reported, the ratio of selling prices to construction costs is not very different from one. In other markets, however, particularly coastal markets and particularly in California, the ratio greatly exceeds one. The authors interpret variations in the magnitude of this ratio as variations in the "regulatory tax" imposed by the restriction building activities.

A more recent extension of this logic (GGS, 2005c) is a comparison of selling prices and construction costs for a panel of more than a hundred metropolitan areas during the period of 1950-2000. These comparisons document a substantial increase in the ratio of selling prices to construction costs during the period, beginning especially during the period of the 1980s (consistent with aggregate trends reported in Figure 3). The comparisons also reveal an increasing dispersion of these ratios across metropolitan areas.

Of course a great many other factors affect the relationship between labor and materials costs and housing output. Changes in land prices attributable to regulation is but one of these. Thus, attributing all these differences to "regulation" is reminiscent of the growth accounting debate of the 1960s. Attributing a residual to "regulation" and labeling it so is an overstatement, and this is recognized by the authors. But the weight of all this evidence suggests quite clearly that land regulation is an important contributor to the escalation of house prices.

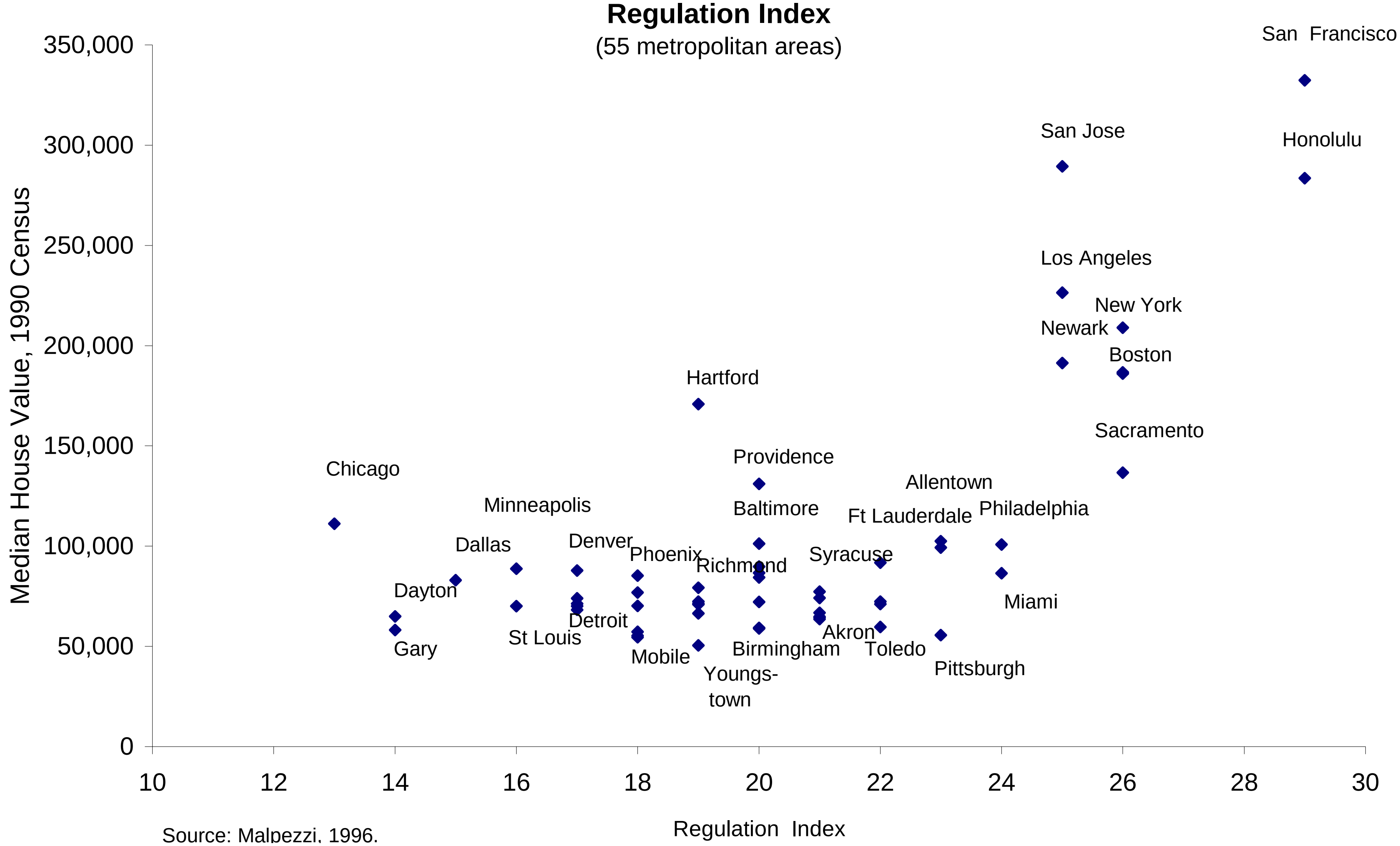
B. Generalizing Survey Evidence

The second and third current research projects currently underway each seek to extend sample survey evidence on zoning and land use rules gathered for other purposes for systematic statistical analysis. The second project, by researchers at the University of Wisconsin, has extended survey information on regulation originally gathered by Linneman, *et al* (1990) and Buist (1991) to a larger sample of metropolitan areas. The third project, by researchers at the University of California, Berkeley, has aggregated and utilized data originally gathered by Glickfield and Levine (1992) for the Lincoln Institute for Land Policy. In contrast to the GGS approach described above, both of these approaches measure land use regulation – or at least certain aspects of land use regulation – directly. They thus offer the possibility of measuring the statistical effects of regulation directly, rather than inferring the effects of regulation by subtraction.

Malpezzi (1996) sought to summarize the large number of measurements of aspects of local regulation gathered by Linneman and his associates (from an eleven page questionnaire) into a small set of variables describing the regulatory milieu of each jurisdiction which had been sampled. He proceeded by applying a standard factor analytic framework to the correlations among the attributes of regulation measured in the original survey. His analysis suggested, however, that a straightforward aggregation of seven measures of local regulation contained most of the information in the principal components. Thus, most of the variation in the many aspects of local government building regulation could be measured by estimates of approval time for single family housing projects, for multifamily projects and for rezoning, as well as a few other measures (See Malpezzi, 1996, pp. 222-224, for a discussion). Malpezzi's detailed analysis of the regulatory index he constructed suggested that it was highly correlated with the course of house values and rents, with building permits issued, and with homeownership rates across metropolitan areas. Figure 4 presents the raw relationship between metropolitan housing prices and regulation.

In related work, Malpezzi and Green (1996) explored the relationship between this derived measure of regulation and prices in the left tail of the distribution of house values. They analyzed a sample of 44 metropolitan areas for which the regulation measure could be constructed and for which estimates of the distributions of house values, and rents could be obtained from HUD. Regressions relating log house prices at the lowest quartile to regulatory stringency revealed a strongly nonlinear relationship. House values at the bottom of the distribution increased with the extent of land use regulation, and they increased far more than proportionately with the measure of regulatory stringency.

Figure 4
Housing Prices and The Malpezzi Regulation Index
(55 metropolitan areas)

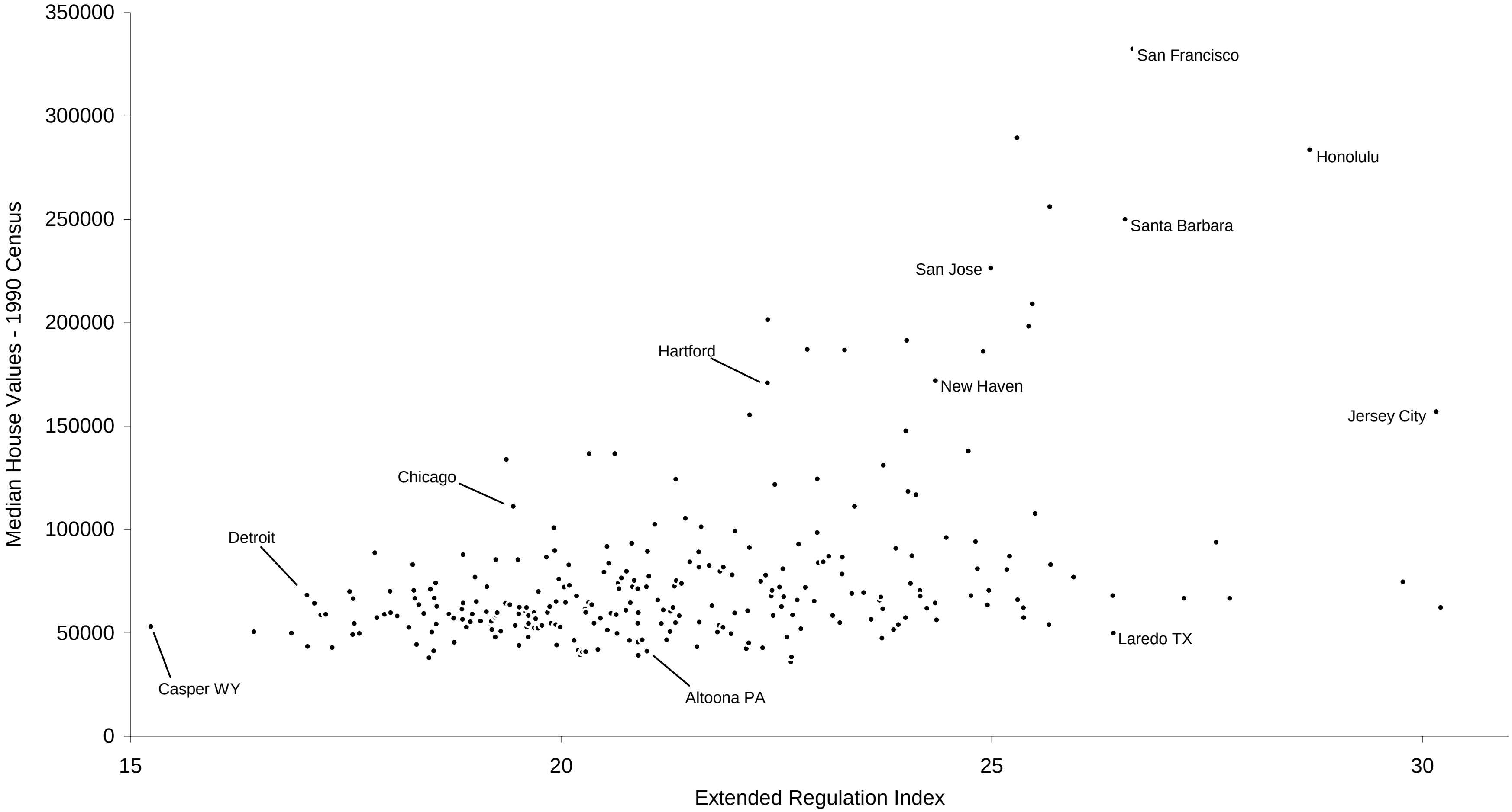


Source: Malpezzi, 1996.

In subsequent work, Malpezzi, Chun and Green (1998) analyzed the relationship between the regulation index, derived from Linneman's survey of 55 metropolitan areas, and a variety of metropolitan aggregates. Using these aggregates and a series of locational indexes as instruments, they generalized the measure to impute measures of regulatory stringency to some 272 metropolitan areas. Figure 5 reports the resulting raw relationship between metropolitan housing prices and this imputed measure of regulation. A detailed analysis of this larger data set relates metropolitan housing prices, adjusted for hedonic quality, to demographic characteristics and to variations in the level of regulation across metropolitan areas. The analysis of this larger data set confirms the strong positive relationship between house prices – adjusted for their hedonic quality characteristics-and the level of regulation in a metropolitan area.

In a more recent paper, Green, Malpezzi, and Mayo (2005) used these same measures of regulatory stringency to investigate variation in the supply elasticity of single family housing across some 45 metropolitan areas over some 18 years. For each metropolitan area, they regress the percentage change in the housing stock the number of new building permits per dwelling on the annual log change in the OFHEO price index in that metropolitan area. The procedure yields an estimate of the elasticity of housing supply for each of the 45 metropolitan areas.

Figure 5
Housing Prices and Extended Regulation Index
(272 Metropolitan Areas)



Source: Data Provided by Stephen Malpezzi, 2006.

Subsequent analysis of the determinants of these supply elasticities confirms that areas that are heavily regulated exhibit low elasticities. Lightly regulated growing metropolitan areas exhibit high supply elasticities. Stagnant metropolitan areas exhibit low elasticities regardless of the level of regulation. A regression relating the supply elasticity to the stringency of regulation has a highly significant and negative coefficient. Increased regulation inhibits the adjustment of housing supply to price signals.

A recent paper by Hwang and Quigley (2006) examines the dynamic effects of regulation using the measures introduced by Malpezzi and his associates. The authors estimate a dynamic model of the course of house prices, vacancies, and residential construction across 74 metropolitan areas during the 1987-1999 period. The stringency of regulation is found to cause a significant reduction in the supply response to housing price pressures – in a variety of specifications and experiments. Simulation exercises, using standard impulse response techniques, document the importance of regulation in affecting the timing of market responses to regional economic conditions. In more regulated markets, the levels of housing prices increase more in response to shocks to the economy, and the price increases resulting from exogeneous shocks are far more persistent over time.

The third research project relies upon a detailed survey of California cities and towns conducted by Glickfield and Levine (1992). This project also relates variations in these measures of regulatory stringency to housing outcomes using detailed jurisdiction –level data for California. The analysis documents the effects of these locally enacted rules on housing outcomes – the distribution of households by race and ethnicity and variations in the prices of single family housing and apartments.

Rosenthal (2000) created two summary measures of the detailed descriptive data (also an eleven page questionnaire) gathered in the original Glickfeld and Levine survey. His measure of the "hospitality" of jurisdictions to new development is based upon a composite of responses to nine survey questions measuring the extent to which California cities provide assistance or encouragement in the development process. The underlying responses include, for example, the willingness of jurisdictions to provide "fast tracking" to developers confronting regulation and the willingness of jurisdictions to rezone land to higher densities. Similarly, his measure of "exclusivity" in local regulation is based upon ten measures restricting residential development, ranging from restrictions on building permits or on population growth to the adoption of urban growth boundaries.

Rosenthal's analysis, based upon the 1990 census, shows that the measures of exclusivity and hospitality are strongly related to economic outcomes, and they have perceptible effects upon levels of residential segregation by race.

In a more recent paper, Quigley, Raphael, and Rosenthal (2004) use these characteristics of California cities, exclusivity and hospitality, as instruments for population growth and the growth in single family housing in those cities during the decade of the 1990s. Their empirical results, analyzing changes in the distribution of population by race in California cities, suggest that the underlying zoning rules have been quite important in affecting changes in the racial and ethnic composition of cities within California's metropolitan areas during the decade of the 1990s. Whether by accident or by choice, the land use policies adopted by California cities have a causal relationship to the distribution of minority households within metropolitan areas.

In a third paper, Quigley and Raphael (QR, 2005) use the same underlying survey data to define an index of restrictiveness for California cities in a manner parallel to that used by Malpezzi for US metropolitan areas. The authors use a simple count of the number of growth controls imposed as a measure of the restrictiveness of the regulatory environment in any city. The underlying growth controls include restrictions on the number of permits allowed or the extent of population growth permitted, rezoning land for agricultural use or upzoning land, growth management measures or growth boundaries. Figure 6 shows the spatial distribution of land use restrictions and their incidence among coastal communities. For comparison, Figure 7 shows the spatial distribution of the median prices of owner occupied housing in 2000.

The QR analysis documents the remarkable extent to which land use regulation increases housing costs in California cities. The authors find a positive relationship between the degree of regulatory stringency and housing prices for both owner-occupied units and rental units. This relationship is evident in 1990 and 2000 cross sections, as well as in the changes in housing prices and rents over the decade of the 1990s. Figure 8 reports the raw relationship between regulation and constant quality house prices for owner occupied housing. The relationship

Figure 6
Spatial Distribution of Land Use Restrictions in California

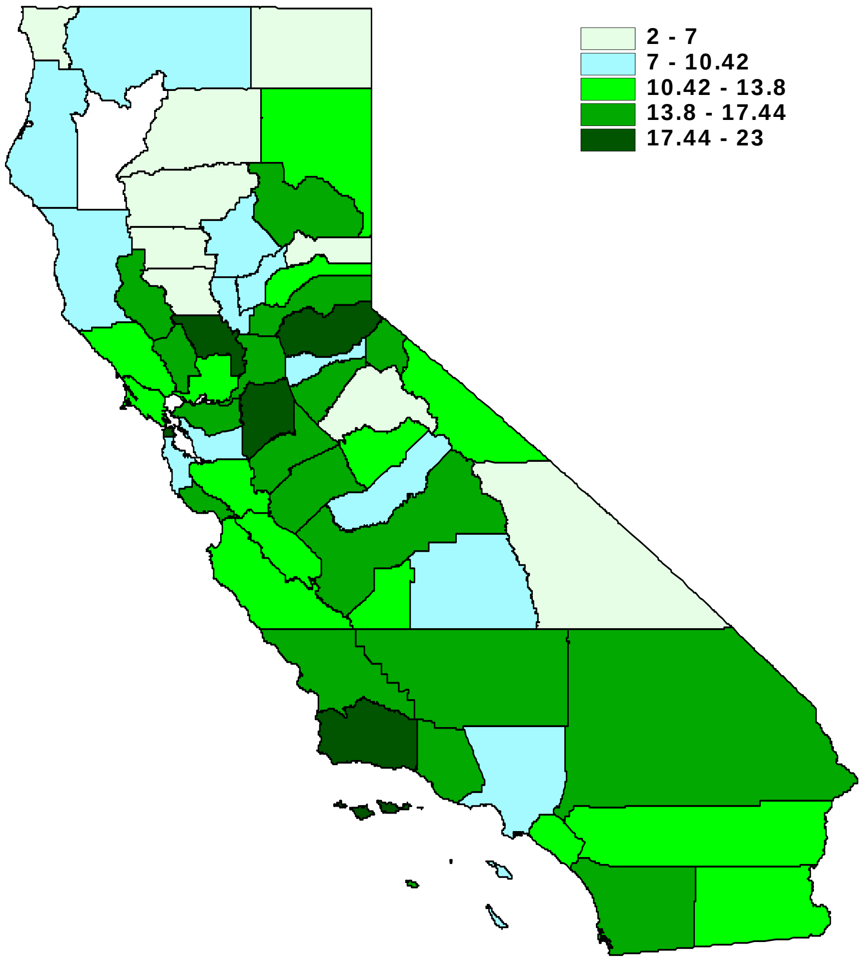


Figure 7
Spatial Distribution of Housing Prices in California

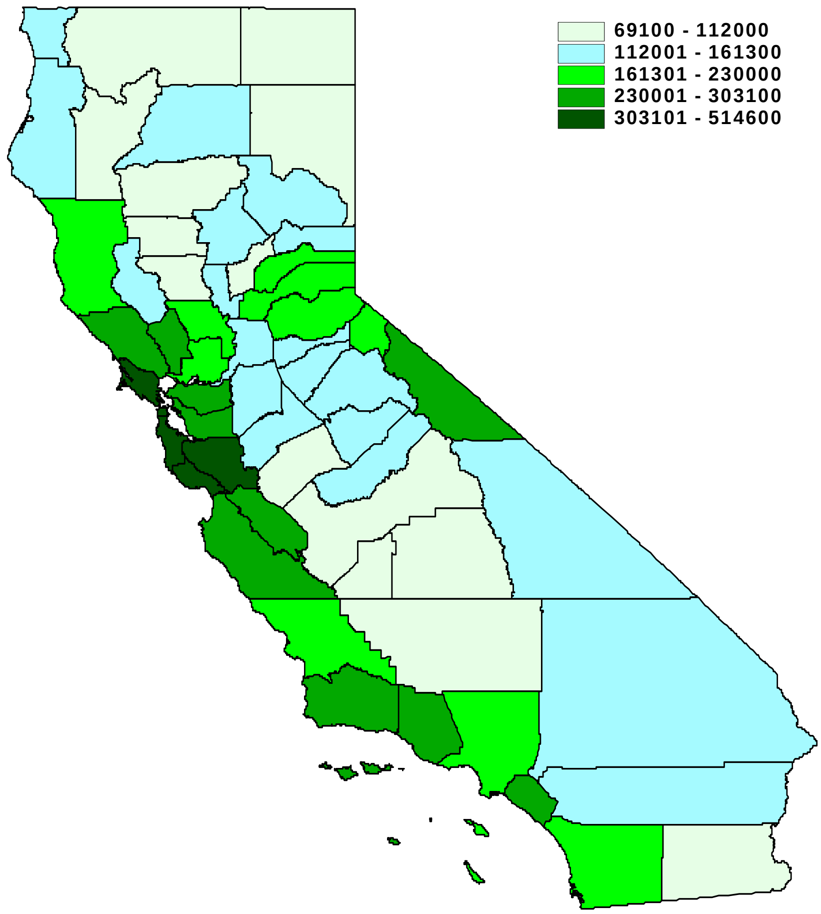
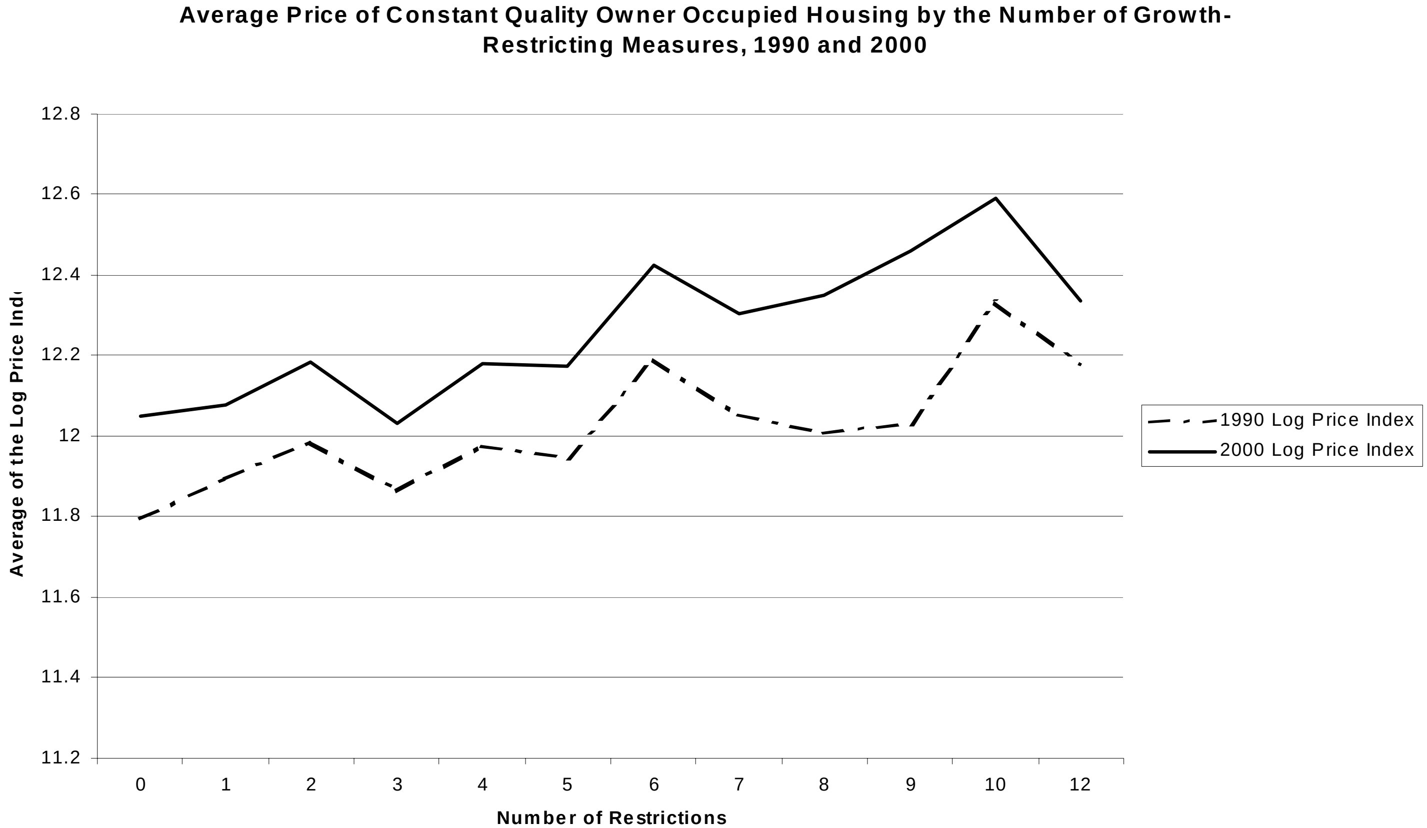


Figure 8



Source: Quigley and Raphael, 2004a.

between the number of restrictive regulations imposed by cities and log house prices is roughly linear, suggesting that house prices increase roughly exponentially with the number of restrictive regulations.

Quigley and Raphael also find evidence that new housing construction is lower in more regulated cities relative to less regulated cities. Housing price appreciation in more regulated cities exceeded the comparable price changes in less regulated cities. The strongest evidence of the impact of regulation on housing cost comes from the estimates of the supply elasticity of housing for regulated and unregulated jurisdictions. Using instrumental variables which control for the endogeneity of regulation, the authors find that the responsiveness of the housing stock via new construction is weaker in more regulated cities, relative to less regulated cities. Moreover, the difference in responsiveness is greatest for the supply of multi-family housing units, the source of supply that is most frequently the target of regulation.

IV. Interpretation

The three research projects described above reinforce and extend our understanding of the consequences of local land use regulation in urban areas. Housing prices are much higher in areas with more stringent regulation. Housing supply is much less responsive to economic incentives in areas with more stringent land use regulation. These analyses do not "prove" that the observed price increases are not justified by the control of externalities. But it seems difficult to imagine that externalities per se could be important enough to rationalize these large effects.

But there are several other types of externalities that can surely underly the restrictive regulations imposed: fiscal and social. If the potential residents of new housing or higher density housing would receive more in locally provided services than they would pay in local taxes, this new housing would produce a negative fiscal externality. The appropriate remedy would be to charge marginal residents appropriately for the services they consume not to deny entry by regulation.[6]

Alternatively, the external effect may be purely social, as when the regulatory barriers are designed to zone out lower income or minority households. Of course, explicit racial or ethnic zoning is illegal, but as the analysis by Quigley, Raphael, and Rosenthal (2004) suggests, land use regulation in California has the same implicit effect.

Some recent work may suggest that these regulatory effects will become more important over time – even if the regulations themselves do not become more restrictive. For example, work by Gyourko, Mayer, and Sinai (GMS, 2004) has drawn attention to the increased dispersion in housing prices across cities which may be attributable to rising household incomes and inelastically supplied housing – for example, from restrictive regulation of land. If cities vary in their levels of amenity and if urban amenities are income elastic in demand, then an increase in income will increase demand more in some

[6] Alternatively, as argued famously by Mills (1979) this is a strong reason to favor the abolition of residential property taxes.

kinds of cities (termed "superstar cities" by GMS) than in others. If housing is supplied inelastically in some high amenity cities, then prices will be bid up and the dispersion of prices across cities will be larger. The authors present a simple model that suggests that the ratio of housing prices to rents will be higher in superstar cities simply because consumers and investors expect incomes to increase. Rising incomes, by themselves, will lead to larger increases in demand for housing in superstar cities, and this will be anticipated by consumers. Housing prices in superstar cities, relative to rents in those cities, will be bid up today because consumers anticipate that rising incomes will increase housing asset values in the future.

The empirical results on regulation can provide a crude test of the magnitudes involved. In the absence of dynamic considerations, house values (V) are merely the capitalized value of the rent streams (R) they generate. Capitalization depends only upon the interest rate (*i*). Increases in amenity levels (A) will increase the ratio of prices to rents. Regulatory barriers (Reg) reduce the elasticity of housing supply, increasing the ratio of housing prices to rents,

(10) $V/R = f(i, A, \text{Reg})$.

We explore this relationship using a panel of metropolitan areas for which annual information is available on housing prices, rents, amenities, and the Malpezzi regulation index shown in Figure 5.[7] The data consist of an unbalanced panel of annual 5905 observations on 274 metropolitan areas observed for various periods between 1983 and 2005.

The simple relationship between housing prices, rents, and interest rates,

$$(11)\quad \log(V/R) = \underset{(46.45)}{0.962} \; - \; \underset{(46.24)}{0.456}\log(i),$$

is highly significant, with the *t* ratios (in parentheses) over 40 and with an R-squared of 0.27. As interest rates have declined secularly, housing prices have increased relative to rents.

When the amenity variable is added to the model and when it is allowed to vary over time, *t*,

$$(12)\quad \log(V/R) = \underset{(37.48)}{1.038} \; - \; \underset{(39.60)}{0.484}\log(i) \; - \; \underset{(5.78)}{0.135}\,(10^{-4})\,\mathrm{A}^2\,\mathrm{t}\;,$$

[7] Housing prices are available by MSA and year from OFHEO. "Fair Market Rents" (estimated rents at the 40^{th} percentile of the rent distribution) are published by HUD by MSA and year. The amenity variable is the "cumulative score" of a variety of amenities, as compiled by Greulich, 2005, from the *Places Rated Almanac*. The Malpezzi regulation index is from Figure 5. Amenity and regulation varies by MSA. Interest rates are from Freddie Mac historical series and are reported annually.

the amenity variable is highly significant,[8] and the explained variance is somewhat higher (0.34). Higher levels of amenity are associated with increases in the ratio of house values to rents over time.

When the regulation variable is included in an analogous specification,

$$\text{(13)}\ \log(V/R) = \underset{(2.10)}{-0.087} - \underset{(6.66)}{0.114}\log(i) + \underset{(23.30)}{0.261}(10^{-4})\,\text{Reg}^2\ t\,,$$

higher levels of regulation are associated with increases in the ratio of house prices to rent.[9]

Finally, when both variables are included together,

$$\text{(14)}\quad \log(V/R) = \underset{(4.63)}{0.202} - \underset{(8.89)}{0.159}\log(i) - \underset{(8.04)}{0.179}(10^{-4})\,\text{A}^2\ t + \underset{(24.02)}{0.269}(10^{-4})\ \text{Reg}^2\ t\ ,$$

both variables are highly significant, and the R-squared is 0.35. Higher levels of regulation have led, not only to higher house prices, but also to increases in the ratio of house prices to rents. Moreover, the markups of house values over rents have increased over time.

Interpreted literally, the coefficients in equation (14) suggest that, holding amenities and regulation constant, the ratio of housing prices to rents has increased by 18 percent

[8] Lower scores represent a higher rating (the mean of this variable is 9.8 in the data).
[9] The mean of this variable is 21.3 in the data.

between 1983 and 2005, as mortgage interest rates have declined from 13.2 to 5.9 percent. In 1983, the ratio of housing prices to rents was 1 percent higher in a heavily regulated metropolitan area (with a regulation index of 25) relative to a lightly regulated metropolitan area (with a regulation index of 15). By 2005, the ratio of house prices to rents was 28 percent higher in the more regulated housing market.

Of course, these numerical estimates are to be taken with a grain of salt. Nevertheless, it does appear that secular increases in incomes will lead to an even greater dispersion in housing prices as a result of regulatory barriers to the functioning of housing markets.

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