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Housing Booms and City Centers†

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The great housing boom that ran from 1996 to 2006 may seem like a vast nationwide phenomenon, but there was enormous spatial heterogeneity in housing price growth over this time period, and the areas that experienced the most growth, like Miami and Los Angeles, also experienced the biggest busts. Across 300 metropolitan areas, 4 variables together can explain over 70 percent of the considerable variation in price growth between 1996 and 2006: price growth was highest in initially expensive areas, with warm winters, less density, and less-educated citizens. The first two effects are compatible with a model that suggests that boom-era buyers overestimated the long-run value of positive local attributes. Faster price growth in less-educated areas may reflect the impact of increasing credit availability to lower income buyers, as in Mian and Sufi (2009).

There was also considerable price growth heterogeneity within metropolitan areas, and prices typically grew faster close to city centers. But the tendency of prices to grow faster in the metropolitan core was not universal and price growth was far more centralized in metropolitan areas where income was more suburbanized.

Figure 1 shows this curious correlation. The horizontal axis shows the coefficient from a metropolitan area–specific regression of the logarithm of census-tract median incomes on the logarithm of distance to the central business district (CBD) as of 1990. The vertical axis shows the difference in price growth in the urban center and in the periphery of the metropolitan area between 1996 and 2006. When poverty was centralized, so was price growth.

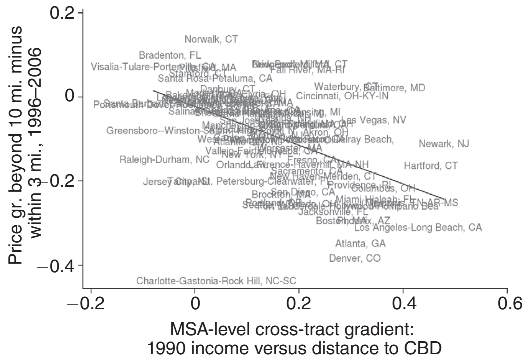

Figure 1. Price Growth in Periphery Minus Core versus Income-Distance Gradients

Notes: Periphery growth minus core growth = −0.46* income gradient −0.023; $R^2 = 0.23$, $N = 81$.

This paper presents these stylized facts about price growth during the boom and aims to interpret them in light of a model of intraurban differences. In the model, which we present in the working paper version of this paper (Glaeser, Gottlieb, and Tobio 2012), neighborhoods differ with respect to distance to the CBD, other exogenous amenities, and neighborhood composition. As in Schelling (1971) and Guerrieri, Hartley, and Hurst (2011), neighborhoods are either filled with richer or poorer people and areas may change their character over time. The possibility of tipping greatly increases the impact that over-optimistic beliefs about fundamentals may have on poorer areas, because those incorrect beliefs lead buyers to think that tipping is imminent.

The model presents one interpretation of the core fact: price growth may have been faster in poor urban centers because those central, poor areas were seen as being more likely to gentrify, which would lead to faster price growth than either centralized rich areas or outlying poorer areas. In Section III, we test this idea along with other explanations and find modest support for this idea. We find even less support for the hypothesis that areas with centralized poverty

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experienced more centralized price growth because their housing supplies were more inelastic. The evidence also speaks against the idea that centralization of poverty is a proxy for the centralization of employment and that areas with more centralized employment had more centralized price growth during the boom.

The data does, however, show support for the hypothesis that centralized poverty actually reflects urban assets, not a lack of urban amenities, and buyers valued those assets more highly during the boom. In particular, centralized poverty often reflects the presence of a stronger public transit network, which attracts the poor to the center (Glaeser, Kahn, and Rappaport 2008). We find that large gaps in public transit usage between core and periphery significantly explain centralized price growth. Those central cities with more public transit usage may be more difficult to reach by automobile from outlying suburbs, which could also make them prone to gentrification.

I. Heterogeneity in Housing Booms

Heterogeneity in the impact of increased subprime lending helps explain some price gains, for growth was typically greater in areas where more borrowers were shut out of credit markets before 2000 (Mian and Sufi 2009). An inelastic housing supply is also associated with faster price growth (Glaeser, Gyourko, and Saiz 2008). Yet Las Vegas and Phoenix saw price explosions despite having few visible barriers to building and the outsized price growth in high-income neighborhoods suggests that subprime lending was likely not the only factor driving prices.

We use Case-Shiller repeat sales price indices for up to 300 metropolitan areas and for zip codes within those areas to examine how much of the variation in growth a simple set of controls can explain. We have defined the two most recent housing boom periods as 1982–1989 and 1996–2006 to reflect the periods during which prices were rising nationwide. During the earlier period, we estimate

$$Log\left(\frac{Price_{1989}}{Price_{1982}}\right) = \underset{(0.52)}{-1.55} - \underset{(0.10)}{0.49}\ Jan.Temp. + \underset{(0.014)}{0.121}\ Log(Density) + \underset{(0.049)}{0.140}\ Log(Value).$$

Standard errors are in parentheses. There are 300 observations and the R^2 is 0.27. Warmer places had less growth during this earlier boom, perhaps because of more elastic housing supply (Glaeser and Tobio 2008). We measure temperature in hundreds of degrees, so the coefficient means that as January temperature increases by ten degrees, growth drops by 0.05 log points. As density doubles, prices rose by an extra 0.08 log points. There was also a tendency of places with higher initial housing values to see faster growth. As housing values in 1980 doubled, growth from 1982 to 1989 increased by 0.1 log points. In the companion working paper, we also control for income and human capital, and both are associated with less price growth during the 1980s. Controlling for them causes the coefficient on initial housing values to rise substantially.

For the 1996–2006 period, we estimate

$$Log\left(\frac{Price_{2006}}{Price_{1996}}\right) = \underset{(0.26)}{-5.25} + \underset{(0.069)}{0.61}\ Jan.Temp. - \underset{(0.01)}{0.052}\ Log(Density) + \underset{(0.025)}{0.524}\ Log(Value).$$

There are again 300 observations and the R^2 is 0.69. Perhaps the most striking difference from the earlier boom is that the three core variables are far better at predicting price variation during this later period. Moreover, as opposed to the earlier time period, January temperature was an extremely powerful, positive predictor of price growth. An extra ten degrees of January temperature is associated with 0.06 log points more price growth.

The effect of initial prices is even stronger. As initial housing prices double, price growth increases by 0.37 log points. Finally, metropolitan-area level population density was negatively associated with price growth from 1996–2006, although the effect is smaller in magnitude than the positive effect found during the 1980s. In the 1996–2006 period, education has a strong negative correlation with price growth; as the share with a college degree increases by ten percentage points, growth falls by 0.09 log points.

TABLE 1—ZIP CODE–LEVEL REGRESSIONS OF HOUSING PRICE CHANGES

Variables	Price growth, 1982–1989		Price growth, 1996–2006			
	(1)	(2)	(3)	(4)	(5)	(6)
Log distance CBD (zip code) × income-distance gradient 1990 (MSA)	−0.106*** (0.0385)	−0.104*** (0.0348)	−0.201*** (0.0455)	−0.191*** (0.0457)	−0.182*** (0.0492)	−0.144*** (0.0466)
Log med. inc. (zip code) × log distance CBD (zip code)	0.000699 (0.00826)	0.00491 (0.00752)	0.00124 (0.0104)	−0.00240 (0.0107)		
Log distance to CBD (zip code)	−0.0216*** (0.00507)	−0.0132** (0.00526)	−0.0400*** (0.00687)	−0.0380*** (0.00804)	−0.0390*** (0.00913)	−0.0387*** (0.00862)
Log median income, 2000 census (zip code)	0.00732 (0.0146)	0.0777*** (0.0227)	−0.102*** (0.0118)	−0.136*** (0.0237)	−0.138*** (0.0363)	−0.142*** (0.0368)
Percent BA or higher, 2000 census (zip code)		−0.0254 (0.0354)		0.0839** (0.0352)	0.0722 (0.0508)	0.0736 (0.0501)
Owner-occupied single-family share of housing units, 2000 census (zip code)		−0.138*** (0.0273)		−0.0152 (0.0317)	−0.0196 (0.0368)	−0.0205 (0.0367)
Log population density, 2000 census (zip code)		0.00539* (0.00289)		−0.00417 (0.00410)	−0.00205 (0.00569)	−0.00186 (0.00594)
Quartile 2 of MSA median income (zip code)					−0.00497 (0.00767)	−0.0305** (0.0151)
Log distance to CBD (zip code) × Average (zip code income – average income within 1 mile)^2 (MSA level)						0.00842** (0.00419)
Log distance to nearest high-price zip code (zip code) × quartile 2 of MSA median income (zip code)						0.0206** (0.0102)
Log distance to nearest high-price zip code (zip code)						−0.0107 (0.0116)
Constant	0.305* (0.156)	−0.428* (0.230)	1.910*** (0.126)	2.286*** (0.247)	2.294*** (0.375)	2.345*** (0.385)
Observations	3,342	3,342	3,342	3,342	1,531	1,531
R^2	0.947	0.950	0.937	0.938	0.936	0.937

Notes: All regressions include metropolitan area fixed effects. Standard errors are clustered at the metropolitan area level. Regressions (5) and (6) include only zip codes below the median income for the MSA sample.
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

The effect of January temperature and initial housing values during the 1996–2006 boom perhaps suggests that the boom may have reflected an overestimation of the value of area assets. After all, temperature is a strong predictor of area growth, and housing values typically reflect area amenities or labor demand (Roback 1982). The negative effect of education is harder to interpret since skills are a strong predictor of area success (Glaeser and Saiz 2004).

Table 1 turns to within–metropolitan area evidence. In this case, we control for metropolitan-area fixed effects and cluster our standard errors at the metropolitan statistical area (MSA) level. Regressions (1) and (2) show results for the 1982–1989 period; regressions (3) and (4) show results for the 1996–2006 period. The first regression illustrates the core finding that motivates the rest of the paper: the connection between price growth and proximity to the central business district. We include two main controls: the logarithm of zip code distance to the central business district, and the interaction between that variable and the income-distance gradient at the metropolitan-area level.

The gradient is calculated using data from 1990 census tracts. For each metropolitan area, we separately estimate a regression of the form

$$Log(Income) = Intercept + Slope \cdot Log(Distance\ to\ Central\ Business\ District).$$

The slopes across MSAs range from −0.11 to 0.51 and the standard deviation is 0.11. We subtract the mean slope from the variable that we include in the regressions.

Regression (1) indicates that during the 1982–1989 boom, prices rose by about 0.014 log points less as the distance to the CBD doubles. This effect gets substantially stronger in those areas where income rises more quickly with distance to the central business district. Even controlling for the interaction between area income and distance to the central business district has no significant effect. Regression (2) shows results for 1982–1989 where we control for other area attributes using data from the 2000 census. We would have preferred to use 1980 zip code data, and use the later year because of data availability. Including a bevy of local controls has almost no impact on our core effects.

The only zip code–level controls with reliably significant effects on the price boom are density, which has a positive and significant effect on price growth, and the single-family owner-occupied share of the housing stock, which has a negative effect. Both variables corroborate the metropolitan area–level regressions, which also show a positive connection between density and growth during this period. The 1980s boom was centered in denser areas closer to the CBD.

The third regression shows our results for the 1996–2006 period. In this case, both key coefficients are significantly larger in magnitude. As distance to the CBD doubles, price growth drops by 0.044 log points. That effect more than doubles in areas with a steeper income-distance to central business district gradient. Figure 1 shows this cross-effect graphically.

Regression (4) includes the other controls. Again, there is no meaningful interaction between income and distance to the CBD. In this case, the controls reduce our core coefficients, but they remain quite large in magnitude. In the 1996–2006 boom, income and percent with college degrees both have strong effects on zip code price growth, but in opposite directions. Richer areas had less price growth, but areas with more educated inhabitants had faster growth. If we don't control for income levels, the education coefficient flips sign. One interpretation for low-income area price growth is increasing access to subprime lending (Mian and Sufi 2009). Regression (5) reproduces these results just for those zip codes that have less than the median income in the metropolitan area.

Still, the results leave us with two core puzzles: why did both booms push prices up more at the city center, and why was this effect more pronounced in areas that had more poverty within the urban core? Perhaps central real estate was seen as more desirable and increased demand for central locations may be harder to satiate with new supply. But why was this effect more pronounced in areas where incomes are higher on the urban periphery?

II. Examining the Hypotheses

We examine four explanations for why city centers in poor areas experienced more price growth. One idea, expounded in Glaeser, Gottlieb, and Tobio (2012), is that these areas had fast price growth quickly because buyers expected these areas to gentrify, which can produce radical changes in neighborhood quality and price. A second explanation is that metropolitan areas with poorer city centers had less housing supply elasticity in the city, because they are older or more regulated or because even with the price growth they are not expensive enough to justify redevelopment. A third hypothesis is that city centers with abundant poverty are also places where employment is more centralized, because the poor centralize to be near jobs. Our final explanation is that cities with centralized poverty are public transit–intensive, because public transit attracts poorer people (Glaeser, Kahn, and Rappaport 2008). In public transit cities, price growth may be faster in the center because it is more difficult to commute in via car.

To examine the gentrification hypothesis, in Regressions (5) and (6) of Table 1 we focus only on zip codes with incomes below the metropolitan area median. These areas could conceivably switch from less skilled to more skilled inhabitants, as in the model. We follow Guerrieri, Hartley, and Hurst (2011) and control for distance to nearest high-income zip code (those in the top quartile of the MSA's zip code income distribution). We interact this variable with an indicator for zip codes in the second quartile of the metropolitan area income distribution. These areas, with relatively higher incomes within this sample, may have more potentially for gentrification.

We also control for the heterogeneity of incomes within the metropolitan area. At the metropolitan area level, we calculate the average square of the difference between zip code income and average income in zip codes within one mile. This measure is low when zip codes have similar-income neighbors. The measure will be high when wealthy areas abut poor areas.

Regression (6) shows that controlling for these measures reduces the interaction between distance to CBD and income decentralization by about 25 percent in the later period. The new controls have no effect on this interaction during the earlier growth period. We estimate a significant effect for distance to high-income zip code during the earlier boom but not during the later boom. The more important effect is that the income-mixing variable seems to flatten the price-growth distance gradient. In places that have more mixing of incomes throughout the metropolitan area, the tendency of price growth to occur more in the city center is attenuated and that causes the core interaction to become less powerful. Overall, these results suggest that gentrification may explain some, but probably not all, of the core interaction.

Table 2 shows the results for our other controls during the recent boom. The first regression reproduces regression (2) in Table 1. Regression (2) includes housing supply elasticity (Saiz 2010) interacted with distance to the CBD, which captures the possibility that building in the city center is easier in less restrictive areas. We also include the share of the housing stock built in the 1990s (at the zip code level) and interacted with distance to the CBD. The interaction between supply elasticity and distance to the CBD has no effect, but the share of new housing stock is negatively associated with price growth and significant, and reduces the core interaction by a fifth. This suggests that supply may help explain the effect, but the endogeneity of share built variable bedevils interpretation.

The third regression includes the share of adults taking public transit in the zip code. We also include the interaction of a metropolitan area measure—the share of people living more than five miles from the CBD who take public transit to work minus the share of people taking public transit within five miles of the city center—with the distance to the CBD. This measure should capture the extent to which the inner city has a comparative advantage in access to public transit. During the 1996–2006 period, price growth is flatter in those areas where there is comparably less public transit within the inner core. Although this coefficient isn't statistically significant, controlling for this effect reduces the core interaction by nearly 40 percent.

The fourth regression in each table controls for the centralization of employment within the metropolitan area. We use the measure of the share of employment within three miles of the central business district in Glaeser and Kahn (2001) (updated to more recent data by Kneebone 2009). More centralized employment was associated with a flatter price-growth gradient, which also substantially diminishes the core interaction.

The fifth regression in each table includes all of these controls. Together, they reduce the interaction by 45 percent. Unfortunately, all together the controls become so imprecisely measured that it is impossible to determine their relative importance with any precision.

III. Conclusion

In both booms, growth was faster in city centers than on the urban periphery. The tendency of growth to occur in more centralized locations was more pronounced within those metropolitan areas where richer people were more likely to live farther from the urban core. We find some evidence supporting the view that poorer inner-city areas experienced faster price growth because these were natural places for changes in neighborhood composition and gentrification. This phenomenon does not explain, however, why price growth was stronger in poorer central cities. There is more support for the importance of inelastic housing supply and urban form. Places with more centralized poverty also have more centralized public transit systems. In these areas, price growth was also faster in the urban core. We do not know exactly why there was a link between centralized transit systems and centralized price growth, but there are several plausible interpretations. If the boom represented a temporary overestimation of the valuation of urban assets, like January temperature, then buyers during the boom may have overestimated the value of public transit. It is also possible that cities highly dependent on public transit, like New York, are also places where suburban access is more difficult. Since suburban space is a poorer substitute for central locations in these cities, it is reasonable that central city land would have been seen as scarcer and more valuable.

TABLE 2—ZIP CODE–LEVEL REGRESSIONS OF HOUSING PRICE CHANGES, 1996–2006, FULL SAMPLE

	Price growth, 1996–2006				
	(1)	(2)	(3)	(4)	(5)
Log dist. CBD (zip code) × income-distance gradient 1990 (MSA)	–0.191*** (0.0457)	–0.152*** (0.0444)	–0.119** (0.0519)	–0.124** (0.0505)	–0.105** (0.0485)
Log distance to CBD (zip code)	–0.0376*** (0.00761)	–0.0478*** (0.00878)	–0.0401*** (0.00911)	–0.0876*** (0.0234)	–0.0762*** (0.0216)
Log median income, 2000 census (zip code)	–0.135*** (0.0233)	–0.0894*** (0.0263)	–0.131*** (0.0238)	–0.116*** (0.0244)	–0.0781*** (0.0274)
Percent BA or higher, 2000 census (zip code)	0.0827** (0.0351)	0.0389 (0.0329)	0.0732** (0.0357)	0.0578* (0.0346)	0.0248 (0.0342)
Percent own.-occ. single family, 2000 census (zip code)	–0.0159 (0.0320)	–0.0443 (0.0338)	–0.0125 (0.0299)	–0.0335 (0.0309)	–0.0478 (0.0319)
Log pop. dens., 2000 census (zip code)	–0.00408 (0.00405)	–0.00834** (0.00411)	–0.00467 (0.00407)	–0.00459 (0.00408)	–0.00877** (0.00431)
Log dist. CBD × Saiz supply elasticity missing indicator		0.0199 (0.0178)			0.00136 (0.0171)
Log dist. CBD × Saiz supply elasticity		0.00370 (0.00973)			0.000440 (0.00957)
Share of housing stock built in last 10 years (zip code)		–0.192** (0.0756)			–0.198** (0.0795)
Log dist. CBD × Share of housing stock built in last 10 years (zip code)		0.00441 (0.00443)			0.00457 (0.00466)
Share of workers taking public transportation to work, 2000 census (zip code)			0.0299 (0.128)		0.0677 (0.130)
Log dist. CBD × pub. trans. share beyond 5 mi. minus w/in 5 mi. from CBD			0.0170 (0.0120)		0.00733 (0.0132)
Log dist. CBD × emp. share w/in 3 mi. of CBD missing indicator				0.0312** (0.0120)	0.0226 (0.0157)
Log dist. CBD × emp. share w/in 3 mi. of CBD, 2006				0.00169* (0.000910)	0.00141 (0.000858)
Constant	2.274*** (0.240)	1.875*** (0.260)	2.239*** (0.250)	2.108*** (0.253)	1.760*** (0.276)
Observations	3,342	3,342	3,342	3,342	3,342
R^2	0.938	0.940	0.939	0.939	0.941

Notes: All regressions include metropolitan area fixed effects. Standard errors are clustered at the metropolitan area level. Missing supply elasticity and centralization data are replaced by the mean of these variables, and a dummy variable indicator is used.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

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