Housing Supply

Prepared for the Annals of Economics
Draft of August 25, 2008

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Abstract

Research on housing supply has grown due to improved data combined with heightened interest in policies such as local land use regulations. Heterogeneity in supply conditions across markets has been shown to be essential to understanding the growing price dispersion across metropolitan areas, as well as whether positive growth shocks to a metropolitan area manifest themselves more in terms of expanding population and homebuilding or in terms of higher wages and house prices. The nature of supply obviously also influences local housing market dynamics. Recent research has shown that differences in the elasticity of housing supply can account for the wide variation in new construction volatility (but not price volatility) across markets over time. The extraordinary nature of the recent boom only increases the need to understand how housing market fundamentals, supply and demand, affect the functioning of this huge asset market.

Keywords: housing markets; supply; regulation; urban outcomes

I thank Andrew Moore for excellent research support, and the Research Sponsors Program of the Zell/Lurie Real Estate Center for financial support

I. Introduction

Until relatively recently, knowledge about the supply side of housing markets has been sparse compared to demand. Lack of importance is not the reason, of course. A thorough understanding of both supply and demand is essential for understanding the workings of any market. Data availability, or the lack thereof to be more precise, certainly has played a big role in housing supply research lagging behind that of demand, but that situation is changing rapidly. In addition, market conditions and policy issues recently have piqued interest in supply-side issues, so this is an opportune time to take stock both of where we are in terms of our knowledge of the supply side and what we need to do to improve our insights into this enormous asset market.

That the housing market is an important one needs little explanation. Its huge scale is depicted in Figure 1's plot of the value of residential real estate owned by household sector, as reported by the Federal Reserve in its Flow of Funds accounts data. Even with the recent dramatic declines in house values, nearly $20 trillion (in 2007 dollars throughout this chapter) still is owned by households.[1] The large size of the asset base is no surprise, as everybody has to live somewhere. According to the 2000 census, there were 106 million occupied housing units in the United States, with just over 71 million of them being owner-occupied.

The production of housing is cyclical. Just in the last three full calendar years, the number of housing starts has fallen from a high of 2,068,000 in 2005 to 1,355,000 in 2007. It is single-family home production that dropped the most over this period, but that is not always the case. Multifamily production dropped by well over half from its peak in the mid-1980s,

[1] This figure is a market value estimate for all types of owner-occupied housing, including farm houses, mobile homes, second homes that are not rented, vacant homes for sale, and vacant land. See Table B.100 Balance Sheet of Households and NonProfit Organizations from the Flow of Funds Accounts of the United States at the following URL: http://www.federalreserve.gov/releases/z1/Current/z1r-5.pdf.

following the elimination of favorable tax code benefits and the onset of a recession in the early 1990s. During that cycle, overall housing production dropped by 40 percent from 1.8 million units in 1986 to 1.0 million units in 1991. While this cyclicality is important to the macro economy, the analysis of macro effects of changes in housing production is outside the scope of this chapter.[2] The focus here is on how housing supply affects the workings of housing markets, as well as the broader urban environment.

Before delving too deeply into housing supply itself, it is useful to note that different groups of researchers approach the study of housing from varying perspectives. Those interested more in broader urban dynamics tend to think of housing supply as the total stock of units in an urban area, with demand being the total number of households in the area. Those more interested in housing markets specifically, not the broader urban environment in which they are situated, tend to think of supply as being captured by the number of homes for sale at a given time, with demand represented by the number of buyers in the same period.

These different perspectives naturally lead to different research questions being investigated. For example, the application and testing of loss aversion hypotheses from prospect theory arises from those interested more in housing market operations *per se* (Genesove and Mayer (1997, 2001); Engelhardt (2003)). Research into how the nature of the supply side affects the duration and magnitude of city decline arises from those more focused on urban dynamics (Glaeser and Gyourko (2005)).

More recently, the extraordinary nature of the recent boom in housing markets has led researchers to ask how supply side conditions might be able to help account for the stylized facts about housing market dynamics. For example, to what extent does the fact that housing is a

[2] In addition, the demographic and economic factors that drive the number of housing units needed are more properly part of a demand side analysis of housing.

durable good which is produced with a lag help account for the well-known predictability of housing prices? Can differences in supply elasticities help account for the large differences in price and quantity change volatility across markets? What is the role, if any, of supply in helping account for the wide and growing dispersion in house price levels across metropolitan areas in the U.S.? Is it due to the rise of increasingly stringent local land use regulation in certain markets and not others? Or, is there some other factor that is primarily responsible?

This chapter will discuss research on these questions, as well as other issues pertaining to housing market and urban dynamics. Doing so requires some detail on the causes of supply, and it is to that issue we turn in the next section. Who produces housing units, how do they do it, and what does it cost in a fundamental sense? These production costs are then compared to actual prices in the market. As will be shown below, prices can and do deviate substantially from production costs in some markets, with local land use controls being a prime reason why.

How supply side conditions influence housing market and broader urban dynamics is considered in Section III. In terms of the workings of housing markets, a wide variety of issues have been the subject of recent research, ranging from how loss aversion might affect the behavior of sellers to whether publicly-subsidized apartment building programs result in substantial crowd out of private building, leaving relatively little net benefit to low income renters. In addition, work on housing market dynamics is reviewed that helps us understand how heterogeneity in supply conditions across metropolitan areas affects the pattern of price and quantity changes in housing markets. In terms of urban effects, supply conditions have been shown to affect how positive demand shocks play out in a metropolitan area—in big population growth and housing construction versus smaller population expansion combined with higher wages and house prices. More generally, this research shows that differences in supply have

important implications for the location of economic activity across markets in the United States. The final section then briefly discusses where research is most urgently needed to help us better understand the workings of housing markets and urban change.

Finally, it should be emphasized that this chapter is not intended as a complete review of the literature on housing supply. Partly, this is due to space limitations, but it also arises from a desire to focus on certain emerging issues that seem critical to housing supply research in the near future. For more breadth and historical context, the interested reader should see DiPasquale (1999) for an excellent review of the research on housing supply to that date, as I generally presume knowledge of much of the work in that fine piece.

II. **New Construction**

a. The Structure of the Market and Construction Costs

Fundamental to any understanding of housing supply is insight into the production of new housing units. Housing is supplied by single-family and multi-family builders. The large number of such builders strongly suggests that homebuilding is a very competitive industry. The 2002 *Economic Census* reports that there were 58,488 establishments of general contractors specializing in building owner-occupied housing, with another 4,370 focused on multi-family (primarily rental) units.[3] The vast majority of these entities are very small, both in terms of the number of employees and dollar amount of business done. Still, there is no evidence the industry is dominated by a handful of firms. Among the builders of owner-occupied units, just under one-quarter (13,825/58,488) do business in excess of $1 million, with 646 such establishments

[3] See the data in table entitled Construction – by Industry at the following URL: http://www.census.gov/econ/census02/data/us/US000_23.HTM. These figures do not include any of the 26,046 so-called operative builders, many of whom construct housing for sale on their own account. In any event, there clearly are many tens of thousands of home builders in the U.S.

building more than $10 million worth of homes. Among the smaller number of purely multifamily builders, over half the establishments have fewer than five employees, but there are only two that have more than 500.[4] Thus, the housing construction industry clearly is not dominated by a handful of large firms, so there is no reason to expect there is any monopoly power that would allow the fixing of prices.

Both structure and land are required to produce housing. Physical construction costs, which are those involved in putting up the structure, are available from a number of building industry consultants who advise developers on the likely costs of different types of structures.[5] Table 1 uses information from one such firm, the R.S. Means Company, to document the cost in 2007 (in 2007 dollars) across most large U.S. markets of providing the physical structure for a standardized, modest quality, single-family home with 2,000 square feet of living area.[6]

One important point to take from this table is that a decent quality, single-family home can be built for under $200,000 almost anywhere in the country. Even in the most expensive market—the New York City area--physical construction costs for our hypothetical 2,000 square

[4] See Table 5 Selected Statistics for Establishments by Employment Size Class: 2002 at the following URL from the 2002 Economic Census: http://www.census.gov/prod/ec02/ec0223i236116t.pdf.

[5] These data are not perfect by any means, and have been subject to criticism (e.g., Somerville (1999)). However, they have passed an important market test of revealed preference in that they are widely used by builders for budgeting purposes. That seems a more convincing indicator of their reliability than the fact they have been used to good effect in academic studies.

[6] The median new one-family home in 2007 contained 2,277 square feet of living area (see the data at http://www.census.gov/const/C25Ann/sftotalmedavgsqft.pdf for more detail), but the typical existing home is smaller. Hence, we are not assuming a small unit in terms of the overall stock. The costs themselves are for the second lowest of four quality types of homes priced by R.S. Means that meets all relevant building code requirements. The company labels those four types as economy, average, custom, and luxury, with Table 1 reporting costs for an 'average quality' home. Costs are about 20% lower for the lowest quality, economy home. Luxury homes are estimated to cost about $170 per square foot of living area in the New York market, so even a very high quality, 2,000 square foot home can be produced for less than $350,000 in that market. This particular firm presumes that the home is built according to a common, national specification that does not vary across markets. It divides the construction of the home into a set of tasks that require a certain amount of labor and materials inputs, and then surveys local suppliers and builders to price those inputs. Construction costs are the sum of the individual task costs. See Glaeser and Gyourko (2003, 2005) and Gyourko and Saiz (2006) for more detail on these data. Other firms such as Marshall & Swift and Zaxon provide similar data that yield very similar results, so use of R.S. Means Company data is not meant to imply that it is superior. Convenience and the author's previous work with their data explain its use here.

foot house still are below $210,000. On a per square foot basis, these numbers range from $64.13 in the Austin-San Marcos area to $104.86 in the New York City area. We will soon see that house prices are well above these levels in most coastal markets, so something other than structure production costs must explain that.

There appears to be a consensus among housing and urban economists that the production of physical traits such as roofs and bedrooms can be increased almost indefinitely on a constant cost basis. One recent estimate in support of that conclusion reports an elasticity of supply is in the range of 50 (Gyourko and Saiz (2006)). While it is difficult to come up with truly convincing identification with the available data, the consensus that the supply of structure is very elastic appears to be quite reasonable, as there is relatively little variation in construction costs in bigger (e.g., Atlanta) versus smaller (e.g., Charlotte) markets that are growing rapidly.

Gyourko and Saiz (2006) argue that the cross sectional variation depicted in Table 1 is driven primarily by supply shifters such as the extent of unionization within the local construction sector, local wages, the nature of local topography such as hills and mountains that can make it difficult to build, and the local regulatory environment. One problem with this work is that it is cross sectional in nature, making it very challenging to come up with convincing instruments (or natural variation) to deal with possible endogeneity problems. The prudent way to view our knowledge in this particular area is that the key correlations and summary statistics have been established, but more work remains to be done to ascertain causal pathways. Given the $40 per square foot range in the cost of construction across major markets, this seems an area worthy of more effort.

Somewhat related work investigates how building codes affect house prices.[7] This work dates back at least to Maisel (1953), who concluded that their impact on housing price was *de mimimus* (less than one percent). More recent studies find higher impacts, but none conclude that house prices are more than 5%-10% higher because of more stringent building codes.[8]

Real construction costs do not appear to have increased much over time, which is consistent with what has happened to the real production costs of many durable goods. Figure 2 plots aggregate data on real construction costs from the R.S. Means Company and the Bureau of Economic Analysis' National Income and Product Accounts from 1982-2007. Both series show there has been a sharp rise in real construction costs since 2000, but the time series indicates that this brings real production costs only slightly above their levels from the early 1980s. This is entirely consistent with Davis and Heathcote's (2007) finding that the vast majority of the rise in residential housing value since 1975 has been due to increases in land, not structure, value.[9]

b. Land Use Regulation, House Values and Housing Supply

Real construction costs may not have increased much over the past three decades, but Figure 3 shows that real house prices have. This plot of the (log) national house price index based on Office of Federal Housing Enterprise Oversight (OFHEO) data documents how extraordinary the recent boom has been. Since 1975, real prices have appreciated at a cumulative compound rate of about 1.6%.

[7] See Listokin and Hattis (2005) for an excellent discussion of the full range of building attributes regulated by building codes. Generally speaking, building codes focus on the materials that can be used in new construction. Land use regulations, which will be analyzed below, deal with what types of buildings can be put on available land.
[8] The relevant studies are by Muth and Wetzler (1976), Seidel (1978), and Noam (1983). Seidel finds the largest impact, with Noam concluding that costs were about 5% higher, with Muth and Wetzler (1976) being the closest to Maisel (1953) at 2%. Listokin and Hattis (2005) reports that the National Commission on Urban Problems (aka the Douglas Commission) found that building regulations raised prices by 13%, but that is an outlier in this area of research.
[9] On an aggregate national basis, they estimate that the value of residential land roughly quadrupled since 1975, which the value of structures only increased by one-third.

There is much greater heterogeneity in house prices than in construction costs across markets. Table 2 documents this in its listing of the 2007 price of the median quality home from the 2000 census for each of the large markets listed above in Table 1.[10] Comparing the data in Tables 1 and 2 shows that house prices for a typical quality owner-occupied unit in the New York City and San Francisco metropolitan areas were about $500,000 above the level of physical construction costs for a modest quality, 2000ft^2 single-family home. Large gaps between house values and structure costs also exist in a number of other primarily coastal markets such as Boston, Los Angeles, San Diego, and Miami. However, house prices are no more than 20% above construction costs in most of the interior markets of the country. In some, prices are below those costs.[11]

That the large aggregate increase in residential land values estimated by Davis and Heathcote (2007) is being driven by changes in a relatively few, primarily coastal markets is confirmed results in Glaeser, Gyourko and Saks (2005a). Those authors compared mean house prices in 102 metropolitan areas in the six decennial census years since 1950 with physical construction cost estimates for a modest quality home using R.S. Means data.[12] If one is willing

[10] These prices are computed as follows. The median home for each metropolitan area as reported in the 2000 census is selected. That figure then is scaled up by the change in the relevant OFHEO repeat sales price index between 2000 and 2007 for each metropolitan area. Over time, this would yield the constant quality price for the typical home as of the 2000 census in each market. As always in this chapter, all monetary figures are in 2007 dollars.

[11] This can result for a couple of reasons. Because we are comparing the physical construction costs of new housing with the price of existing housing (the median quality unit from the year 2000, to be specific), we are contrasting the production costs of new units with the price of older units. There is no reason the former could not exceed the latter. Urban decline could be another factor. In declining markets, demand may be shifting down on a vertical part of the supply schedule. In that case, prices can fall well below replication costs (Glaeser and Gyourko (2005)). See the discussion later in this chapter for more on this point.

[12] This comparison of price to cost is slightly different from that involved in contrasting Tables 1 and 2. First, the mean, not the median, house is used. In addition, the quality of the home can and undoubtedly does change over time in Glaeser, Gyourko and Saks (2005a). And, the nature of a modest quality home also changes over time in the R.S. Means data.

to treat land value as the difference between house price and physical construction costs[13], then the implied land share of house value is 1-(CC/P), where CC is construction costs and P is price. In 1980, the average of the 102 ratios of price-to-construction cost was 1.15, which implies an average land share of about 13%. The 90th percentile land share was only 33% that year, so there were only a very few markets with expensive land at the end of the 1970s. Two decades later, the picture looked quite different. In 2000, the average ratio of P-to-CC was 1.46, implying a mean land share of about 31%. This time, ten percent of the metropolitan areas had land shares above 50%.[14] Over the last two decades, land has become very expensive in a small number of markets, and Tables 1 and 2 show that they are almost all on the east and west coasts of the country. In addition, the full range of prices across metropolitan areas is at an all-time high.

This then begs the question of what explains this change. That something happened on the supply side of the market is beyond doubt, as the pattern cannot be accounted for by demand factors alone. That said, it is not immediately obvious that demand differences alone cannot account for the high land and house prices in coastal markets. After all, the bedrock spatial equilibrium model in urban economics introduced by Rosen (1979) and Roback (1982) implies that house values reflect the price one must pay to access the productivity and amenities of an area. Both the New York City and San Francisco markets are very productive with plenty of high paying finance and tech sector jobs. The Bay Area also is blessed with a wonderful set of natural amenities. Hence, standard theory would predict high house prices and land values (presuming construction costs do not vary enough, which is the case as shown in Table 1) in

[13] This is not quite right, as there are other so-called 'soft costs' such as those associated with design or accounting functions that may not be fully reflected in data provide by firms such as the R.S. Means Company. However, this rule of thumb is a reasonable guide to land value in most cases. It also highlights a serious data problem—namely, the absence of transactions prices on residential land. Almost always, land is bundled with the structure, so its value must be imputed via some type of decomposition. See Haughwout, et. al. (2008) for a report on a project by the New York Federal Reserve Bank to create a data base on vacant land. Many more such efforts are needed.

[14] See Table 2 and the discussion in Glaeser, Gyourko and Saks (2005a) for more detail.

markets just like New York and San Francisco. Much empirical work has confirmed the essential insights of the Rosen-Roback model, including that people are willing to pay a lot for access to high paying jobs and amenities such as a temperate climate (e.g., Blomquist, et. al. (1988); Gyourko and Tracy (1991)).

Thus, differences in income across metropolitan areas certainly can and do influence the demand for housing, but if demand was the only thing that differed across markets, then we should see abundant new construction accompanying high prices in the high income/high amenity markets. That is, if supply conditions really were the same across markets, then high prices, which necessarily reflect strong demand, should elicit a strong supply response. Low house price areas should be associated with relatively weak new construction. However, Figure 4's plot of house values in the year 2007 against new construction since the year 2000 as a share of the 2000 stock depicts a sharply negative slope. The high price markets such as New York and San Francisco have experienced very little new construction, while the lower price markets such as Phoenix and Las Vegas have greatly expanded their number of housing units. It is not possible to understand why New York and San Francisco have very high prices and very little new construction while Phoenix and Las Vegas have moderate prices and much construction, without supply side conditions differing across these two types of markets.

While it is clear that supply in New York and San Francisco is relatively inelastic, it is not obvious what causes that condition. It has long been recognized that local regulation is one possible explanation, with Ellickson (1977) and Fischel (1985) being prime examples of those who were quick to recognize the potentially exclusionary nature of the land use control movement.[15]

[15] See Fischel (2001), Hilber and Robert-Nicoud (2006) and Ortalo-Magne and Prat (2007) for more recent work on the political economy of zoning.

There is a now lengthy empirical literature on this topic dating back at least to Katz and Rosen's (1987) comparison of prices across northern California communities with and without growth control legislation that is consistent with these policies driving up prices. Other studies in this vein that also find significant impacts on house prices include Pollakowski and Wachter (1990) and Levine (1999). Ihlanfeldt (2005) provides perhaps the most recent estimates. Quigely and Raphael (2005) also provide a more recent analysis for California, and Quigley and Rosenthal (2005) ably summarize the literature do date, providing a thorough bibliography on research in this area. That local land use regulations restrict housing supply and drive up prices is intuitively appealing because there must be some constraint preventing competitive homebuilders from supplying extra units at prices well above their cost of production. However, none of these studies uses a research design that is able to exploit truly experimental variation to deal with the potential endogeneity arising from the likelihood that the communities adopting various land use regulations are not a random sample of jurisdictions.

Glaeser and Gyourko (2003) and Glaeser, Gyourko and Saks (2005b) pursued another path to show that local regulation was artificially restricting supply, thereby pushing up housing values. The latter paper focused on the condominium market in Manhattan, comparing the costs of adding another floor to a high rise building with the actual sales prices of condominiums in the market. Manhattan highrises are an interesting submarket to study because building up does not require more land. Hence, the marginal cost of supplying an extra unit is reasonably accurately defined by the physical cost of construction, so measurement is not bedeviled by having to impute land costs (which almost always are unobserved). Even given the very high construction costs in that market and for highrise product, Glaeser, Gyourko and Saks (2005b)

concluded that restrictions on building pushed up the price of a typical Manhattan condominium unit by as much as 50 percent in the early part of the 21st century.[16]

The problem with this approach is that the evidence is entirely indirect. Part of the difficulty with this area of research is that there has not been much systematic measurement of local land use regulations. Fortunately, this is changing as progress has been made in measuring the state of local land use regulation. Recently, there have been three major research projects focused on documenting and measuring local residential land use controls.[17] Two are national surveys of thousands of communities across the country (Pendall, et. al. (2006) and Gyourko, et. al. (2008); the other is a detailed examination of the state of regulatory restrictions in the Boston area (Glaeser, Schuetz and Ward (2006) and Glaeser and Ward (forthcoming)).

Both types of data collection efforts are needed. Land use regulation has grown in scale and scope, making it difficult to completely describe the environment across many places. Glaeser and Ward (forthcoming) comes the closest to doing so for a subset of the Boston metropolitan area. They conducted a very detailed analysis of local zoning codes that enabled them to make precise calculations of potential housing supply across communities. However, the magnitude of the effort involved virtually prevents its replication across multiple markets by a single research term. The national surveys by Pendall, et. al. (2006) and Gyourko, et. al. (2008) are less ambitious in terms of trying to describe the regulatory environment in detail, but

[16] However, their estimated price impacts do vary over time because of demand fluctuations. In the stock market bust of the early 1990s, they found much smaller price impacts, which highlights an important point that supply side restrictions can only be influential if demand is relatively strong.

[17] These are not the first such efforts, but they probably will be more relevant to research in the near term. See Saks (2008) for a summary of previous efforts in this area. They include American Institute of Planners (1976), Glickfield and Levine (1992), Linneman, et. al. (1990), Malpezzi (1996), and Seidel (1978).

they are able to provide useful data and summary statistics on a large number of communities in many markets across the country.[18]

These new data provide the most comprehensive picture of land use regulation we have ever had. They document an extremely wide range of conditions, but also show that the typical community now is far from unregulated. In the Gyourko, et. al. (2008) sample, the typical town has two bodies that must approve any project requiring a zoning change, has some type of minimum lot size constraint, and has an exactions program for developers.

House prices at the metropolitan area level are strongly positively correlated with the strictness of local land use regulation based on the index developed by Gyourko, et. al. (2008). The simple correlation is 60 percent, and a one standard deviation increase in the index is associated with a $133,000 increase in average house prices. A stricter regulatory regime also is associate with less permitting, but that relationship is made murky by the fact that markets experiencing very low demand will have low permitting levels even if they are unregulated (e.g., Detroit). Still, there is a strong negative relationship between the degree of regulation and building activity.[19]

While these data will become much more useful once there are consistently measured time series available, presently they can only be correlated with prices and quantities. Glaeser and Ward (forthcoming) are able to do more econometrically because of their time series on communities in the Boston area. They find that larger minimum lot sizes are associated with much smaller housing stocks in the community, controlling for a host of other factors that include local attributes from before the Second World War. House prices are higher, too, and

[18] For example, Gyourko, et. al. (2008) provide information on 2,611 communities across all fifty states and 293 distinct metropolitan areas. Their data may be downloaded at http://real.wharton.upenn.edu/~gyourko/Wharton_residential_land_use_reg.htm.

[19] See Glaeser and Gyourko (forthcoming 2008, Chapter 4) for more detail.

this study can reject that this is efficient. That is, community land values are not being maximized. The supply of housing appears to be reduced far more than would be needed to maximize aggregate land value.

Thus, there is a lengthy literature and an emerging consensus that local land use regulation has become a binding constraint on the supply of new housing units in certain markets and that this is leading to increased prices in the most constrained markets. There certainly is less of a consensus on the magnitude of the impacts, but improved data and research designs hopefully will change that situation for the better in the near future.[20]

That supply is constrained is not necessarily inefficient, of course. New development typically imposes external costs such as congestion and pollution on neighbors that should be internalized. Hence, the optimal amount of development controls is non-zero. Glaeser, Gyourko and Saks (2005b) investigate whether Manhattan's implicit regulatory tax can be justified on economic grounds. Convincing welfare analyses of zoning are extremely difficult to perform, but Manhattan well may be the best place to make such as attempt. In contrast to residents of a small suburb, it is not credible for Manhattanites to argue that relaxing regulations in way that allows more housing would change the nature of the island in some fundamental way. Glaeser, Gyourko and Saks (2005b) estimate the marginal social cost of a new resident which includes the value of lost views, added congestion[21], and any fiscal externalities. These costs did not sum to more than one-half the value of the increase in condo prices generated by the development restrictions themselves. In this market, too, regulation appears to be inefficiently strict.

[20] An emerging consensus does not signal unanimity. See Davidoff (2008) for a counter example. In addition, this consensus does not imply that removing building constraints in a single market such as Manhattan would lead to asharp drop in prices. If there is a large queue of people wanting to enter that market, prices need not fall very much (Aura and Davidoff (2008)). A more global deregulation may be needed for that.

[21] Congestion externalities probably are lower in Manhattan than anywhere else in the United States. In social terms, adding to the existing density well could be positive if all relevant environment effects are considered.

While those estimates properly should be considered educated guesses or good back-of-the-envelope calculations, it is not hard to understand why individual communities would go too far in an economic sense in restricting new development. Most of the costs of new development, especially the external social costs, are borne by local residents that are near the new homes. However, the bulk of the benefits accrue to the landowner who was able to develop her property (who may or may not be a resident) and outsiders who got to move into the community. For this reason, Glaeser and Gyourko (2008) argue that a new federal housing policy is needed to counter this natural tendency of communities to be overly restrictive towards new housing development. They recommend a set of incentives that would encourage local communities to allow more building, essentially providing them with cash resources with which they could internalize some of the negative externalities of development.

While much effort has been made to better understand how land use regulation affects prices and quantities in housing markets, we still have relatively little insight into why regulation is so strict in some markets, but not others. The exclusionary motives initially described by Ellickson (1977) and Fischel (1985) are well understood, as is the need to internalize negative externalities associated with an increasing population. However, these factors presumably exist in Atlanta as much as they do in San Francisco, yet communities in the Atlanta market have a relatively lax land use regulatory regime, while the Bay Area is justifiably famous for the stringency of its development controls. Something beyond a desire to generate and protect capital gains is relevant here, as demand has been plenty strong enough in the Atlanta area for its communities to have used building restrictions to limit supply and push up prices over time.

Thus, an important area for future research is to improve our understanding of the causes of variation in the stringency of land use regulation across markets. Work on this is only

beginning. One interesting working paper is by Saiz (2008), who uses topography to get at this issue. Using geographical information systems (GIS) technology, Saiz (2008) computes the fraction of developable land in each metropolitan area.[22] Providing a careful measure of land availability across all major metropolitan areas is a very useful contribution in its own right, and the paper's impact will be greater to the extent it can show that this is an exogenous measure that impacts housing supply. As we begin to think about useful instruments for research, careful consideration will have to be given to a number of issues. For example, is land availability really orthogonal to demand factors? Oceans and hills are thought to be amenities, too. This general concern is compounded by the general equilibrium issue of where people end up living. If they are residing in some place that is hard to build in, there well may be something else that is good about the location. Much more work needs to be done to establish the quality of the instrument, but the promise is great and more research on this issue is needed.

This paper also delves into the question of what might lead certain areas to be adopt more stringent land use controls. Saiz (2008) shows that the more topographically constrained an area is, the stricter is its local regulatory environment as defined in Gyourko, et. al. (2008). Whether this is an indication that more stringent land use regulation gets adopted in places where residents think there is something scarce to protect is an open question. More immigration, higher taxes, and more liberal political leanings also are associated with a more highly regulated land use regime. Hopefully, this work and data will spur others to begin research on this vital question.[23]

[22] More precisely, he computes the share of land which is not steeply sloped (it is very difficult to build on a slope of greater than 15 degrees) and not covered by water (rivers, oceans or lakes). See his working paper for more detail.
[23] The use of satellite imagery and improved mapping techniques seems likely to rapidly improve data quality in this area. These controls are local in nature and now can be mapped precisely to the relevant community. See Duranton, et. al. (2008) and Strange and Rosenthal (2008) for other examples using this technology.

III. **Supply and the Functioning of Housing and Urban Markets**

a. Housing Supply and the Workings of Housing Markets

One interesting new development in research pertaining to housing supply has been the testing of prospect theory's claim that reference points are important and can affect behavior. Genesove and Mayer (1997, 2001) asked whether individual households would react differently to lower house prices based on their degree of loss aversion. Conditional upon the decision to list the home for sale, these authors found that time on the market increased materially and listed sales price was higher where a nominal loss might be involved. Engelhardt (2003) followed with a study that showed nominal loss aversion also affected longer-run mobility rates, using a sample of younger households. Thus, we now know that psychological factors, not just the standard social and economic variables established from a lengthy mobility literature, affect supply as reflected in the number and listing price of homes for sale.

Another relatively new set of research investigates how publicly-subsidized development of apartments affects the overall supply of multifamily units. This is part of a broader research agenda on housing affordability, with the focus on how much new supply the Low Income Housing Tax Credit (LIHTC) program really generates. Two recent studies investigate whether the subsidized housing in this program (and others) ends up crowding out purely private development (Eriksen and Rosenthal (2007); Sinai and Waldfogel (2005)). Both conclude the answer is 'yes', with the crowd out estimates ranging from one-half to two-thirds. Thus, this research indicates that the net addition to the housing stock is relatively small, especially considering how expensive these subsidies are.[24]

[24] Moreover, Susin (2002) and Glaeser and Gyourko (2008) conclude that low income renters do not receive appreciably lower rents, so the distributional benefits also are not favorable.

These two papers estimate crowd out effects using aggregate data. Actual crowd out occurs at the local market level, and standard price theory suggests that crowd out will be greater in markets with more elastic supply. Thus, we would expect subsidized apartment production to generate very little net new supply in markets such as Atlanta and Houston, with the converse holding in markets like San Francisco and New York. Of course, this presumes we actually know the local elasticity of supply at the metropolitan area. Unfortunately, this is not the case, which makes this another vital area for new research.

Saiz (2008) provides the most recent estimates of local supply elasticities. Using his topographically-derived estimates of developable land along with the local regulation data from Gyourko, et. al. (2008), he provides housing supply elasticity estimates at the metropolitan area level that are functions of both physical and regulatory constraints. The five most inelastic markets according to Saiz (2008) are the Los Angeles-Long Beach, Miami, San Francisco, New York City, and Boston-Worcester-Lawrence metropolitan areas. Each has a supply elasticity under 0.7. His five most elastic markets are Dayton-Springfield (OH), Tulsa, Indianapolis, Fort Wayne, and Wichita, each with an elasticity of at least 2.9.[25]

Econometric challenges, including difficult endogeneity issues that need to addressed within the framework of a formal urban model that accounts for the fact that limited availability of land due to water may also reflect demand pressures as discussed just above, mean that these results are not the final word on local supply elasticity. However, they hold much promise and should serve as an important stepping stone for others to follow.[26]

[25] See his Table 7 for the full list of elasticity estimates for 95 metropolitan areas.

[26] Most of the previous literature on the elasticity of supply uses national data (e.g., Topel and Rosen (1988); Blackley (1999)). Both articles, as well as Olsen's (1987) review piece are well worth a careful read by those interested in estimating supply elasticities. They are not discussed in the text solely for space reasons. Topel and Rosen's estimate of a national aggregate elasticity of supply between 1 and 3 probably is the most widely recognized. And, it is consistent with the range of local elasticities cited above from Saiz (2008). Finally, there have been many other useful insights and contributions, including the one by Mayer and Somerville (2000) which

Other recent work has attempted to incorporate heterogeneous housing supply into general equilibrium models of housing market dynamics (Glaeser and Gyourko (2006); Van Nieuwerburgh and Weill (2006)). While these models are intended to address a wide variety of features of the working of housing markets, they have yielded some insights very specific to housing supply. For example, because housing is a complex durable good that cannot be delivered immediately to the market, production lags could be at least partially responsible for the well-known predictability of house prices (e.g., Case and Shiller (1989)). In Glaeser and Gyourko (2006), the model can generate mean reversion both through a tendency of local demand shocks to mean revert and from new construction causing future declines in prices. Their simulations show that only a small amount of mean reversion in the average market is due to supply side effects. There is a greater effect in highly elastic markets, but most of the observed mean reversion in prices appears due to demand side forces.

It is also noteworthy that incorporating supply into such a general equilibrium framework still does not allow those authors to fully account for the volatility in prices that we see in the more inelastically supplied markets on the west coast of the market. This raises the possibility that some non-rational explanation may be at work, but much more work is required before that conclusion can be reached. Incorporating heterogeneous supply is much more successful in explaining the variation in the volatility of construction across markets. Specifically, the high degree of construction volatility observed in the high growth markets in the Sunbelt region is compatible with lower building cost parameters for those areas.

Another recent effort examines how the nature of housing supply would affect both how bubbles would form and how they would play out in markets with elastic versus inelastic

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correctly pointed out that a new housing unit represents a change in supply, and that new housing construction should be specified as a function of changes in things like input prices, rather than their levels.

supplies (Glaeser, Gyourko and Saiz (2008)). Bubbles can form even in elastically supplied markets where new supply is forthcoming in response to price increases, but they are likely to be short in duration. It is only in inelastic markets that large and long duration bubbles are likely to exist. The conditions necessary for an endogenous bubble to persist require prices to continually validate expectations of increasingly rapid price appreciation, and inelastic supply makes that more likely.

b. Housing Supply and Urban Areas

The nature of housing supply also affects broad urban outcomes in important ways. Glaeser, Gyourko and Saks (2006) show this in a model of urban development in which there exists heterogeneity in supply conditions across markets. Building upon the work discussed above regarding the influence of development restrictions on supply elasticity, their model shows that how elastic the supply side of the housing market is helps determine the extent to which increased productivity in a market leads to the city becoming bigger and more populous versus staying the same size with richer workers living in more expensive homes.

Saks (2008) notes that because house prices influence migration across labor market areas, the elasticity of housing supply also can affect local labor markets, not just the housing sector. Her empirical work finds that housing supply constraints alter local employment and wage dynamics in the markets where the degree of regulation is most severe. Building upon Blanchard and Katz's (1992) model of adjustment to shocks to local economic conditions, Saks (2008) concludes that the long-run response of employment to an increase in local labor demand is about 20 percent lower in metropolitan areas with a high degree of housing supply regulation.

Along similar lines, Glaeser and Tobio's (2008) analysis of the rise of the Sunbelt region concludes that its population growth since 1980 has more to do with an elastic supply of housing

and modest house prices than it does with an increase in the willingness-to-pay for amenities such as warm weather and sunny days. Thus, the nature of housing supply is not just affecting how much housing costs, but where people can live and how growth manifests itself.

Glaeser and Gyourko (2005) show that housing supply mediates urban decline, not just growth. Importantly, decline is not the mirror image of growth, and the fact that housing is so durable is the reason why. A kinked supply schedule is posited, in which supply is vertical for prices below construction costs. When demand falls so low that prices are below reproduction costs, the housing remains because it depreciates so slowly. This is why urban decline is such a long process. The presence of very cheap housing is attractive to some, so fewer people leave for stronger labor market areas than would be the case if prices were at least as high as construction costs (which is the case in growing markets). Moreover, the poor are relatively more attracted to the cheap housing, as there is not much of a wage premium for low skilled labor in growing markets, but house prices can and do fall well below construction costs in declining markets. Thus, the nature of housing supply appears to play a key role in explaining the relatively high concentrations of poverty found in declining markets.

Other work by Van Nieuwerburgh and Weill (2006) and Gyourko, et. al. (2006) tries to account for the growing price dispersion in house prices noted above in the discussion in Section II. Van Nieuwerburgh and Weill (2006) use a calibrated general equilibrium island model of the economy and show that increases in the cross sectional dispersion of wages over the past three decades can generate the observed increases in both price levels and dispersion. In equilibrium, workers flow into the more productive metropolitan areas, driving up housing prices. An important assumption of their model is that the housing supply cannot adjust rapidly because of regulatory constraints, so price effects are greater in the more regulated (inelastic) markets.

Gyourko, et. al. (2006) take a different approach, and argue that the growing spatial skewness in house prices is explained in part by an inelastic supply of land in some attractive locations combined with an increasing number of high income households nationally, at least some of whom want to live in the supply constrained locations. What those authors call 'superstar cities' arise when the number of rich people willing to live in the markets with limited housing units (and no willingness to allow building to satisfy the demand) leads to the bidding up of prices that forces out the non-rich. While there are many differences between these papers, one common factor is that heterogeneous supply conditions across markets are essential to any sensible explanation of the wide and widening price dispersion we see over the past few decades.

In sum, the nature of housing supply affects urban areas because they are physical entities. While housing unit production can be expanded rapidly at close to constant cost to accommodate growth in areas that want it, the durability of housing prevents decline faster than the depreciation rate on housing. This is why urban decline is so persistent, especially when compared to growth. And, the choice of whether a market wants to expand is a political one, with some parts of the country deciding that they have enough people. This is playing an important role in driving growth to the parts of the country such as the Sunbelt with more permissive land use regulation controls. It also may be facilitating the spatial sorting of people along income lines across metropolitan areas. While we have long observed this across communities within labor market areas, this appears to be a relatively new phenomenon at the metro area level. And, supply heterogeneity seems essential for understanding why the difference in house prices between San Francisco, CA, and Columbus, OH, has grown so much over time.

IV. **Conclusions and Thoughts on Future Research**

While there has been much progress made in terms of understanding housing supply and how it influences the workings of housing and urban markets, much remains to be done. Better data on local land use regulations is needed. Time series information would be particularly helpful so that we can tell how the regulatory environment has changed over time. It also would be very valuable for empirical work, most of which is presently is forced to rely on fairly simple correlations using a single cross section. Better data would help us pin down more precisely the effects of these local policies on both house prices and quantities.

Beyond this fairly straightforward expansions of existing research programs, there are other potentially important implications of higher prices that result from supply-side constraints which seem worthy of study. For example, how might it be contributing to skewness in prices? Given the magnitude of this market, skewness in home values could be more important economically that that reported for the income distribution. How supply constraints are affecting the affordability of housing by the middle class needs to be much more closely examined, too.

A second important area for future work must be the development of robust estimates of local market supply elasticities. Work has begun on this topic, and more is needed. Supply heterogeneity is key to much of the discussion above, and we clearly need to measure any such variation more precisely.

Next, it is important that we fully integrate heterogeneous supply into a well-specified general equilibrium model of housing market dynamics. Initial efforts are being made in this area, too. Success will be achieved when a well-calibrated model is completed that will help us better understand the nature of housing market changes, as well as provide important robustness checks on the voluminous empirical work being done.

Finally, we need to think through more of the implications of the spatial effects on the distribution of economic activity that recent research concludes arises from varying supply side conditions in housing markets. Most population growth and housing construction is occurring outside of the Bay Area, New York, and Boston areas. Given how productive those agglomerations appear to be, should we care that some growth is being channeled to the Sunbelt region, at least partially because their markets allow plentiful new home construction? Should we care if income sorting across metropolitan areas begins to approach the intensity with which we already see it happen across communities within a given labor market area. The superstar cities research suggests that is a possibility, but almost no thought has been put into how that might affect society or the economy.

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Table 1: 2007 Total Physical Construction Costs

2,000 Sq. Ft. Single Family Home

		Cost of 2,000 Sq. Ft. Average Quality Unit ($2007)			Cost of 2,000 Sq. Ft. Average Quality Unit ($2007)
1	New York-White Plains-Wayne	$209,727	**29**	Denver-Aurora	$151,935
2	San Francisco-San Mateo-Redwood City	$195,985	**30**	Columbus	$151,155
3	Boston-Quincy	$186,922	**31**	Indianapolis-Carmel	$150,181
4	Philadelphia	$183,608	**32**	Baltimore-Towson	$148,621
5	Chicago-Naperville-Joliet	$181,757	**33**	Cincinnati-Middletown	$148,524
6	Newark-Union	$180,490	**34**	Tampa-St. Petersburg-Clearwater	$148,134
7	Minneapolis-St. Paul-Bloomington	$179,808	**35**	Louisville-Jefferson County	$147,062
8	Hartford-West Hartford-East Hartford	$175,032	**36**	Miami-Miami Beach-Kendall	$145,113
9	Camden	$174,740	**37**	Orlando-Kissimmee	$144,333
10	Sacramento-Arden-Arcade-Roseville	$174,545	**38**	Atlanta-Sandy Springs-Marietta	$144,236
11	Los Angeles-Long Beach-Glendale	$172,986	**39**	Phoenix-Mesa-Scottdale	$143,944
12	Santa Ana-Anaheim-Irvine	$170,647	**40**	Richmond	$143,554
13	Riverside-San Bernardino-Ontario	$170,257	**41**	Birmingham-Hoover	$143,164
14	Providence-New Bedford-Fall River	$169,964	**42**	Virginia Beach-Norfolk-Newport News	$142,482
15	San Diego-Carlsbad-San Marcos	$169,185	**43**	Houston-Sugar Land-Baytown	$142,287
16	Detroit-Livonia-Dearborn	$168,503	**44**	Fort Lauderdale-Pompano Beach-Deerfield Beach	$141,897
17	Seattle-Bellevue-Everett	$167,041	**45**	New Orleans-Metairie-Kenner	$141,507
18	St. Louis	$166,261	**46**	Salt Lake City	$140,922
19	Portland-Vancouver-Beaverton	$165,189	**47**	Nashville-Davidson--Murfreesboro--Franklin	$140,727
20	Kansas City	$164,702	**48**	Memphis	$139,461
21	Milwaukee-Waukesha-West Allis	$164,604	**49**	Jacksonville	$135,465
22	Buffalo-Niagara Falls	$164,312	**50**	Dallas-Plano-Irving	$135,075
23	Warren-Troy-Farmington Hills	$162,558	**51**	San Antonio	$132,931
24	Las Vegas-Paradise	$162,460	**52**	Oklahoma City	$132,151
25	Cleveland-Elyria-Mentor	$160,706	**53**	Fort Worth-Arlington	$131,372
26	Rochester	$159,342	**54**	Charlotte-Gastonia-Concord	$129,422
27	Pittsburgh	$159,049	**55**	Raleigh-Cary	$128,740
28	Washington-Arlington-Alexandria	$158,952	**56**	Austin-Round Rock	$128,253

Source: R. S. Means 2008.

Notes: The data correspond to a 2,000 square foot housing unit of average quality (economy quality in the R. S. Means data). Sample includes MSA Divisions with populations over one million according to the 2007 U.S. Census estimates.

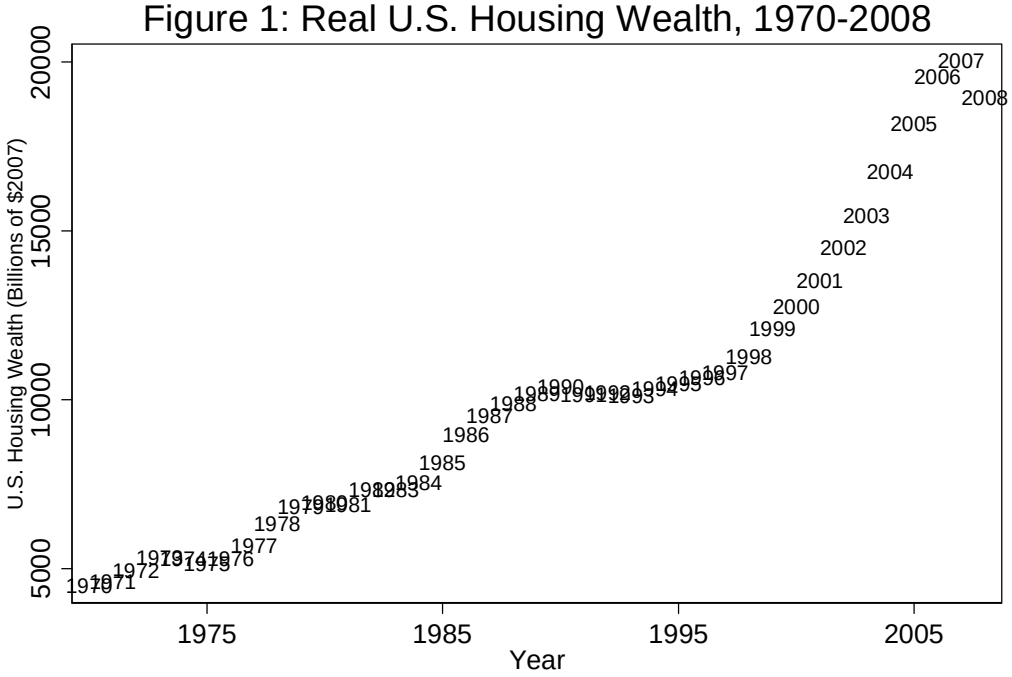
Table 2: 2007 Median Quality Single Family House Price

		Constant-Quality House Price ($2007)			Constant-Quality House Price ($2007)
1	New York-White Plains-Wayne	$720,863	**29**	Denver-Aurora	$217,760
2	San Francisco-San Mateo-Redwood City	$721,694	**30**	Columbus	$149,531
3	Boston-Quincy	$322,721	**31**	Indianapolis-Carmel	$135,988
4	Philadelphia	$219,469	**32**	Baltimore-Towson	$275,101
5	Chicago-Naperville-Joliet	$259,812	**33**	Cincinnati-Middletown	$143,263
6	Newark-Union	$395,231	**34**	Tampa-St. Petersburg-Clearwater	$192,969
7	Minneapolis-St. Paul-Bloomington	$216,199	**35**	Louisville-Jefferson County	$133,783
8	Hartford-West Hartford-East Hartford	$247,951	**36**	Miami-Miami Beach-Kendall	$330,573
9	Camden	$242,346	**37**	Orlando-Kissimmee	$230,099
10	Sacramento-Arden-Arcade-Roseville	$308,714	**38**	Atlanta-Sandy Springs-Marietta	$187,799
11	Los Angeles-Long Beach-Glendale	$514,650	**39**	Phoenix-Mesa-Scottdale	$258,467
12	Santa Ana-Anaheim-Irvine	$594,163	**40**	Richmond	$198,628
13	Riverside-San Bernardino-Ontario	$332,515	**41**	Birmingham-Hoover	$136,861
14	Providence-New Bedford-Fall River	$264,245	**42**	Virginia Beach-Norfolk-Newport News	$240,531
15	San Diego-Carlsbad-San Marcos	$447,962	**43**	Houston-Sugar Land-Baytown	$125,962
16	Detroit-Livonia-Dearborn	$107,097	**44**	Fort Lauderdale-Pompano Beach-Deerfield Beach	$303,956
17	Seattle-Bellevue-Everett	$417,512	**45**	New Orleans-Metairie-Kenner	$159,207
18	St. Louis	$143,323	**46**	Salt Lake City	$273,874
19	Portland-Vancouver-Beaverton	$311,169	**47**	Nashville-Davidson--Murfreesboro--Franklin	$176,949
20	Kansas City	$135,415	**48**	Memphis	$114,848
21	Milwaukee-Waukesha-West Allis	$190,099	**49**	Jacksonville	$199,607
22	Buffalo-Niagara Falls	$122,500	**50**	Dallas-Plano-Irving	$136,368
23	Warren-Troy-Farmington Hills	$176,499	**51**	San Antonio	$118,524
24	Las Vegas-Paradise	$283,653	**52**	Oklahoma City	$110,531
25	Cleveland-Elyria-Mentor	$139,847	**53**	Fort Worth-Arlington	$115,798
26	Rochester	$122,900	**54**	Charlotte-Gastonia-Concord	$173,802
27	Pittsburgh	$116,960	**55**	Raleigh-Cary	$203,291
28	Washington-Arlington-Alexandria	$403,374	**56**	Austin-Round Rock	$180,222

Source: U.S. Census 2000 Median House Price and OFHEO House Price Index.

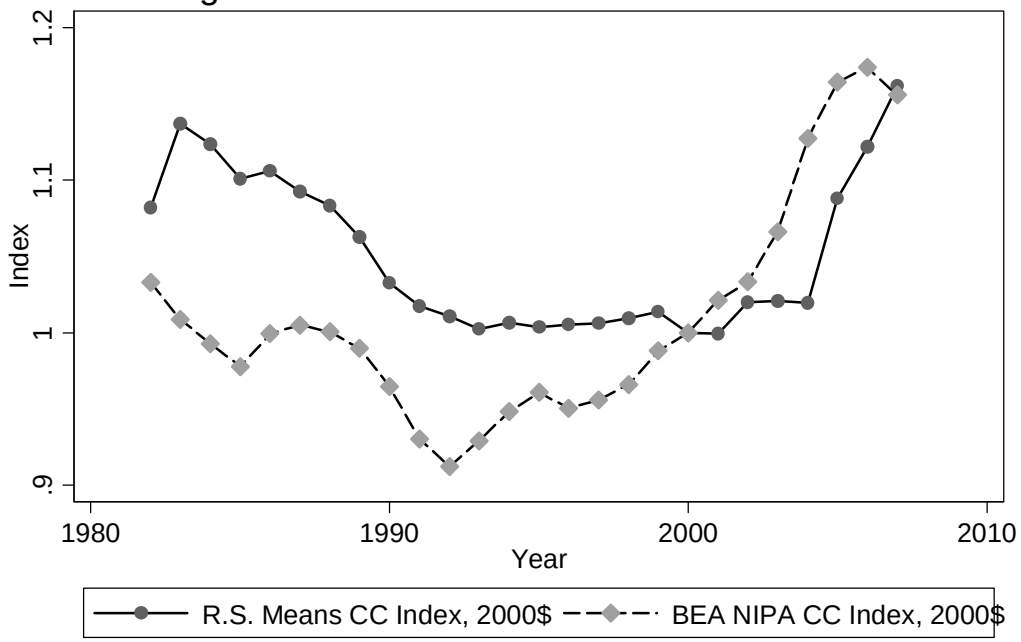
Notes: The year 2000 median single family detached house price is weighted by the OFHEO House Price Index to calculate the 2007 price of the median quality house from each market.

Figure 1: Real U.S. Housing Wealth, 1970-2008



Source: Federal Reserve Board Balance Sheet of Households and Nonprofit Organizations

Figure 2: Real Construction Costs Over Time



Sources: Glaeser and Gyourko (American Enterprise Institute Book)

Figure 3: National Constant Quality Real House Price Index, 1975-2007

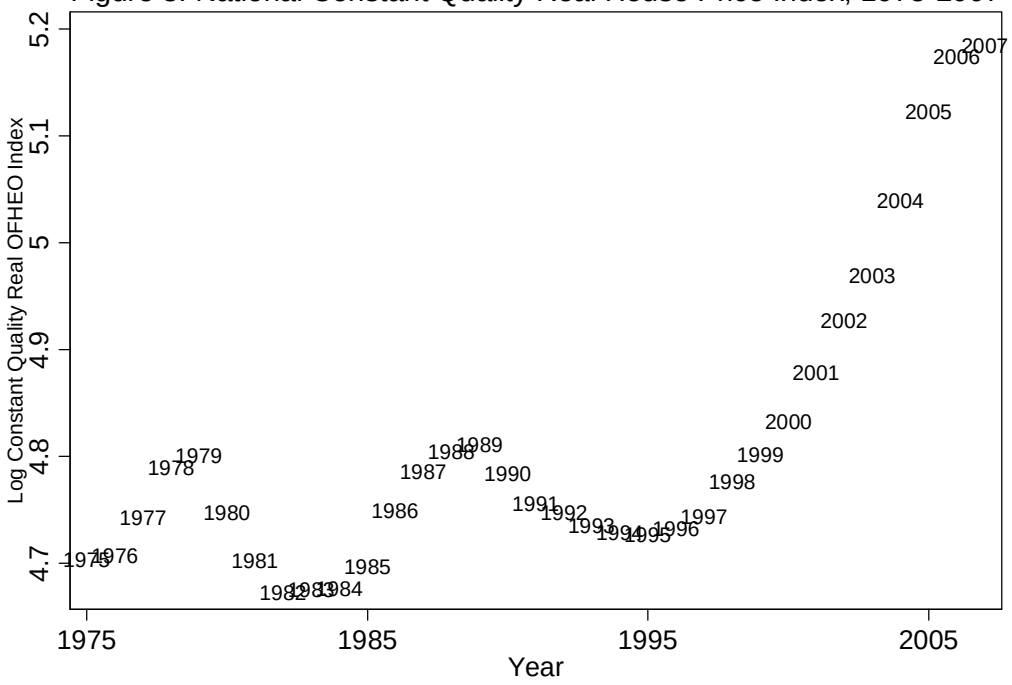


Figure 4: 2007 Constant Quality House Value and Permit Issuance