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VERY LOCAL HOUSE PRICE DYNAMICS[‡]

Within-City Variation in Urban Decline: The Case of Detroit[†]

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When a city experiences a decline in either income or population, do all neighborhoods within the city decline equally? Or, do some neighborhoods within the city decline more than others? If so, what are the characteristics of the neighborhoods that decline the most? In this paper, we provide some answers to these questions by looking at what happened to different types of neighborhoods within the city of Detroit as Detroit experienced a sharp decline in average income and population from the 1980s to the late 2000s. The large declines in population and average income during this period relative to other large cities make Detroit a natural candidate to study the within-city properties of urban decline.

We view our analysis through the recently developed model of Guerrieri, Hartley, and Hurst (2011) (hereafter, GHH). In that model, individuals are endowed with either high or low income and all individuals have a preference for living around richer neighbors. This is a shorthand way to model individuals having preferences for amenities that are provided endogenously when neighborhood income rises (such as lower crime, more entertainment and service amenities, peer effects in schooling, etc.).[1] Under relatively general assumptions, the model yields an equilibrium in which residents sort by income. Land prices are highest in the rich neighborhoods because of the higher consumption externality and decline as the distance from the rich neighborhoods increases. A key prediction of this model is that in response to a positive population or income shock at the city level, the new influx of richer residents will choose to locate in the poorer neighborhoods that border the richer neighborhoods so as to maximize their consumption of the positive neighborhood amenities. In GHH, we refer to this process as endogenous gentrification. We then provide a variety of evidence showing that in response to positive citywide labor demand shocks, such as an influx of richer residents, the poor neighborhoods that border the rich neighborhoods experience the greatest increase in housing prices within the city because they are the neighborhoods that gentrify (poor residents exit and richer residents migrate in).

The innovation in this paper is to show that empirically, the response of house prices to negative citywide demand shocks is symmetric. When a city experiences an extended period of the out-migration of residents, the model of GHH predicts the following: (1) the population declines should be the largest in the ex ante poorest neighborhoods and smallest in the ex ante richest neighborhoods; (2) the income declines should be greatest in ex ante richest neighborhoods and smallest in the ex ante poorest neighborhoods; and (3) housing prices in some neighborhoods would be lower than they would otherwise be because of the declining

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[1] Recent work that finds strong support for such preferences includes Bayer, Ferreira, and McMillan (2007) and Rossi-Hansberg, Sarte, and Owens III (2010).

TABLE 1—COMPARISON OF INCOME, HOUSE PRICES, POPULATION, AND DEMOGRAPHICS OF DETROIT AND OTHER LARGE US CITIES IN 1980 AND 2005–2009

	Detroit			Chicago			Chicago, New York, Los Angeles, and Philadelphia		
Variables	1980	2005–2009	Growth	1980	2005–2009	Growth	1980	2005–2009	Growth
Income									
Median	34,999	26,671	−23.8	36,198	42,081	16.3	33,999	43,850	29.0
25th percentile	16,120	12,714	−21.1	17,899	20,376	13.8	17,000	21,261	25.1
75th percentile	55,996	49,244	−12.1	57,995	73,770	27.2	55,986	78,535	40.3
House price (census)									
Median	42,474	69,279	63.1	94,943	224,138	136.1	104,937	366,771	249.5
25th percentile	32,480	52,978	63.1	64,961	152,821	135.3	64,961	183,386	182.3
75th percentile	57,465	91,693	59.6	124,925	285,267	128.4	169,897	509,405	199.8
Population	1.2M	0.9M	−24.0	3.0M	2.8M	−6.6	14.8M	16.5M	11.3
Percent with bachelor degree	8.3	12.1	46.1	13.8	32.0	131.6	16.4	31.1	89.5
Percent black	63.0	77.6	23.1	39.9	34.1	−14.7	28.1	24.8	−11.9
Home ownership rate	41.5	44.3	6.7	59.3	51.4	−13.3	65.0	60.1	−7.6

Notes: Table shows income and demographic statistics for the city of Detroit, the city of Chicago, and the pooled cities of New York, Los Angeles, Chicago, and Philadelphia. All data comes from the IPUMS dataset. The 1980 data is from the US census. The 2005–2009 data is from the pooled American Community Survey. All dollar values are in 2000 dollars. The growth columns refer to the growth between 1980 and the 2005–2009 pooled samples.

amenities in those neighborhoods that result from the influx of poor residents. As we show below, the first of these two predictions are definitely borne out in the Detroit data during the 1980-to-late-2000s period. Given the nature of the house price data, it is hard to say definitely whether the patterns in the house-price changes across neighborhoods are consistent with the endogenous changing amenity story. As we show, however, the patterns in house-price movements across Detroit neighborhoods are very different than the patterns within other large US cities during the same time period.

Before proceeding, it is worth mentioning why such an analysis is interesting. Recently, many papers have explored the welfare implications of differential citywide demand shocks across US cities (e.g., Moretti 2008 and Notowidigdo 2011). One implication of these theories is that poor residents can be made partially better off after a negative citywide labor demand shock because of the cheaper housing stock. The intuition is that rich residents are more likely to migrate out of the city after the negative citywide labor demand shock. This puts downward pressure on housing prices in the city, partially making the remaining poorer residents better off. Researchers making such welfare calculations, however, almost always assume that none of the decline in housing prices at the city level in response to a negative citywide labor demand shock is due to declining amenities in the city. As we show, that assumption seems to be strongly violated in the data. Part of the reason house prices are low in cities that face a negative labor demand shock is that the out-migration of richer residents makes the city as a whole a less desirable place to live.

I. The Decline of Detroit

Table 1 compares the trends in income, house prices, population, and other demographics between the city Detroit and two comparison samples. The first comparison sample is the city of Chicago. We pick Chicago because it is another large midwestern city that had a similar income and demographic composition in 1980. The second comparison sample is a composite of the other US cities that had the largest populations in the 1970s. All data in Table 1 come from the IPUMS samples and all variables are reported in real year 2000 dollars. The 1980 data come from the US census. The pooled 2005–2009 data come from the American Community Survey (ACS). Lastly, we want to stress that our

Table 2—1980–2005/2009 Changes in Within-City Population and Household Income, by 1980 Neighborhood House Price Deciles

1980 house price decile	Panel A. 1980–2005/2009 percent growth in population			Panel B. 1980–2005/2009 percent growth in median household income		
	Detroit	Chicago	Average across broad set of comparison cities	Detroit	Chicago	Average across broad set of comparison cities
1	−35.7	−23.4	1.2	−13.7	61.0	42.6
2	−34.2	−22.0	−2.1	−13.8	30.4	31.0
3	−27.4	−28.2	0.0	−13.7	11.8	23.0
4	−38.2	−20.0	1.9	−18.6	12.3	19.0
5	−15.1	−7.4	9.8	−27.0	24.5	25.2
6	−12.9	−9.8	10.9	−28.5	4.2	20.5
7	−7.4	4.9	10.9	−26.8	14.1	21.3
8	−11.6	10.7	11.1	−22.1	24.8	34.1
9	−4.0	9.3	10.2	−23.4	34.8	37.8
10	1.1	4.8	5.5	−4.3	39.5	52.3

Notes: Table shows the growth rate in population (panel A) and median household income (panel B) for Detroit, Chicago, and our broad comparison set of cities (which includes New York, Los Angeles, Chicago, and Philadelphia) across different within-city deciles of house prices in 1980. The level of analysis is within-city census tracts. Deciles are made by ranking census tracts by their median house value in 1980. Roughly one-tenth of all census tracts are in each decile. Decile 1 includes the census tracts with the lowest house prices in 1980. To compute the growth rates, we calculate the population (panel A) or income (panel B) for 1980 and the 2005–2009 period separately by averaging over the census tracts in the decile. When averaging over the census tracts in a given year within each decile, we weight by the number of people in the census tracts. For the average across the broad set of comparison cities, we compute the growth rate in population (or income) in each decile separately for each city and then take the simple average over the four cities.

analysis is at the city level and not at the broader metropolitan statistical area level.

A few things are noticeable from Table 1. First, with respect to median household income in 1980, Detroit was similar to both Chicago and the broader comparison set of cities. The income distribution (twenty-fifth and seventy-fifth percentiles) in 1980 was very similar between Detroit and the comparison samples.

Second, relative to the comparison cities, Detroit's population plummeted between 1980 and the late 2000s. This is similar to the findings of Glaeser and Ponzetto (2007).

The third fact to notice from Table 1 is that as the population fell in Detroit relative to other cities, Detroit was becoming poorer relative to other cities. Consistent with the income data, the change in educational attainment in Detroit during this period was much smaller than the comparison cities.

The final fact about Detroit during this time period is that median house values increased much less than in Chicago and in the comparison cities.

As a result, Detroit becomes a natural candidate to explore within-city patterns of urban decline.

II. Neighborhood Income, Demographic, and Housing Price Changes in Detroit

When exploring within-city changes in population, income, demographics, and housing prices, our unit of analysis is census tracts within the city. We use the tabulated data from the 1980 census (Neighborhood Change Database) and from the 2005–2009 ACS, respectively, for our initial and final periods of observations. Our sample for Detroit consists of the 207 census tracts. We restricted attention to census tracts with boundaries that remained constant or changed only slightly between 1980 and 2009, and with nonmissing tabulated values for median house prices, income, and key demographic variables within both the 1980 Neighborhood Change Database and the 2005–2009 ACS. A formal description of how we constructed our sample can be found on the authors' websites. As above, we use as comparison groups the census tracts in New York, Los Angeles, Chicago, and Philadelphia. For these comparison groups we make similar sample restrictions as for Detroit.

We begin by segmenting the census tracts in each of the cities by their initial median house

value in 1980. Specifically, we divide the census tracts into ten groupings, each representing their decile in the 1980 median housing price distribution. As a result, for our Detroit sample, each decile has roughly 21 census tracts in it. We hold these deciles fixed in Tables 2, 3, and 5.

Table 2 tests two of the predictions of GHH for cities experiencing a negative labor demand shock that causes an outflow of residents. First, the model predicts that population should decline most in the poorer neighborhoods relative to the richer neighborhoods. This is because the city should be contracting and people want to locate as close to the richer neighborhoods as possible given the higher externalities from those neighborhoods. Second, the model predicts that the income declines should be greatest in the neighborhoods that were initially close to the rich neighborhoods. This is because the rich neighborhoods will contract. The neighborhoods that used to be the fringe rich neighborhoods will now be populated by poorer residents. As a result, we should observe disproportionately large declines in income in these neighborhoods as they flip from being higher income to being lower income.

In panel A of Table 2, we show the percentage change in population by initial within-city house price decile for Detroit, Chicago, and a simple average across New York, Chicago, Los Angeles, and Philadelphia. The first thing to notice is that the population changes were not the same across the ten deciles in Detroit based on 1980 housing prices. It should be noted that the initial population in each of these deciles were nearly identical because of the way we created the deciles. The differences in the change in population across the three groupings were statistically significant at the 1 percent level.[2] As the city contracted, it lost most of the population from the initially poor neighborhoods. The city contracted in toward the initial rich neighborhoods. It should be noted that Chicago also lost some population from its initially poor neighborhoods. However, the richer deciles in Chicago experienced relatively large population gains.

[2] The difference in means between population growth in deciles 1–4 and deciles 5–8 was −0.24 with a standard error of 0.04. The difference in means between deciles 1–4 to deciles 9–10 was −0.40, standard error 0.8. The difference in means between deciles 5–8 to deciles 9–10 was −0.16, standard error 0.05.

The decline in income within Detroit was concentrated among deciles 5–9. For reference, it should be noted that household income increased monotonically throughout the deciles in 1980. In the late 2000s, most of the deciles in Detroit were substitutable with one another at very low levels of income. The formerly richer deciles became poorer despite the relatively stable population patterns.

A few additional things are worth pointing out. First, the patterns of income growth across the deciles in Chicago and the broader set of comparison cities display a strikingly different pattern. In particular, there was large across-the-board income growth throughout the deciles. Second, for the comparison cities, it was the poorest and the richest deciles that saw the largest income growth. As we documented in GHH, much of these two patterns can be explained by areas of those census tracts gentrifying. Some of the poorest neighborhoods were the neighborhoods that were bordering the richest neighborhoods. Finally, as seen in Table 3, other demographic variables display similar patterns as household income. In particular, within Detroit, the relatively rich neighborhoods experienced a larger influx of black residents, a larger decline in home ownership rates, and a relatively large increase in the poverty rate. All the results point to the fact that the formerly rich neighborhoods in Detroit experienced a large influx of poorer residents as Detroit declined. So, despite the population in these neighborhoods remaining relatively constant, their composition changed dramatically. As neighborhood composition partially determines house prices, part of the movement in Detroit average housing prices or for individual neighborhoods within Detroit will be a reflection of changing amenities.

Before looking at housing prices across the neighborhoods within Detroit, we wish to test one other prediction of the GHH model: the neighborhoods that border the richest neighborhoods should decline the most as the city experiences a large decline in population. In Table 4, we report the results of a regression of census-tract income growth on the log distance from that census tract to the nearest census tract that is in the top 1980 decile and the census-tract log median household income in 1980. We restrict our sample to include only those census tracts in deciles 7–9 (in the upper range of the initial house price distribution). As seen from Table 4,

Table 3—1980–2005/2009 Changes in Within-City Percent Black, Homeownership Rate, and Poverty Rate, by 1980 Neighborhood House Price Deciles

1980 house price decile	Panel A. 1980–2005/2009 percentage point change in percent black			Panel B. 1980–2005/2009 percentage point change in homeownership rate			Panel C. 1980–2005/2009 percentage point change in poverty rate		
	Detroit	Chicago	Average across broad set of comparison cities	Detroit	Chicago	Average across broad set of comparison cities	Detroit	Chicago	Average across broad set of comparison cities
1	4.2	1.0	−14.4	−0.9	12.2	5.1	20.0	−3.2	−3.5
2	9.6	3.1	−5.9	3.0	8.1	0.9	16.1	1.3	0.7
3	14.1	2.8	0.6	−4.3	3.0	−1.8	14.4	3.7	2.5
4	11.3	3.7	4.7	−6.9	2.9	−1.2	13.3	5.5	4.0
5	31.2	2.9	6.3	−15.0	5.2	−0.4	18.6	2.9	3.0
6	35.1	6.0	7.5	−14.3	0.5	−0.8	19.6	7.4	4.6
7	31.8	7.2	8.7	−11.2	3.1	0.5	19.9	4.6	4.1
8	20.8	9.8	5.1	−10.0	6.0	2.4	11.9	4.1	2.5
9	41.3	4.2	3.1	−10.1	7.8	5.3	13.9	4.0	1.8
10	31.2	−0.5	0.2	1.1	13.1	11.5	6.2	2.4	0.1

Notes: See the note to Table 2 for how the deciles were computed. Aside from exploring the percentage point change in percent black (panel A), the percentage point change in the home ownership rate (panel B), and the percentage point change in the poverty rate (panel C), the table is analogous in setup and sample to Table 2.

Table 4—Relationship between Growth in Income between 1980 and 2005/2009 at Census Tract Level and Distance to Rich Neighborhoods

Independent variable	Detroit	Chicago
Log distance from census tract to nearest census tract in the top decile of housing prices in 1980	−0.055 (0.026)	0.017 (0.062)
Log median household income in 1980	−0.145 (0.061)	−1.421 (0.428)
Observations	61	235
R^2	0.121	0.275

Notes: Table reports the simple regression of percent change in income growth within the census tract between 1980 and the pooled 2005–2009 sample on the log distance of that census tract to the nearest census tract in the top housing price decile in 1980 and the log of median household income in 1980. The level of observation is the census tract. We include only observations from deciles 7–9 in the regression. Among relatively richer deciles in 1980, we are asking how the change in income in that decile is related to the distance to the nearest census tract in the top housing price decile. The regression is weighted by population in 1980. Robust standard errors in parentheses.

it is the census tracts that are closest to the richest census tracts within Detroit in 1980 that experience the largest declines in income between 1980 and the late 2000s. These formerly rich neighborhoods changed to poor neighborhoods as the city contracted. In contrast, in Chicago, distance to the nearest top-decile census tract does not explain income growth among the upper range of the initial house price distribution (deciles 7–9).

Table 5 shows the changes in median house prices for census tracts based on the deciles of within-city 1980 housing prices for Detroit, Chicago, and the broader set of comparison cities. Unlike Tables 2 and 3, we aggregate some of the deciles together for the housing price table to mitigate some of the noise across the individual deciles. The increased noise is due to the fact that we only have house prices for home owners and the home ownership rate

TABLE 5—1980–2005/2009 PERCENT CHANGE IN WITHIN CITY HOUSE PRICE GROWTH, BY 1980 NEIGHBORHOOD HOUSE PRICE DECILES

1980 house price pooled deciles	Panel A. 1980–2005/2009 percent growth in house prices (no hedonic adjustments)			Panel B. 1980–2005/2009 percent growth in house prices (with hedonic adjustments)		
	Detroit	Chicago	Average across broad set of comparison cities	Detroit	Chicago	Average across broad set of comparison cities
1 and 2	93.8	394.4	374.0	108.0	362.0	366.8
3, 4, and 5	60.0	186.7	207.6	107.8	195.6	229.9
6, 7, and 8	56.1	113.2	155.1	129.1	167.1	211.6
9 and 10	53.0	82.3	121.2	121.9	156.8	189.7

Notes: This table is analogous to Tables 2 and 3 except the variable of interest is the percent growth in median house prices. See the note to Table 2 for a more detailed description of the table setup and samples used. For exposition, we pooled together deciles 1 and 2, deciles 3–5, deciles 6–8, and deciles 9–10. In panel A, we show the unadjusted growth rates in house prices. In panel B, we adjust the change in house prices within the census tract for the change in housing quality in the census tract over the period. See the text for details. All results are reported weighting the census tracts in the decile groupings by the number of owner-occupied housing units in the census tract.

is much lower in Detroit than in other cities. With respect to housing price growth, we simply report the growth in median house prices within the census tracts in the combination of deciles (weighting by the number of home owners in the census tract). In panels A and B, respectively, we do not and do hedonically adjust for the changing quality of the housing stock in the census tracts over time. A description of our hedonic adjustments can be found on the authors' websites.

As seen from Table 5, poor neighborhoods appreciated much more extensively in Chicago and the broader set of comparison cities than richer neighborhoods. This fact was extensively documented in GHH. Part of this was due to the gentrifying of poorer neighborhoods as Chicago and the broader set of comparison cities got richer during the 1980s, 1990s, and 2000s. In Detroit, however, the housing appreciation rates were nearly identical across the different deciles (after adjusting for hedonic differences). So despite the differential patterns across census tracts with respect to population and income, the changes in house prices are, if anything, slightly smaller in the poor neighborhoods. How much of these effects are driven by changing amenities in the city as a whole or in the individual neighborhoods? It is hard to tell from this analysis. The reason is that the large decline in population in the poor neighborhoods is putting downward pressure on the housing prices in these neighborhoods. Likewise, the declining amenities in the richer neighborhoods put downward pressure on the house prices in these neighborhoods. The net effect of the two factors makes it hard to tease out the effect of declining neighborhood amenities on house prices within Detroit. The takeaway from Table 5 is that (1) there is not much difference in house price appreciation rates across rich and poor neighborhoods within Detroit during the last 30 years; and (2) the patterns for Detroit with respect to within-city house price growth looks different than the patterns within the comparison set of cities.

III. Conclusion

In this paper, we have shown that there are important within-city dynamics that occur when a city experiences a prolonged period of population decline. In particular, the patterns of population and income movement are represented well by the model of endogenous gentrification put forth by Guerrieri, Hartley, and Hurst (2011). The declines in population and income were not experienced uniformly across the census tracts within Detroit. The poorest census tracts experienced the largest declines in population while it was the rich census tracts that experienced the largest declines in income. In particular, it was the relatively rich neighborhoods that were in close proximity to the richest neighborhoods that experienced the biggest income declines.

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