

The Supply Side of the Housing Boom and Bust of the 2000s

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November 6, 2011

These views are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of New York or the Federal Reserve System. The authors would like to thank David Crowe, Stephen Melman, and Elliot Eisenberg of the National Association of Home Builders (NAHB) for providing various data and suggestions. We would also like to thank Dan Oppenheim from Credit Suisse, Nishu Sood from Deutsche Bank, and Joshua Pollard from Goldman Sachs, for sharing their knowledge of the homebuilding sector. Sarah Stein provided expert assistance with the CoStar land sales data.

The boom and subsequent bust of housing construction and prices over the 2000s is widely regarded as a principal contributor to the Financial Panic of 2007 and the subsequent “Great Recession”. As of this writing, housing market activity remains at depressed levels as the economy slowly resolves the legacy of excess supply and sharply lower prices. Over 2.6 million foreclosures have been completed since 2008 and 1.9 million foreclosures in process.¹ Much has been written about the demand side of this pronounced housing cycle, in particular the innovations in mortgage finance and loosening of underwriting standards that greatly expanded the pool of potential home buyers. In this paper, we take a closer look at developments on the supply side of the housing market. Following a short literature review, we begin with a descriptive review of housing production, sales, and prices at the national, regional, and state levels. We then look at developments in the home building industry over this period. We also take a closer look at land markets using a quarterly price index for MSAs with both elastic and inelastic housing supplies across the United States. An important question is to what extent the supply side of the market contributed to the boom/bust dynamics. A second question is whether the significant changes in the industrial organization of the homebuilding industry exacerbated or ameliorated this supply impact.

Literature Review

There is considerable interest in evaluating the efficiency of various asset markets including housing. Case and Shiller (1989) report evidence of serial correlation in quality-adjusted housing returns. If housing markets were fully efficient, then future housing returns could not be predicted based on current information. There are frictions on both the demand side and the supply side of the housing market that might lead to imperfect arbitrage. On the demand side, housing is heterogeneous in a number of dimensions and there are significant transaction costs associated with buying and selling property. On the supply side, there are time frictions involved in the supply of new housing that limit how quickly builders can respond to any

¹ See OCC & OTS Mortgage Metric Reports

mispricing. There may also be costs of adjustment in housing supply that cause builders to spread any supply response out over time (Topel and Rosen (1988)).

Rosenthal (1999) tests for inefficiencies on the supply side taking into account that builders cannot instantaneously supply new housing to the market. He uses data on single family detached housing sales in Vancouver, BC from 1979 to 1989 to estimate a quality-adjusted price of housing using hedonic regressions. An error correction model is estimated to determine how quickly deviations in quality-adjusted prices from building costs are dissipated. The results for a standard building indicate that 96 percent of a short-run price shock disappears within two quarters. When estimates of these price shocks are added to a construction equation, they are not significant. This is consistent with additional evidence that during this period builders required two to three quarters to complete a construction project. Consequently, the observed price shocks were on average too short-lived for builders to earn excess profits by adjusting their construction activity in response to the shocks. Rosenthal concludes that any inefficiencies must originate in the land markets.

Glaeser, Gyourko and Saiz (2008) explore the role of housing supply elasticity in how possible housing bubbles would manifest themselves in different markets. Their model predictions are that any irrational demand during a bubble will result in higher prices and a more prolonged duration of the bubble in markets where housing is less elastically supplied. In contrast, in markets with relatively elastic supply, bubbles should result in more new residential investment and consequently less of a price response. This muted price response also makes it likely that the bubble will be shorter in duration. They test these predictions using the proxy for housing supply elasticity developed in Saiz (2008).² Their estimates confirm that prices react relatively more than quantities in housing markets with inelastic supply, and that as a consequence periods of significantly high prices relative to replacement costs on average last longer. However, they note that several of the markets that experienced the largest booms in the recent cycle have high measured supply elasticities. These markets also demonstrated little variability of prices relative to replacement costs prior to the recent cycle. While having an elastic housing supply limits the likelihood of a serious housing bubble in a local market, it clearly does not prevent one from happening.

² This proxy is the percent of land within a 50 kilometer radius area that has a slope of less than 15 degrees.

While an elastic supply of housing can limit the price rise associated with a temporary period of irrational exuberance in demand, given the durability of housing the larger supply response during the boom means that prices may fall below their pre-boom levels once demand again reflects fundamental factors.³ Housing supply is nearly completely inelastic at the current stock of housing for prices below replacement costs (Glaeser and Gyourko (2008)). This implies that if housing demand reverts back to its pre-boom level when the bubble bursts, then prices will overshoot to the down side in elastically supplied markets.

This is illustrated in Figure 1 which contrasts two local housing markets – one with a completely inelastic short-run housing supply curve, $S(I)$, and one with an elastic short-run supply curve, $S(E)$. The replacement cost of housing is given by C and initially both markets start out with prices equal to replacement cost at point A. A housing bubble develops which shifts out housing demand in both markets from D_0 to D_1 . There is no supply response in the inelastic market so prices ration this irrational exuberance by increasing to $P_1(I)$ as indicated at point C. In contrast, in the elastic supply market both prices and new housing supply react to the outward shift in demand. As a consequence, prices adjust by less than in the inelastic market rising only to $P_1(E)$ as indicated at point B. When the bubble bursts, assume that demand reverts back to D_0 . Prices in the inelastic market decline back to their pre-bubble level of P_0 . However, due to the new housing supply added to the elastic market and the durable nature of housing, prices in the elastic market overshoot on the downward side to $P_2(E) < P_0$.⁴ As fundamental demand begins to expand in the elastic supply market, prices will adjust upward but there will initially be no new building activity. Once prices have recovered to the replacement cost, new supply will again be added to the market. Overbuilding to the extent that it occurs has important consequences for local housing markets.

There is an emerging literature on rational models of overbuilding. DeCoster and Strange (2010) argue that rational overbuilding may occur in markets with uncertainty due to herding behavior by builders. They explore statistical and reputational models of herding behavior (see

³ The tendency for house prices to “overshoot” on the down side will be magnified if lending standards are significantly tightened during the bust phase of the housing cycle and to the extent that the bursting of the housing bubble weakens fundamental housing demand due to higher rates of unemployment.

⁴ If lending standards are tightened following the bust relative to the pre-boom period then the demand for housing will be contract even further magnifying the downward overshoot in prices. Also, if the burst of the housing bubble results in a recession increases unemployment then this will further put downward pressure on home prices.

Banerjee (1992) and Welch (1992). In statistical herding, a builder may choose to ignore a bad signal about future demand prospects in the market if this builder can infer that other builders have received more positive signals. This tendency to ignore bad signals is more pronounced if the market is characterized by leading builders who are perceived as having high quality information regarding market conditions and who may act as “first movers” in the market. In a market characterized by a few large builders and many small builders, statistical herding is most likely to be exhibited by the small builders who are attempting to free ride on the information gathered and acted upon by the large builders. Changes in market structure in the building industry can impact the likelihood of overbuilding due to statistical herding. As a market becomes more concentrated, there is a tradeoff between the increased likelihood that the smaller builders will discount their signals and follow the market leaders and the possible greater reliability of the signals received by the market leaders. Reputational herding may take place if banks have imperfect information on the quality of developers. The likelihood that a bank will cut off funding to a particular builder may be lower if that builder mimics the actions taken by another builder. This type of herding adds noise to the signal that the bank uses to attempt to discriminate between the builders.

Descriptive Review of New Home Production and Sales

Figure 2 presents a half century time series of housing starts per 1,000 people, broken out by single-family and multi-family units. From the mid 1960s to the late 1980s, housing production expressed in these terms was quite volatile around a downward trend. Then, from the early 1990s until 2005 a strong upward trend is evident, particularly for single-family units. Following the peak in 2005Q3, total housing starts fell a cumulative 75% by the first quarter of 2009. As of mid 2011 housing starts are only modestly higher than the level at the trough.

The increase in housing production from the early 1990s through 2005 and the subsequent downturn are notable in several respects. First, both the upturn and downturn were of relatively long duration. Earlier housing construction cycles were characterized by trough to peak intervals of only a few years rather than a full decade. A second distinctive feature was the role of multi-family housing supply. Earlier cycles were characterized by increases in construction of both single-family and multi-family housing. In contrast, over the most recent

cycle construction of new multi-family housing was relatively constant. Lastly, while total housing starts per capita at the peak in 2005Q3 were not particularly high compared to the 1960s and 1970s, as seen in Figure 3, at the peak residential investment was the highest share of GDP since the mid-1950s. Several factors contributed to this development. First, as already noted, the increase in housing production was primarily of single-family units, which tend to represent a much larger “value-put-in-place” per unit than do multi-family units. Second, from the mid 1990s through the mid-2000s, the average size and amenities of new single-family homes increased significantly. For example, as shown in Table 1, the average size of new homes increased from 1,970 square feet in 1997 to 2,512 square feet in 2005. Finally, residential investment includes additions and alterations (“improvements”) to the existing stock of housing in addition to construction of new housing. Spending on improvements also rose sharply as a share of GDP over the period in question and can rightfully be viewed as a significant component of the boom and bust.

As noted, the peak level of housing starts per capita in 2005Q3 was not particularly high relative to the prior peaks in the 1970s. However, it should be noted that the underlying demographic conditions of the country were quite different in these two periods. These underlying demographic dynamics can have important long-term impacts on the demand for housing (Mankiw and Weil (1989)).

As seen in Figure 4, up until the mid-1970s, the number of people in the 25 to 34 year age group (the post WWII baby boom) was growing very rapidly. People at this stage of the life-cycle tend to establish independent households for the first time such that the headship rate for this age group is quite a bit higher than for people under 25 years of age (Figure 5). In the second half of the 1970s, the number of people in the 35 to 54 age group, whose headship rate makes another distinct jump upward, began to increase rapidly. These age-specific population growth rates, along with some increase in age specific headship rates, resulted in a rising aggregate headship rate (Figure 6). This meant that the demographically driven number of households was rising quite a bit faster than the underlying population.

In contrast, from the mid-1990s through the mid-2000s the number of people in the 25 to 34 year age group was actually declining, while the growth rate of those 35 to 54 years of age was slowing sharply. At the same time, the number of people aged 55 to 64 was rising rapidly.

In addition, headship rates for individual age groups generally peaked in the 1980s and have since been relatively stable to slightly declining. These factors combined to keep the overall U.S. headship rate essentially flat since the mid-1980s. As a result, underlying trend growth of the number of households was limited to the growth of the population, which was slowing rapidly from the mid-1990s onward.

It is also interesting to consider the relationship between housing production and underlying demographic dynamics by where the increase in housing production occurred. Figure 7 sheds light on this question. Each of the blue dots in the chart represents a combination of population growth (expressed at a compound annual rate) over the period from 1990 to 2000 and the average level of housing starts per 1,000 people over the same time period for each of the 50 states. Note the fairly tight positive relationship indicated by the close clustering of the blue dots relative to the regression line. Focusing on this period, the supply side of the housing market showed a tremendous ability to scale production rates to a wide variation in local population growth rates. There is no evidence that housing supply lagged population growth by any significant degree even in the fastest growing states such as Arizona and Nevada.⁵

The red dots in Figure 7 represent the combinations of population growth rates and housing starts per 1,000 people for each state over the period from 2000 to 2005. Note that virtually all states moved to the right relative to the earlier decade, meaning an increase in housing starts for a given population growth rate. That is, the housing boom from a supply perspective was to a degree a national phenomenon. The magnitude of shift, however, tended to be larger for those states that experienced above average population growth in the 1990s. This can be seen for three of the four “sand states”.⁶ The population growth rate in Florida was fairly constant relative to the 1990s, while the rate of housing supply per capita nearly doubled. Arizona experienced a slight slowing in its population growth rate, but like Florida its rate of housing supply per capita increased significantly, growing by roughly a third. Unlike the other sand states, Nevada experienced a significant slowdown in its rate of population growth. However, the rate of housing supply in Nevada in 2000-2005 did not respond to this slowdown

⁵ If there were significant costs of adjustment to housing supply, this might show up as the blue dots associated with the fast growing markets tending to be to the left of the regression line.

⁶ The “sand states” refer to Arizona, California, Florida and Nevada.

resulting in Nevada's red dot being significantly to the right of the regression line.⁷ Three other states that stand out in Figure 7 in terms of a high rate of housing supply relative to population growth are Georgia, North Carolina and South Carolina. The fact that housing supply increased relatively the most in these three states as well as the sand states may reflect that home builders were producing a product geared toward people at the later stages of their careers who might be looking for a second home or a retirement home.⁸

Another feature of the increase in housing production from the mid-1990s through the mid-2000s was that an increasing share of single-family units was “built for sale” (Figure 8). Built for sale, sometimes referred to as a “spec” or speculative start, refers to situations where the land and structure are sold in one transaction. An example is when a home builder develops a section of land, putting in roads and utilities, and then begins selling individual lots with houses—either already completed, under construction, or not yet started. In contrast, contractor- or owner-built units are cases in which an individual or firm already owns the land and either hires a general contractor or acts as their own general contractor.⁹ Monthly data on sales of new single-family homes refers only to sales of “spec” units, and the sale can occur at various stages—completed, under construction, or even not started. Due to the shift toward construction of single-family units, and the shift toward speculative units within the single-family market, sales of new single-family homes per 1,000 people in 2005 reached the highest of the entire period for which there is data (dating back to 1963) (Figure 9).

The shift toward more speculative building also meant that even though new housing starts declined abruptly and remain quite low to this day, the home building industry ended up with a large inventory of units in their production pipeline which took quite some time to unwind. Figure 10 presents the inventory of new single-family homes for sale broken down into the categories of not started, under construction, and completed. As house prices peaked in

⁷ California is the only sand state that did not have a population growth rate in the 1990s that exceed the national average. California's rate of housing supply in the 1990s was not significantly higher than what would be predicted from the regression relationship. During the boom, California's rate of housing supply did increase, but this increase only moved it to the regression line and not to the right of the regression line.

⁸ It should be noted, however, that housing starts are not necessarily the same as net additions to the stock of housing due to destruction and demolition of existing units.

⁹ It is also the case that an increasing share of multi-family starts were build for sale, likely as condominiums, as opposed to for the rental market.

many markets in early 2006, builders began to reduce their units not started and under construction. The pace of contraction was faster in units under construction which may reflect the continuing option value of keeping improved lots on hand in case markets stabilized. Completed units did not reach their peak until late 2007, nearly a year and a half after the slowdown was underway in units under construction. The inventory of completed units for sale has only recently returned to levels that prevailed prior to the boom. A question that we will return to is whether builders were too slow to respond to changing demand conditions in their respective markets contributing to an excess of housing inventory.

In addition to the inventory of unsold new homes, the housing boom and bust has left the nation with a relatively high percentage of vacant housing units. Table 1a. presents an aggregate vacancy rate for the US housing stock based on data from the Census Bureau's Housing Vacancy Survey. This survey provides quarterly estimates of the stock of housing and its occupancy status. In this particular case, the denominator is the entire stock of housing units intended for year-round use. The numerator is the number of units vacant for rent and vacant for sale. In addition, we have added a "held off the market for other reasons" category. Units in this category have risen rapidly over the recent past, apparently reflecting units that have been taken back by lenders (held in their REO inventory) but not yet offered for sale. While there appears to be a secular uptrend in this vacancy measure, it is clear that the values of the past few years are well above that trend. This measure peaked in the second quarter of 2010 and has since begun to decline, primarily due to a decline in units that are vacant for rent.

Figure 12 presents an estimate of the number of "excess" housing units, meaning vacant units above a rough estimate of normal or equilibrium vacancies. In this particular case, separate estimates of equilibrium vacancy rates are derived for single- and multi-family units for sale, single- and multi-family units for rent, and single- and multi-family units held off the market for other reasons. Excess units are defined as units in each of these six categories above the number of units implied by the equilibrium vacancy rates. The estimate of the number of excess units peaked at 3 million in mid-2010 and has since come down to around 2.5 million, again due primarily to a decline in vacant for rent units.

The peak number of excess units provides a rough estimate of the amount of "overbuilding" of housing that occurred during the boom. Interestingly, it roughly corresponds

to the sum of the number of housing units started over the period from 1996 through 2005 minus the increase in the number of households over the same period.

Figure 13 and Table 1a provide some regional detail on vacant and excess units. Figure 13 presents the same vacancy measure as in Figure 11 but for the four major census regions. This regional data is provided on an annual basis only, and the most recent data is for 2010. Table 1a presents the percentage point increase in these regional vacancy rates measured from the average of the 1990s to 2010. The largest increases in vacancy rates occurred in the South and the Midwest, with a somewhat smaller increase in the West and a relatively small increase in the Northeast. These increases in vacancy rates are roughly consistent with data shown earlier in Figure 7 which compared housing starts with population growth.

Finally, the information on production relative to population growth by state and vacancy rates by region are roughly consistent with information on changes in home prices and rents. Figure 14 presents a scatter plot of state level home price data with the total percent change from 2002 to 2007 plotted on the vertical axis and the total percent change from 2007 through the third quarter of 2010 plotted on the horizontal axis. The four sand states, Arizona, California, Florida, and Nevada had quite large increases in prices during the boom, and have also seen much larger than usual declines since the peak. Nonetheless, as seen in Figure 15, very few states have seen price declines to date such that current prices are significantly below their 2004 average level. The rate of increase of owners' equivalent rent as measured in the Consumer Price Index slowed dramatically over the period in which vacancy rates were rising the most (Figure 16). But this also corresponded to the "Great Recession" during which employment plunged and nominal incomes declined.

Trends in the Home Building Industry

The home building industry has traditionally been characterized as having relatively low barriers to entry such that there are a large number of firms producing a relatively few number of units per year. Indeed, 79 percent of the builder members of the National Association of Home Builders started 10 or fewer homes in 2010. However, a characteristic of the housing boom from the early 1990s through the mid 2000s is the pronounced growth of market share of a relatively

few number of firms, the bulk of which were publicly owned and, to a large extent, financed directly through capital markets rather than financial intermediaries such as banks. This consolidation within the building industry has been discussed by others (see Ambrose (2009, 2010) and Frey (2003)). Below we update some of this prior analysis. We then add to that analysis by discussing whether the capital markets provided more timely signals than the banking industry for builders to start to reduce their activity levels.

Figure 17 provides a time series of the share of new home sales accounted for by the top 10 to top 60 builders by size. In 1990 the top 60 builders accounted for 20 percent of new home sales (as defined by the Census Bureau) while the top 10 builders accounted for 9.4 percent. Over the next 15 years there was steady consolidation in the industry, such that by 2005 the top 60 accounted for 36 percent and the top 10 for 22.6 percent. For this increase in share of the top 10 builders to occur, it means that these firms captured roughly one-third of the increase in sales that occurred over that period. The top 60 largest firms accounted for nearly half of the increase. It is also interesting to note that the 10 largest firms experienced additional large increases in market share over the period from 2006 through 2008. However, this increase occurred when overall sales and prices were declining, and reflected the fact that the large builders had accumulated a large inventory of homes in their production pipelines.

This rapid growth by the largest builders reflected a mix of internal or “organic” growth as well as growth through acquisitions. Table 2 shows the growth in closings by the top 10 builders over the period from 1993 to 2004, and the decomposition by organic versus acquisition. For the group as a whole, 46 percent of their growth in closings over the 11 year period leading up to the peak was due to acquisitions. As one might expect, there were multiple motivations for these acquisitions. But in conversations with leading analysts of this industry, the prime motivation appears to have been to obtain land and local expertise in promising markets.

There are several dimensions on which large and small builders differ. Small builders are to a large extent reliant on bank financing. Their ability to launch new construction projects and to continue building spec homes depends on the willingness of those banks to extend financing. The scrutiny of the builder’s activities by the lender can be surprisingly intense. In contrast, large builders are much less reliant on banks, obtaining the bulk of their financing through issuance of

debt and equity directly in capital markets. Thus, the ability of these large builders to expand their balance sheet is determined by the willingness of markets to advance more funds.

A second distinction is that large builders are vertically integrated from land acquisition and development, construction, marketing, and mortgage financing. This organization helps these builders exploit scale economies involved in large development projects and to have a broader source of revenues and potential profits. It is also possible that by being involved in each segment of the production and distribution chain, large builders had an informational advantage in the markets they operated in.

To shed light on these points, Figure 18 presents the balance sheet of Toll Brothers, a well known publicly traded homebuilder, as of April of 2005, right around the peak of new home construction. At that time assets totaled \$5.4 billion, of which 80 percent was the firm's inventory of lots, homes under construction, and completed homes. Liabilities totaled \$3.1 billion, of which notes issued in the capital markets represented 43 percent. Bank financing, consisting of loans payable (the used portion of a credit line extended by a consortium of banks) and the mortgage subsidiaries warehouse line of credit, represented just 17 percent of total liabilities. The debt to equity ratio of the firm was 1.35.

Table 3 shows the building lot inventory data for the top 10 builders from 2002 to 2008. The lot inventory is broken down into lots that were owned by the builders, lots where the builders held options to purchase, and lots that were part of joint ventures. The last column converts the total inventory into a year's supply at the prevailing sales rate. The first thing to note is that the inventory of lots grew quite rapidly over the period from 2002 to 2005, suggesting that these builders remained quite optimistic about future sales prospects even as the market was approaching its peak. Indeed, in terms of years supply the builders were substantially lengthening their investment in land, from 5.4 years in 2003 to 6.8 in 2005.

As we know now, single-family housing starts peaked in 2005Q3 and home prices peaked roughly one year later. It appears that the top 10 builders responded aggressively to this turn of events. From 2005 to 2006, the largest builders reduced their lot inventory by 24 percent. Almost all of this reduction, 97 percent, was through the lots that they held options on. Options continued to be the dominant adjustment mechanism as well in 2007 with 67 percent of the

shrinkage accounted for by optioned lots. It is not until 2008 that the adjustment process is roughly balanced between percentage reductions in owned and optioned lots. Note, however, that lots are only one portion of a builder's inventory. While we do not have data on homes either under construction or completed for these large builders, the macro data indicate that it took quite a bit longer to reduce inventories in those categories.

This review of the macro data and the data on individual firms in the home builder industry suggests that one of the reasons the housing downturn has been so severe and so prolonged is the industry, particularly the largest firms, built up such substantial inventories of lots and homes at various stages of production. As these largest firms tend to obtain financing from capital markets rather than banks, an interest question is whether the capital markets were providing any early indications that this inventory represented a significant downside risk to their earning should demand turn out to be weaker than expected. In Figure 17 we compare a fixed weighted index of the equity prices for six large home builders and the Federal Reserve's Senior Loan Officer Opinion Survey (SLOOS) data on lending standards for mortgage loans.¹⁰ For the SLOOS, values above (below) zero indicate that standards on net are reported to be tighter (looser) since the prior survey. We can see that bank lending standards were being loosened from 2004 to mid-2006. The SLOOS indicates that lending standards began to tighten in the fourth quarter of 2006. In contrast, the home builder equity price index peaks in August 2005 more than a year earlier than the onset of tightening by banks. By the end of the third quarter of 2006, the home builder equity price index had declined by 45 percent. Figure 19 summarizes analyst equity recommendations for the major builders. Again, we see a sharp drop-off in "buy" recommendations in the third quarter of 2005 matched by a pickup in "sell" recommendations. Finally, Figure 20 shows a market capitalization weighted average of short interest in the major builders. This series picks up in second quarter of 2006. While the SLOOS data is not a perfect measure of when banks would have been tightening their lending to small builders, these

¹⁰ In order to create the fixed weight equity index, we collected Bloomberg's market capitalization and equity time series for a subset of homebuilders. Specifically, we selected homebuilders that had a large market presence before the housing bust and are still in operation today. The homebuilders in our equity index are: Toll Brothers Inc., Pulte Group Inc., Lennar Corp., DR Horton Inc., Hovnanian Enterprises Inc., and Beazer Homes USA Inc. Keeping the market capitalization fixed at Q12006, the quarter in which housing starts peaked, we then created a market capitalization weighted average of the quarterly equity prices of each homebuilder. The resulting series was then indexed to equal 100 for the first quarter of 2006.

comparisons suggests that the capital markets did provide the large builders with a substantially earlier signal to pull back than the small builders likely received from their banks.¹¹

Land Markets during the Boom and Bust

Builder's use of vacant lot inventories, whether owned outright or optioned, suggests an important role for vacant land as a potential driver of builder costs, and ultimately house prices. In addition to the cost and access to capital discussed above, the cost of building a new home consists of construction labor and material costs, along with the cost of developable land. Davis and Heathcote (2009) and Davis and Palumbo (2008) estimate the value of residential land nationally and in metropolitan areas, respectively, using a combination of the cost of construction and the value of housing in place. Davis and his coauthors conclude that the value of land rose sharply in the US during the housing boom, particularly in metro areas that experienced the largest house price booms.

Given the prominent role that land inventories played on builders' balance sheets during the 2000s housing cycle, we supplement the Davis analysis with information from vacant land transactions for select metropolitan areas. Vacant land may exhibit different dynamics from land with a housing unit already in place, since the latter reflects the value of the particular structure present, as we argued above and as shown in Figure 1. In addition, our data allow a parcel-level analysis of the evolving prices and quantities as well as the features of vacant land that was selling in the metro areas for which we have data.

Our land sales data come from the COMPS dataset produced by the CoStar Group. Residential land sales – as opposed to other real estate transactions – are distinguished by the buyer's intention, as reported to CoStar, to use the *land* for construction of residential units, rather than to build other types of projects or to use structures currently present. Figures 21 and 22 display the residential land price indexes and log number of acres sold in eight MSAs with inelastic and elastic housing supplies, respectively, as estimated by Saiz (2010). For comparison

¹¹ It is interesting to note, however, that smaller builders apparently were not caught with such large inventories of homes under construction or already completed.

purposes, CoreLogic's overall House Price Indexes for each MSA are reported as well.¹² Several features of the land sales data are noteworthy.

First is the amount of acreage transacted over time and space. In the figures, the bars show the 4-quarter moving average of the natural log of acres sold.¹³ Perhaps unsurprisingly, the great majority of land sold for residential development came from the more elastically-supplied MSAs (Figure 22). In those cities, particularly Atlanta and Phoenix, quarterly sales of 10,000-20,000 acres of land for residential development were common throughout the boom. During 2005, CoStar reported average quarterly land transactions in Phoenix alone that exceeded 50,000 acres. In inelastically supplied cities like Chicago, peak land sales were closer to 3,000 acres a quarter. Land sales volumes in all cities track house prices relatively closely and began to fall quickly after the HPI peaks.

Also shown in Figures 21 and 22 are land price indexes. In order to abstract from changes in the mix of properties being sold over time, we create a quarterly price index that controls for such traits as location, presence of a structure, level of preparation for building, and characteristics of the transaction. The index we employ here is interpretable as the price paid in a standard arms-length transaction for an unimproved square foot of centrally-located residential land relative to some benchmark period (2001Q4) for that city.¹⁴

Land prices exhibit some interesting dynamics in these cities. First, as expected given relatively steady increases in building costs during the boom, raw land price increases frequently outstripped house price increases. In constrained markets like New York, Seattle and South Florida, vacant land prices tripled or quadrupled during the boom, as theory would predict. However, perhaps as evidence of housing prices that were straying from fundamentals, even elastic markets experienced rapid price appreciation during the housing boom. In Denver, for example, raw land prices doubled between late 2001 and the end of 2006; in Las Vegas they quintupled.

¹² In the case of South Florida, we use the Miami MSA HPI.

¹³ We use natural logs because a few markets completely dominate the acreage calculations; plotting acreage itself with consistent axes yields figures that are hard to see in comparison with Atlanta and especially Phoenix.

¹⁴ Haughwout, Orr and Bedoll (2008) describe the development of the land price index for one of the sample cities, New York; other cities' indexes are constructed similarly. To control for the influence of outliers, the indexes are constructed from a trimmed sample, excluding the 1% of transactions with the highest and lowest actual prices per square foot. Indexes are smoothed using a 4-quarter moving average.

Land prices in elastic and inelastic markets are more distinguished by their tendencies during the bust, from 2007-2010, as anticipated by our discussion of Figure 1. In cities with elastic housing supplies (Figure 22) nominal prices reversed course soon, although not immediately, after the housing market peak, and had generally reverted to their 2001 levels by the end of 2010. In cities with inelastic supply, residential land prices fell after the house price peak, but now seem to have firmed (again, in nominal terms) at levels 50-100% above their 2001 levels. South Florida, a victim of extreme overbuilding in spite of inelastic supply, is an exception. There raw land prices are currently about where they were in 2001.

The price dynamics shown in Figures 21 and 22 control for property location, but, like most other information on housing prices, are calculated at the MSA level, making it difficult to determine the price dynamics at different points in the metropolitan landscape. Our data, however, allow a finer look at the geography of the land boom and bust, and Table 4 reports these results for 15 large cities. In each city, a measure of the center is created – typically the tallest building - and land transactions are grouped according to whether they are among the 25% (of plots sold) in closest proximity to the center, the 25% farthest from the center, or the middle 50%.

The mean figures, reported at the bottom of the table, reflect some general tendencies across the cities: during the boom (2000-2006) prices rose in all parts of the average metropolitan area; in the bust they fell in all parts. Generally speaking, the boom was the strongest on the fringe, and the bust was weakest there as well. Thus the housing cycle of the 2000s was associated with a flattening of the price gradient in these metros.

But the overall data mask substantial heterogeneity, as the large standard deviations indicate. In some cities – Atlanta, Denver, Phoenix, South Florida – the boom was noticeably concentrated on the fringe. In others, particularly supply-constrained cities like New York, Los Angeles and Seattle, land prices in the center more or less kept pace with price changes on the fringe, leaving the gradient either unchanged or, in some cases, steeper.

Conclusion

Our description of the supply side of the housing boom and bust cycle of the 2000s reveals many changes in the structure and costs of the homebuilding industry. Many of these developments might have been expected to provide some cushion against the possibility that the housing market would stray far above from fundamental valuations for an extended period. The increased concentration of the industry in the decade leading up to the boom meant that large shares of the market were held by large firms with substantial market information. In addition, these firms' reliance on deep public capital markets, rather than special arrangements with individual financial intermediaries, brought with it close investor and analyst scrutiny of the marketplace and firms' positions and strategies. Smaller builders could easily observe the actions taken by the large builders operating in their markets and to free ride on the market information available to the larger builders. Furthermore, the use of land options by large builders allowed them, if market conditions changed, to exit projects before purchasing land and embarking on difficult-to-reverse building projects. The concentration of new building activity in fast-growing, supply elastic markets in areas like Phoenix and Las Vegas meant that new housing should have helped to limit and then to offset price increases that were originally driven by demand shifts.

Were a housing expert to be told only of these developments, without knowing what actually transpired in the housing market during the 2000s, he might well have taken some comfort that conditions were in place to discourage a market that strayed far from fundamentals. Yet while many factors may have been expected to constrain price increases and make the supply side of the market more responsive to market conditions, as a whole they were insufficient to forestall both a bubble in prices and a significant oversupply of units. It is impossible to determine how much worse things might have been absent these supply side developments, but it seems clear in retrospect that on their own, favorable supply-side conditions cannot be exclusively relied upon to restrain the effects of major, but temporary, demand shocks.

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Table 1. Characteristics of New Homes

Survey Year	Rooms	Bedrooms	Baths	Sq Footage
1985	5.18	2.38	1.61	
1987	5.50	2.54	1.71	
1989	5.81	2.66	1.81	
1991	6.06	2.78	1.91	
1993	6.35	2.97	1.93	
1995	6.30	2.92	1.98	
1997	6.13	2.98	2.02	1,970
1999	6.23	3.00	2.06	2,299
2001	6.28	3.01	2.07	2,351
2003	6.32	3.01	2.08	2,468
2005	6.56	3.10	2.14	2,512
2007	6.30	3.11	2.20	2,586

Notes: American Housing Survey data. Means of characteristics for homes built in the survey year or prior year.

Table 1a. Percentage Point Increase in Vacancies Relative to Averages of the 1990s

	Percent
National	2.1
Northeast	0.9
Midwest	2.4
South	2.3
West	1.9

Source: Census Bureau and Authors' calculations

Table 2. Total Closings and Percentage Change from Mergers and Acquisitions

Company	1993	2004	Change 1993-2004	Percent through Acquisition/Merger
D.R. Horton	1,668	44,005	42,337	45.1
Pulte Homes	9,798	38,612	28,814	38.7
Lennar Corp.	4,634	36,204	31,570	55.7
Centex Corp.	11,685	32,896	21,211	15.6
KB Homes	5,982	26,937	20,955	63.2
Beazer Homes USA	2,496	16,437	15,921	72.9
The Ryland Group	8,319	15,101	6,782	19.9
Hovnanian Enterprises	3,671	14,586	10,915	105.8
M.D.C. Holding	3,344	13,876	10,532	20.5
NVR	4,248	12,749	8,501	7.0
Total	55,845	251,383	195,538	46.1

Source: *Builder Magazine*, *Mergers Online* and *NHAB Economics*

Table 3. Lot Inventory for Top 10 Builders

Year	Inventory				Percent Change	Percent of Total Change			Years Supply
	Total	Owned	Optioned	JV		Owned	Optioned	JV	
2008	655,734	459,014	170,491	26,229	(33)	(43)	(44)	(13)	4.0
2007	976,896	595,907	312,607	68,383	(35)	(26)	(67)	(7)	4.6
2006	1,497,799	733,922	659,032	104,846	(24)	(4)	(93)	(3)	5.1
2005	1,981,488	752,965	1,109,633	118,889	19	38	25	37	6.8
2004	1,659,661	630,671	1,028,990	0	13	38	62	0	6.6
2003	1,473,000	559,740	913,260	0	59	26	74	0	5.4
2002	928,719	417,924	510,795	0					4.8

Notes: JV indicates "joint-venture". () indicates negative changes. Source *Builder* magazine and NAHB.

Table 4. Residential Land Price Dynamics Across the Metropolitan Landscape

City	<i>Boom, 2000-2006</i>			<i>Bust, 2007-2010</i>		
	Inner 25%	Middle 50%	Outer 25%	Inner 25%	Middle 50%	Outer 25%
Atlanta	6.4%	13.4%	17.0%	-14.1%	-2.3%	-10.8%
Chicago	7.9	8.6	11.6	0.1	4.3	-21.9
Denver	5.2	14.6	19.8	2.4	-4.8	4.0
LA Basin	21.5	18.4	19.5	-10.8	-17.2	-8.2
Las Vegas	26.2	31.3	28.5	-29.5	-28.7	-19.2
New York	22.9	24.9	22.2	-14.6	-13.7	-10.4
Orlando	17.7	21.8	11.2	-26.9	-8.2	26.0
Philadelphia	18.4	7.0	15.7	5.2	2.2	2.8
Phoenix	19.1	22.6	50.5	-11.7	-19.1	-27.3
Portland	17.7	9.9	16.9	-10.0	-5.0	-20.2
Seattle	12.4	18.6	13.2	-10.5	-7.5	-1.7
South Florida	20.5	25.9	29.3	-25.5	-16.2	-31.6
Tampa	26.4	26.4	24.3	-14.4	8.2	15.3
Tucson	15.6	16.7	20.6	-2.4	-4.0	-0.7
Washington	20.0	1.6	16.3	-13.9	19.4	19.4
<i>Unwtd Mean Across Cities</i>	17.2	17.4	21.1	-11.8	-6.2	-5.6
<i>Unwtd Std Dev Across Cities</i>	6.6	8.3	9.8	10.3	12.0	17.2

Source: CoStar Group; Authors' calculations

Notes: Figures in the table are compound average annual growth rates for the specified periods.

Figure 1. House Price Dynamics in Inelastic and Elastic Supply Markets

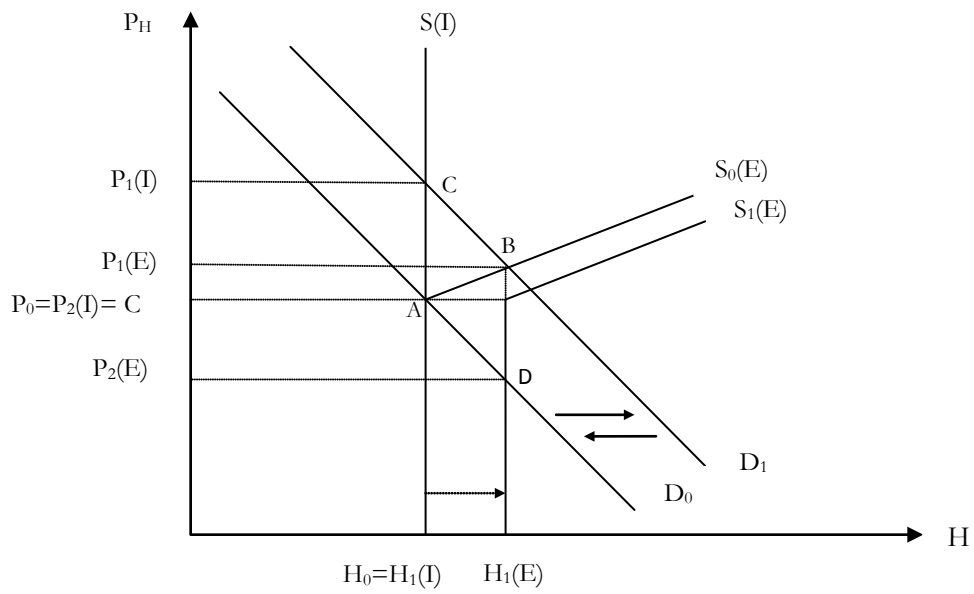
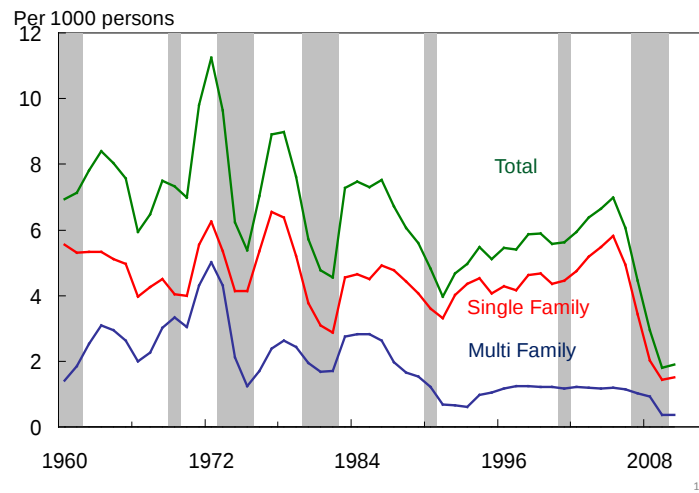
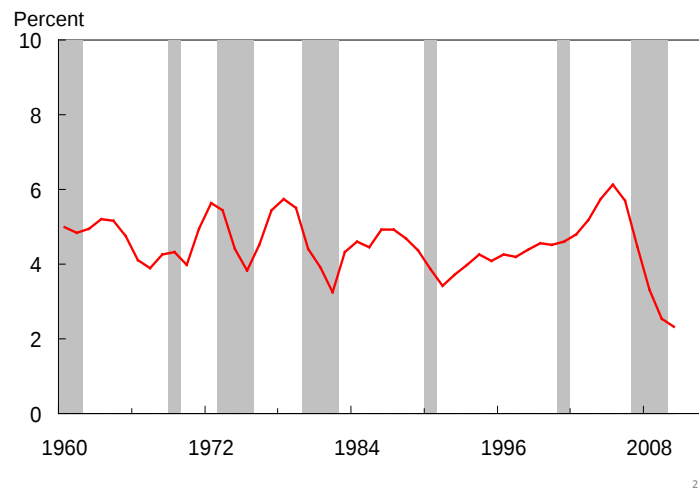


Figure 2. Single and Multi Family Housing Starts Over Total Population



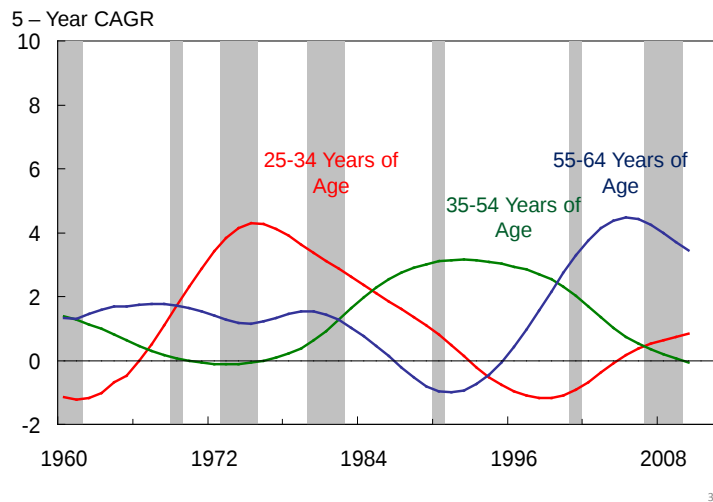
Note: Shading reflects NBER recessions. Data source: Census Bureau

Figure 3. Residential Investment as a Percent of GDP



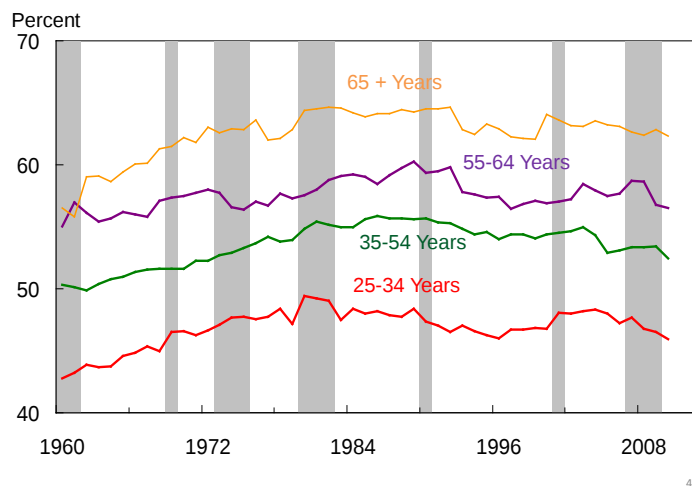
Note: Shading reflects NBER recessions. Data source: Census Bureau

Figure 4. Five-Year Compound Annual Growth Rates of Population



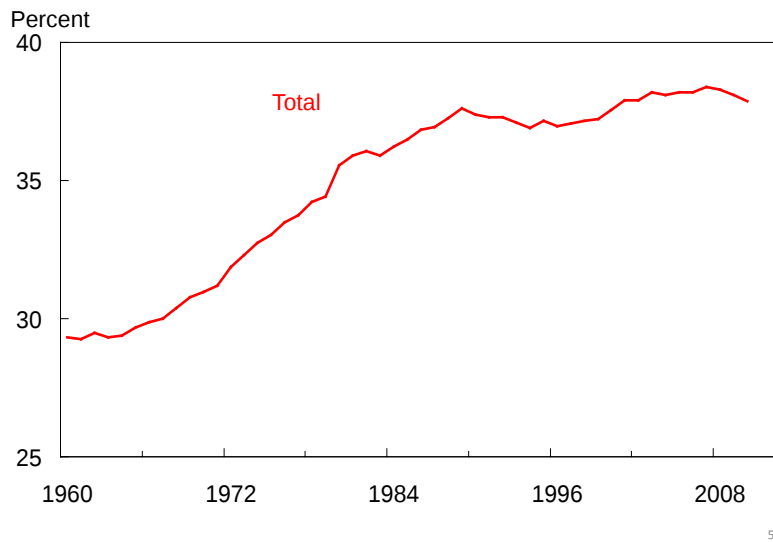
Note: Shading reflects NBER recessions. Data source: Census Bureau

Figure 5. Household Headship Rate



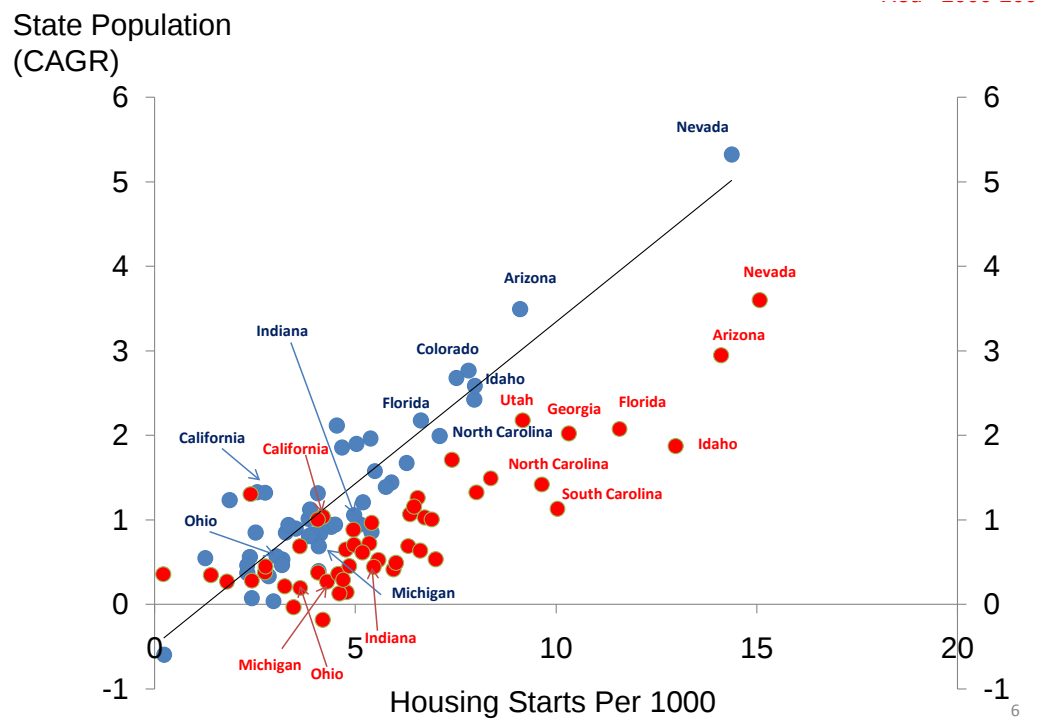
Note: Shading reflects NBER recessions. Data source: Census Bureau

Figure 6. Household Headship Rate



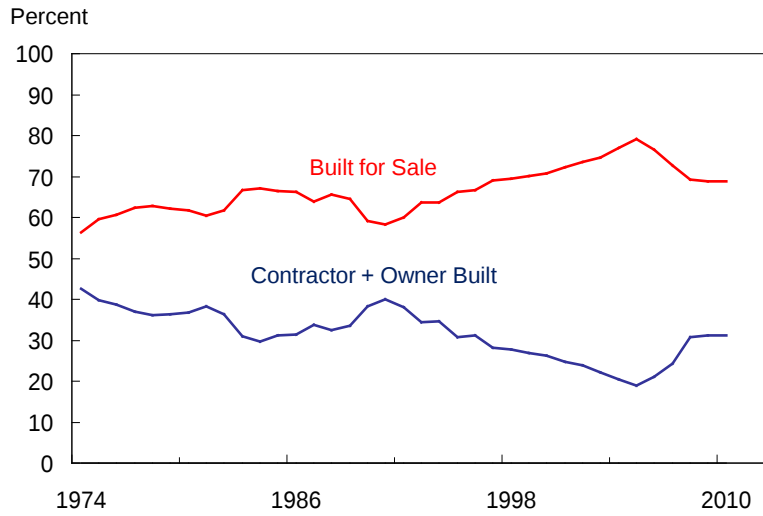
Note: Data source: Census Bureau

Figure 7. State Population Growth and Housing Starts Per 1000



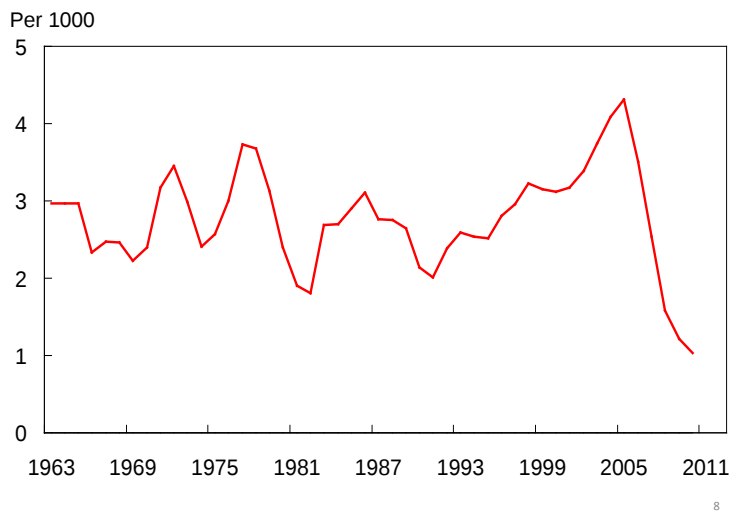
Note: Data source: Census Bureau

Figure 8. Single – Family Starts



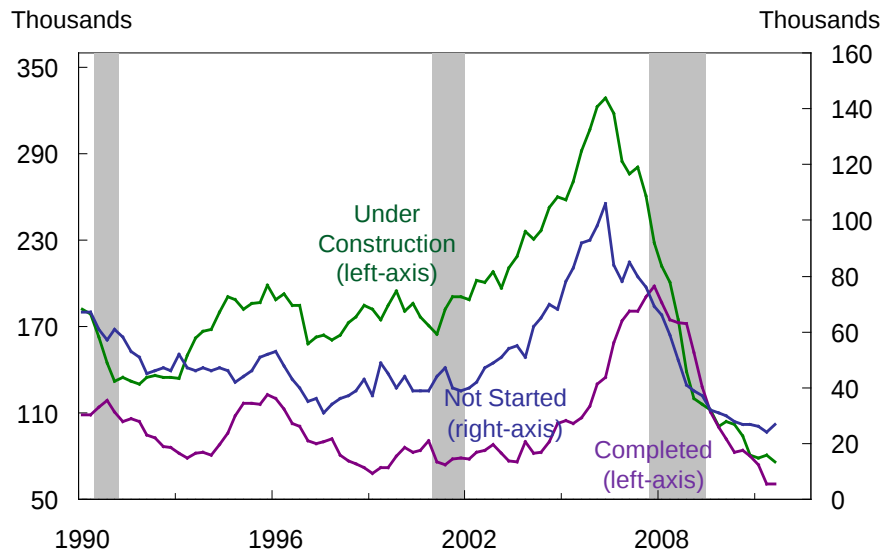
Note: Data source: Census Bureau

Figure 9. New Single Family Homes Sold Per 1000 Persons



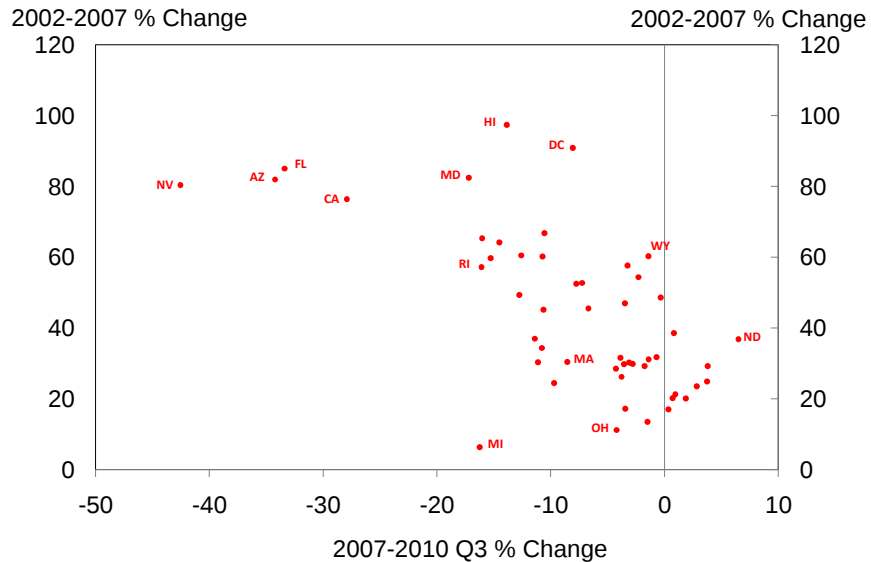
Note: Data source: Census Bureau

Figure 10. New Single Family Houses: For Sale



Note: Shading reflects NBER recessions. Data source: Census Bureau

Figure 11. Home Price Change by State



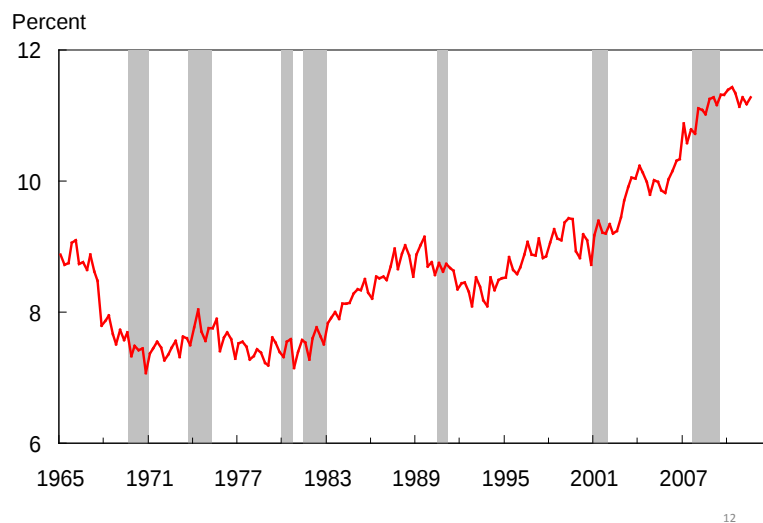
Note: Data source: Economy.com and author's calculations. House price changes are based on FHFA All Transactions repeat-sale house price indices.

Figure 12. Home Price Level by State



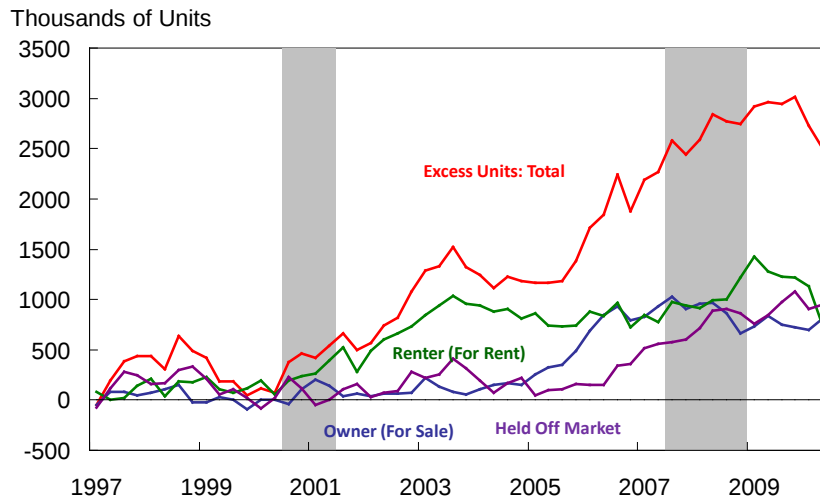
Note: Data source: Economy.com and author's calculations. House price changes are based on FHFA All Transactions repeat-sale house price indices.

Figure 13. Vacancies as a Percent of Total Housing Units Excluding Seasonal Vacancies



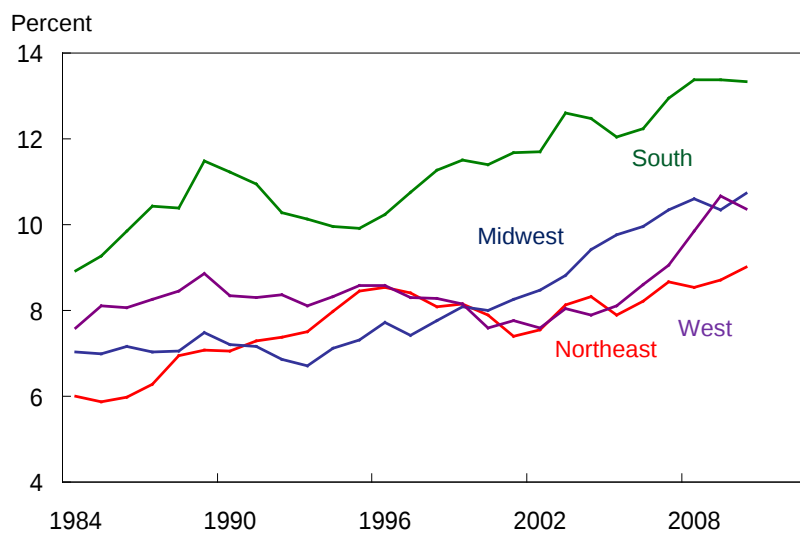
Note: Shading reflects NBER recessions. Data source: Census Bureau

Figure 14. Excess Supply of Housing



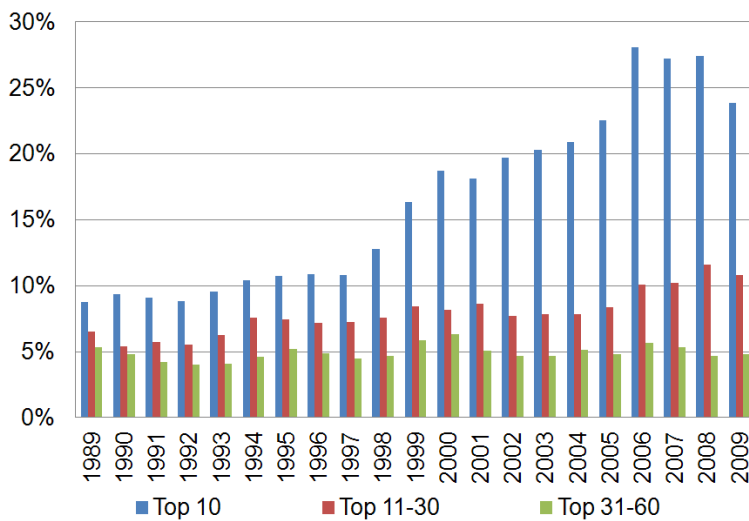
Note: Shading reflects NBER recessions. Data source: Census Bureau

Figure 15. Regional Vacancy Rates Excluding Seasonal Vacancies



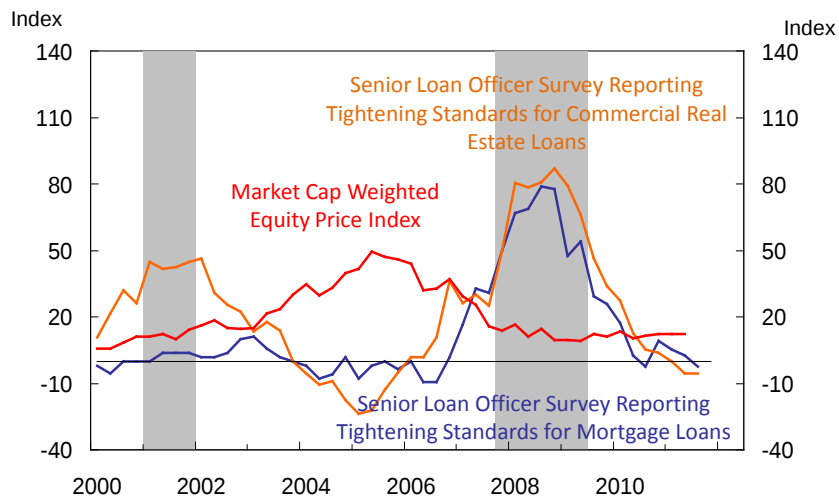
Note: Data source: Census Bureau

Figure 16. Share of New Home Sales by Size of Homebuilder



Note: Data sources: *Builder Magazine*, Census Bureau

Figure 17. Equity Price Index and Various Measures of the SLOOS



Note: The weight used in the equity price index is the market capitalization at the peak of the housing starts series for each security in the index.
Source: Bloomberg, author's calculations

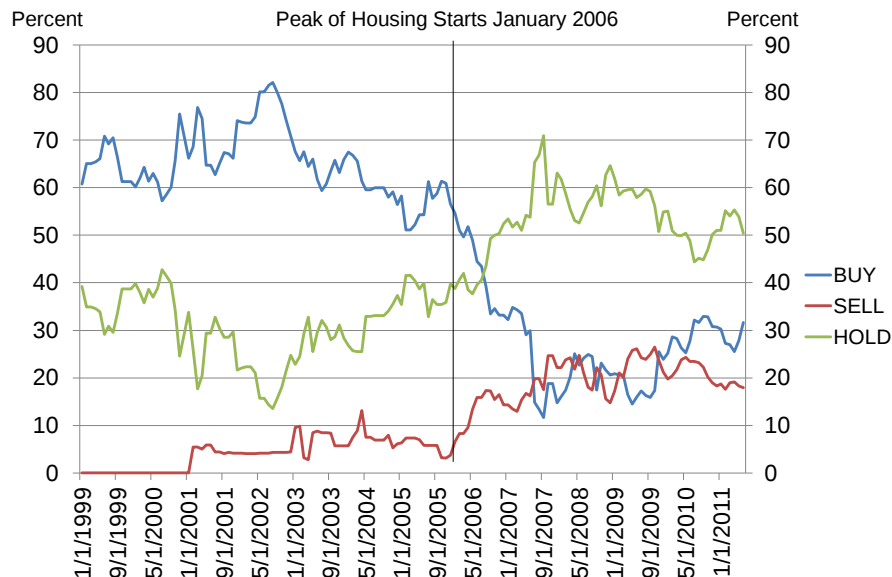
Note: Shading reflects recessions as determined by the NBER. Data source: Federal Reserve Board and author's calculations

Figure 18. Toll Brothers, Inc. Balance Sheet

Toll Brothers, Inc. and Subsidiaries as of April 30, 2005		
Assets	(\$ in Thousands)	% of Total Assets
Cash and Cash Equivalents	566,668	11%
Inventory	4,299,587	80%
Property, Construction and office equipment, net	63,649	1%
Receivables, prepaid expenses and other assets	152,009	3%
Mortgage loans held for sale	78,663	1%
Customer deposits held in escrow	76,681	1%
Investments in and advances to unconsolidated entities	114,196	2%
Total Assets	5,351,453	100%
Liabilities		% of Total Liabilities
Loans Payable	358,922	12%
Senior Notes	845,914	28%
Senior Subordinated Notes	450,000	15%
Mortgage Company Warehouse Loan	69,108	2%
Customer Deposits	389,265	13%
Accounts Payable	202,918	7%
Accrued Expenses	611,340	20%
Income Taxes Payable	147,964	5%
Total Liabilities	3,075,431	100%
Equity		
Common Stock	776	
Additional Paid In Capital	251,646	
Retained Earnings	2,051,056	
Unearned Compensation	(834)	
Treasury Stock	(26,622)	
Total Equity	2,276,022	

Note: Data sources: U.S. Securities and Exchange Commission – *EDGAR Company Search*

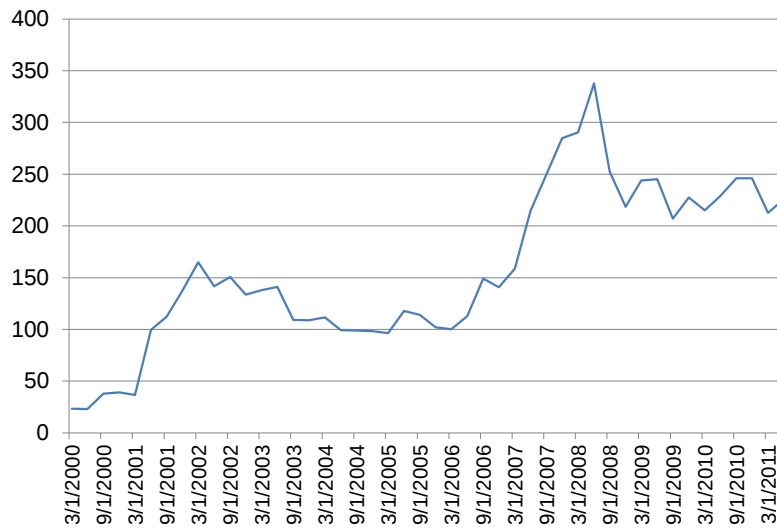
Figure 19. Equally Weighted Analyst Equity Recommendations



Note: Data sources: Wharton Research Data Services

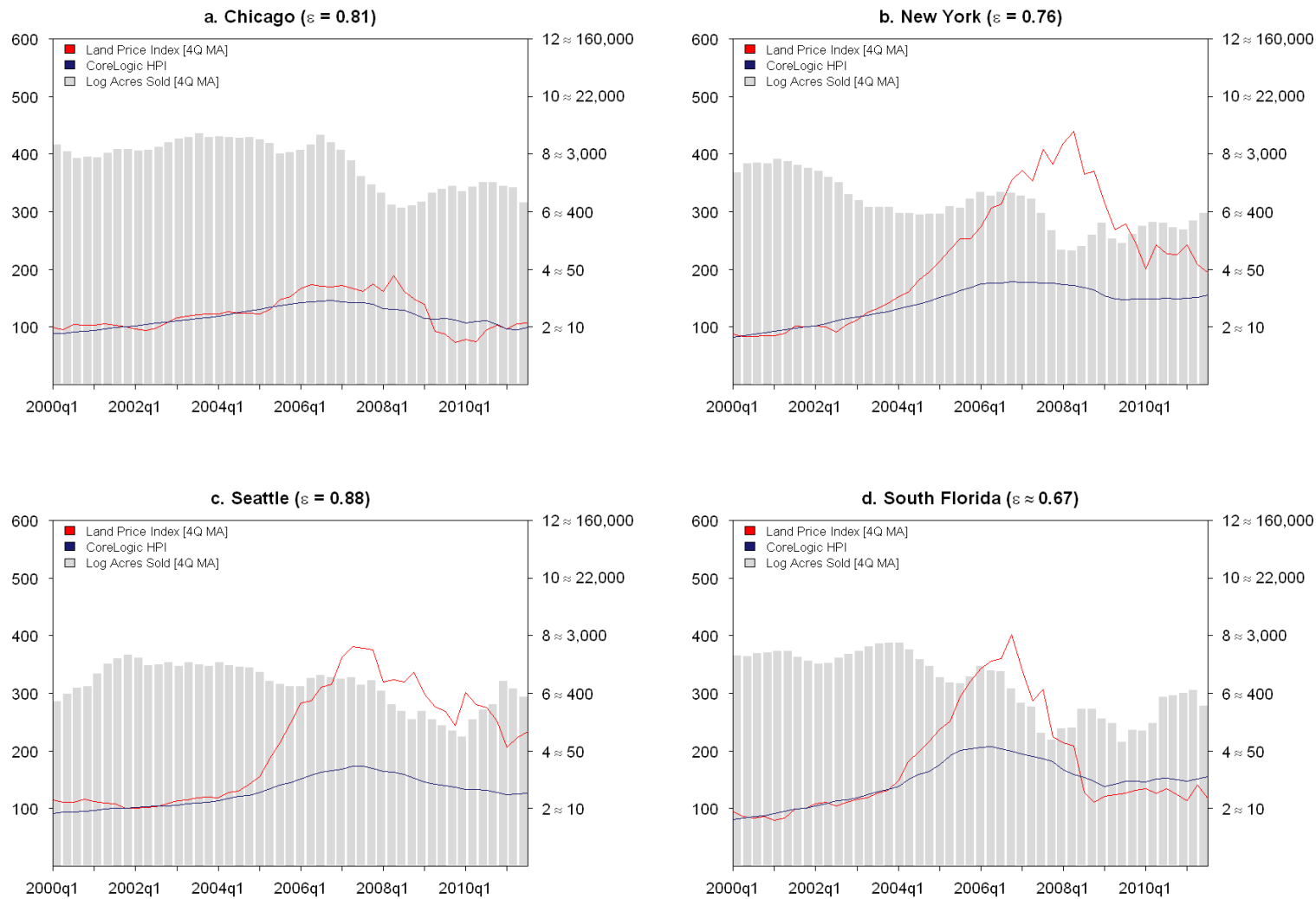
Figure 20. Market Capitalization Weighted Homebuilder Short Interest

Index = 100 at the peak of housing starts (Q12006)



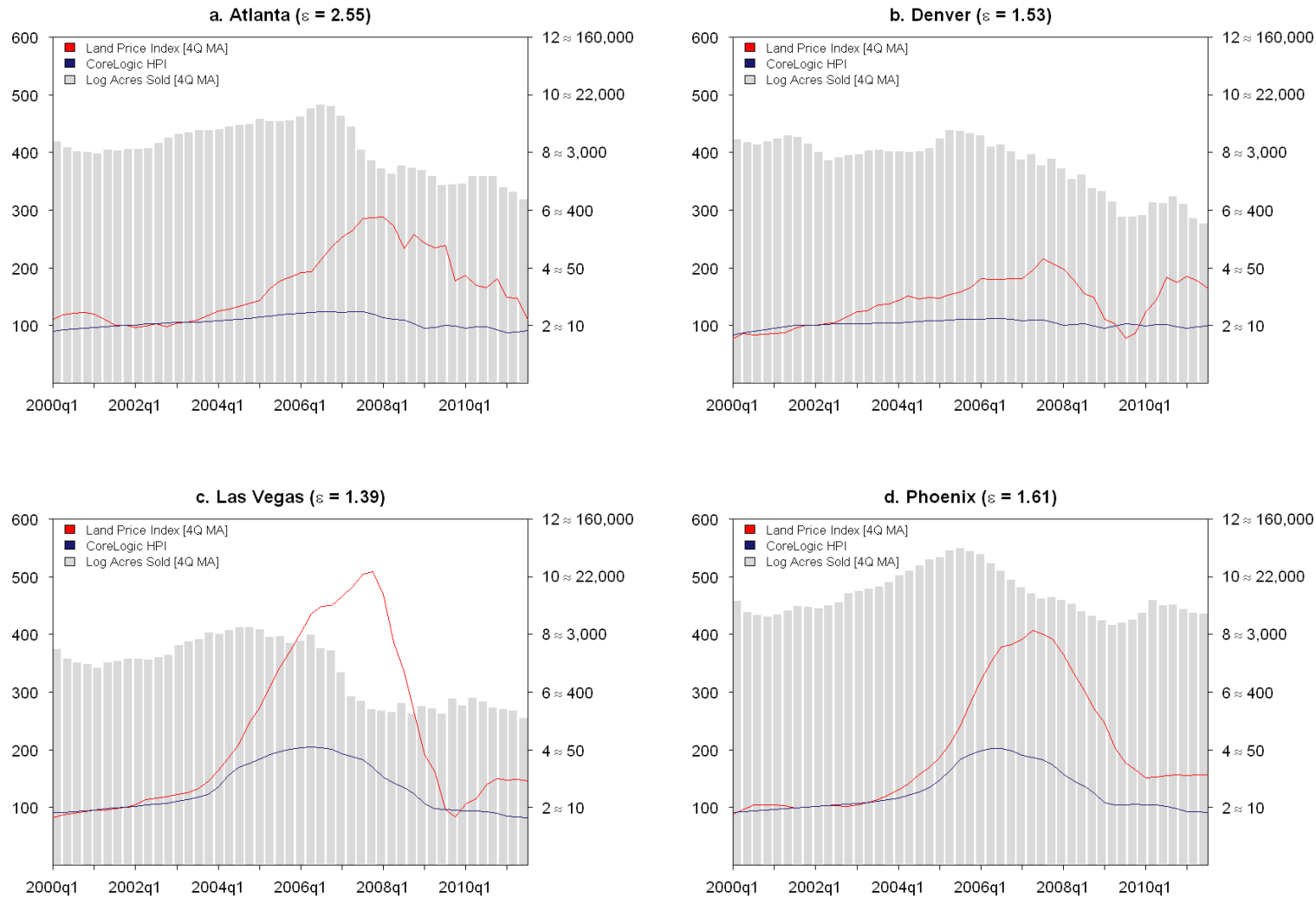
Note: Data sources: Bloomberg, author's calculations

Figure 21: Land Prices in Select Markets with Relatively Inelastic Supply



Notes: Acreage: right scale; land and house price indexes left. Data Sources: CoreLogic, CoStar, authors' calculations. Elasticity estimates from Saiz 2010). South Florida comprises the Miami, Fort Lauderdale and West Palm Beach MSAs.

Figure 22: Land Prices in Select Markets with Relatively Elastic Supply



Notes: Acreage: right scale; land and house price indexes left. Data Sources: CoreLogic, CoStar, authors' calculations. Elasticity estimates from Saiz 2010).

Appendix: Sources and Definitions of Data

The US Census Bureau is the primary source of data on both the stock of existing housing and the production of new housing. The information presented in this paper is derived from several different Census housing data programs. The following summarizes those sources and some key definitions.

Housing Units Authorized (Building Permits):

Monthly data on building permits for single- and multi-family housing units are released as part of the “New Residential Construction” release. The building permits data are derived from the “Building Permits Survey” (BPC) which is a representative sample of permit-issuing authorities.

New Privately-Owned Housing Units Started (Housing Starts):

Monthly data on single- and multi-family housing starts, units under construction, and units completed are also released as part of the “New Residential Construction” release. A housing unit is considered to be started “...when excavation begins for the footings or foundation of a building.” A housing unit is considered to be completed “...when all finished flooring has been installed.” These data are generated by the “Survey of Construction” (SOC) which begins with a sample of individual building permits. On a monthly basis, census field representatives contact the individual or firm to whom the permit was issued to determine dates of starts and completions as well as physical characteristics of the units. If the unit is for sale, the eventual sales date and price are obtained while if the unit is for rent the eventual date of occupancy (absorption) and rent are obtained.

New Residential Sales (New Home Sales):

Monthly data on new single-family homes sold, for sale, and median and average sales prices are released in the “New Residential Sales” release, the information for which is also derived from the SOC. In this data set, new single-family homes sold or for sale are defined as units “built for sale”, sometimes referred to as a “spec” or speculative sale, in which the land and structure are sold in one transaction. In contrast, contractor- or owner-built units are cases in which an individual or firm already owns the land and either hires a general contractor or acts as their own general contractor. Thus, new single-family homes sold are a subset of single-family housing starts and permits. A new single-family home is defined as sold “... with the signing of

a sales contract or the acceptance of a deposit." New single-family home sold and for sale can be in one of three categories, completed, under construction, or not started.

Included within the New Residential Sales data program is annual data on the characteristics of new homes sold. This information is also used to construct a quarterly Price Index for New One-Family Homes Sold Including Value of Lot which is a constant quality price index based on hedonic methods.

Housing Vacancies and Home Ownership:

Quarterly data on the housing stock of the US and its occupancy status are derived from the Housing Vacancy Survey (HVS). Housing units are occupied, by owners or renters, or are vacant. There are several categories of vacancies including for rent, for sale, rented or sold but not yet occupied, and other. Within the other category are units held for occasional use, units temporarily occupied by persons whose usual residence is elsewhere, and other, which includes units held for settlement of an estate. Finally, there is a category of vacant but for seasonal rather than year-round use.