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Raven E. Saks

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RAVEN E. SAKS
Federal Reserve Board of Governors

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Spurred by the widening geographic disparities in residential construction and house prices, a growing body of research has emphasized the importance of local factors in explaining housing market dynamics. However, geographic dispersion in housing market outcomes does not necessarily imply that nationwide shocks have no effect on local housing markets. A prominent example to the contrary is the current housing market downturn. As illustrated in figure 1, many metropolitan areas experienced a deceleration of house prices and a contraction in construction from 2005 to 2006, suggesting that the recent decline in housing demand has been widespread across the United States.[1] Thus, a complete analysis of housing market fluctuations should consider national economic conditions as well as the local aspect of housing markets. In order to assess the relative importance of national and local factors, this paper examines the contribution of national and local shocks to annual changes in metropolitan area housing stocks and house prices from 1981 to 2006.

The analysis establishes several stylized facts that describe the evolution of housing markets over the past 25 years. First, metropolitan area fixed effects explain a large fraction of the variation in annual changes in the housing stock,

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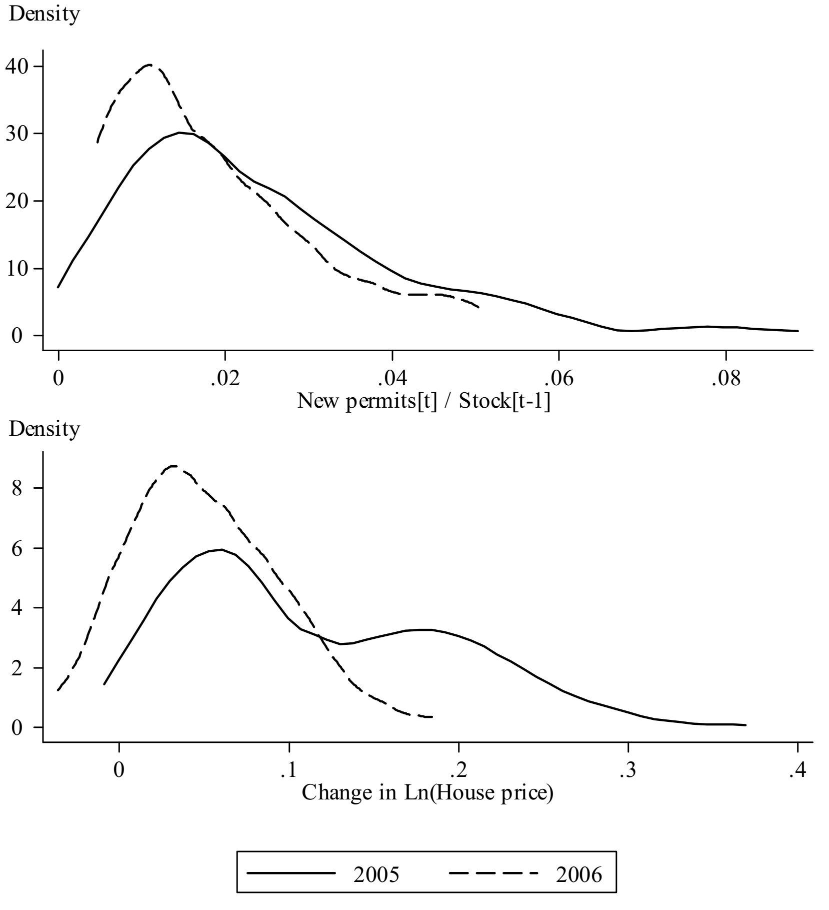
1. As described in later in this chapter, these data cover a balanced set of 115 metropolitan areas with unchanging metropolitan area boundaries over time. Similarities across metropolitan areas may not be limited to housing market downturns. For example, Davis and Palumbo (2006) documents an increase in the value of residential land from 1984 to 2004 that occurred in many metropolitan areas across the United States.

Figure 1. Distributions of Construction and Changes in House Prices across Metropolitan Areas, 2005 and 2006[a]



Source: Author's calculations from Census Bureau (building permit and housing stock) and OFHEO (house price) data.
a. Sample includes 115 metropolitan areas; house prices are derived from the OFHEO repeat-sales price indexes. See the text for details.

but they are not important for annual changes in house prices. These results are consistent with a model in which location-specific trends in productivity or amenities generate persistent differences in construction across locations (and thus diverging trends in city size), while household migration offsets shocks to house price differentials across locations.[2] Second, the component of construction and changes in house prices that is common across all locations (that

2. Robak (1982); Glaeser and Gyourko (2007).

is, year fixed effects) is small. However, that fact does not necessarily imply that metropolitan area housing markets are dominated by idiosyncratic local shocks. In fact, a third important empirical regularity is that metropolitan areas with similar characteristics in 1980 experienced similar fluctuations in construction and house prices during the subsequent 25 years. Those initial characteristics likely reflected differences in the elasticity of housing demand and supply, which cause national shocks to result in different housing market outcomes in locations of different types. Thus, both national and local factors have an important influence on metropolitan area housing market dynamics.

These results suggest an alternative interpretation of the common saying "All real estate is local." It is true that housing market outcomes differ considerably across locations, but the local factors that explain most of the variation in construction and house prices since 1980 are highly persistent and do not seem to be correlated with fluctuations in local variables. Moreover, the co-movement of locations with similar characteristics reveals that national factors cannot be ignored when trying to define the patterns of construction and house prices across metropolitan areas.

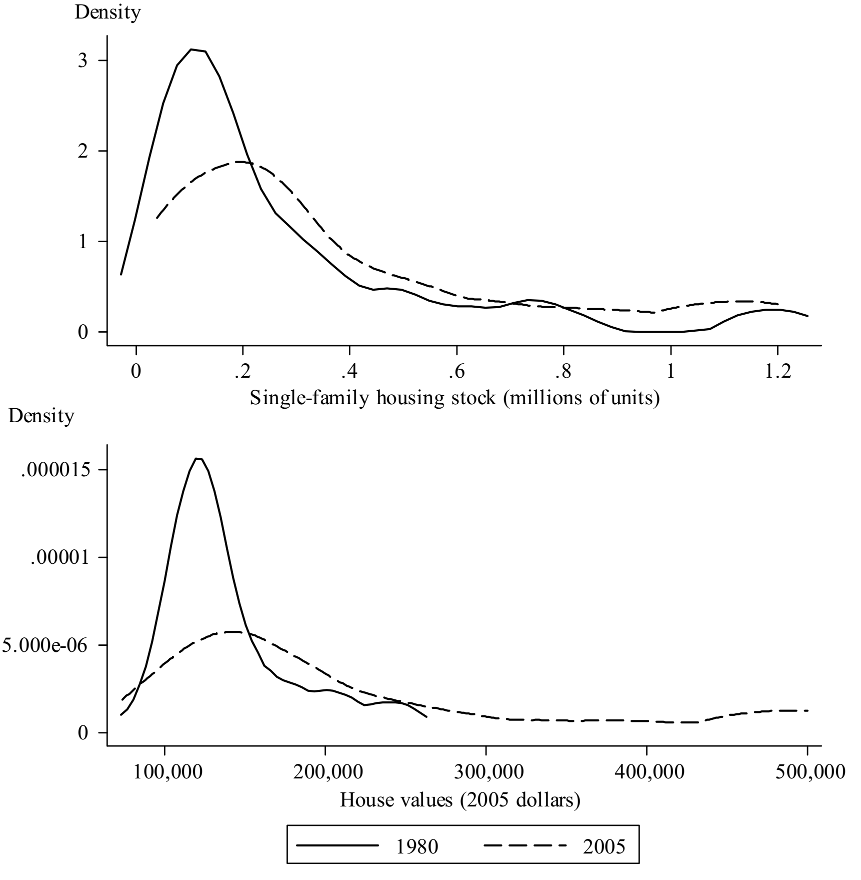
Background

A growing geographic heterogeneity in both house prices and new construction has become a prominent feature of metropolitan area housing markets. Figure 2 illustrates that dispersion by showing the distributions of house values and the size of the housing stock across metropolitan areas in 1980 and 2006.[3] Several recent studies have explained the variation of house prices both across and within metropolitan areas as being a result of idiosyncratic shocks to local housing demand combined with slow adjustment of the housing supply.[4] These studies calibrate models of local housing market dynamics using data on changes in local wages or income to estimate the time series behavior of local productivity shocks. Combined with geographic differences in the elasticity of housing supply, the local demand shocks in their models generate disparities in house prices and residential construction across metropolitan areas that are similar to actual outcomes, suggesting that idiosyncratic local factors are the primary explanation for the growing dispersion of housing market outcomes across locations. The importance of local shocks is also

3. House values are derived from median reported values in the 2005 American Community Survey and changes in the Office of the Federal Housing Enterprise Oversight (OFHEO) repeat-sales price indexes (www.ofheo.gov/hpi.aspx).

4. Glaeser and Gyourko (2007); Van Nieuwerburgh and Weill (2007).

Figure 2. Distribution of Housing Stock and House Values across Metropolitan Areas, 1980 and 2006[a]



Source: Author's calculations.

a. Sample includes 115 metropolitan areas; house are values derived from median reported values in the 2005 American Community Survey and the OFHEO repeat-sales price indexes. See the text for details.

emphasized in Hwang and Quigley (2006), which uses a more empirical approach by estimating the dynamic responses of metropolitan area house prices, construction, and vacancy rates to local changes in income, employment, transfer payments for unemployment insurance, and the local price-rent ratio.

Although the role of local shocks has dominated the literature to date, the conclusion that only local shocks matter may be misleading because prior research has not addressed the potential for shocks to be correlated across locations. For example, metropolitan areas with similar industrial compositions or consumption amenities might experience similar changes in housing demand, signaling that at least some housing demand shocks extend across multiple metropolitan areas. Some shocks that extend across all metropolitan areas—which I refer to as national shocks—affect housing demand or supply in all locations.

Even though a national shock is felt in all locations, the effect of a national shock on house prices and construction will not necessarily be identical everywhere because the response to a shock depends on the elasticity of housing supply and demand. For example, if two locations with a different elasticity of housing supply experience the same increase in housing demand, house prices should increase by more in the location with a more inelastic housing supply. A large body of research has documented geographic differences in the elasticity of housing supply,[5] and a few studies have related geographic variation in elasticity to differences in housing market outcomes. In particular, Hwang and Quigley (2006) shows that locations with different degrees of regulation of the housing supply—which is likely to be correlated with the elasticity of housing supply—experience considerably different changes in house prices and new construction in response to a change in income.[6] Although that result emphasizes the local aspect of housing markets, it does not distinguish between the effects of idiosyncratic local shocks and shocks that may be correlated across locations.

It is especially useful to sort out the relative importance of local and national shocks because if real estate is driven primarily by local shocks, then knowledge about the specific idiosyncratic factors affecting each location would be needed to understand housing market fluctuations. In this case, the "national" housing market would be no more than a collection of idiosyncratic local factors, and aggregate statistics would reveal little about the important factors driving changes in housing supply and demand. On the other hand, if shocks are correlated across locations, then national variables can provide useful insight into local housing market dynamics.

In this paper, I provide insight into the correlation of shocks to metropolitan area housing markets by decomposing economic variables that affect housing demand and supply into national and local components. In most cases, I estimate a national shock as a change in the national average of a given variable and a local shock as a deviation from that average. Therefore, a national shock in this analysis reflects a change in economic conditions that would be experienced by a household or firm regardless of its geographic location. For

5. Malpezzi (1996); Mayer and Somerville (2000); Saks (2005).

6. Another example is provided by Edelstein and Tsang (2007), which reports that changes in the 10-year Treasury bond rate had substantially different effects on rents in four different metropolitan areas in California.

example, a change in the national average of real income is a national shock because it reflects the component of income that is common across all households. By contrast, a local shock—such as a change in MSA income relative to the national average—reflects a change in housing demand or supply that is specific to a given location.

Sample and Data Description

The analysis in this paper is based on a balanced panel of 115 metropolitan areas (MSAs) from 1981 to 2006. The panel includes all locations for which a complete time series of house prices is available for 1980–2006. I measure house prices using the fourth-quarter values for repeat-sales house price indexes of the Office of Federal Housing Enterprise Oversight (OFHEO), so that annual changes in prices reflect the change over the course of the entire year. I measure construction as the number of single-family building permits issued in a year relative to the size of the single-family housing stock in the previous year. Thus, abstracting from depreciation and maintenance, this measure of construction approximates the percent change in the housing stock. Single-family housing is chosen to be consistent with the OFHEO house price data. Also to be consistent with the house price data, I aggregate the construction data from county-level data using the 2005 census definitions of metropolitan areas in every year.

Until the inception of the American Community Survey (ACS) in 2001, housing stock estimates were published only every ten years in the decennial census. Therefore, I estimate the number of single-family housing units in a given year as the number of units in the previous year plus the number of building permits issued in the previous year, less a depreciation factor set to make the housing stock estimates match the reported totals in the 1980, 1990, and 2000 censuses.[7]

Although this group of metropolitan areas is only 32 percent of the total number of metropolitan areas in the United States, it represented 76 percent of all single-family housing units in 1980 and 77 percent in 2005, so it accurately reflects the housing market conditions experienced by most households in the United States.

7. American Community Survey (www.census.gov/acs/www/index.html). Because the ACS reports only the number of single-family housing units for locations with a population greater than 65,000, it is not possible to compute the size of the single-family housing stock from county-level ACS data. In addition, the ACS data reported at the MSA level uses different geographic definitions in each year. Therefore, I impute housing stock values for 2001–04 using the metropolitan area totals from the 2005 ACS and the same accumulation equation used for the 1981–99 data.

Table 1. Fraction of Annual Variation Explained by MSA and Year Fixed Effects, 1981–2006[a]

Fixed effect	*Construction*	*ΔLn(Price)*
Panel A		
MSA	0.67	0.05
Year	0.05	0.15
Residual	0.28	0.79
Panel B		
MSA	0.21	0.02
Year alone	0.03	0.09
Year interacted with initial MSA characteristics	0.16	0.44
Residual	0.11	0.35
Panel C		
Year interacted with		
Industrial composition	0.05	0.07
Census division	0.03	0.11
Water area/total area	0.00	0.02
Housing units/kilometer^2 in 1980	0.00	0.00
Near ocean coast	0.00	0.01
Ln (Income per capita) in 1980	0.00	0.01
Fraction of population with a college degree in 1980	0.01	0.02

a. Each cell reports the partial sum of squares of each independent variable relative to the total sum of squares. The contributions in panel B do not sum to 1 due to the covariance among the independent variables. Industrial composition is defined as the fraction of employment in each of fifteen major industrial groups, excluding the construction industry. The "near ocean coast" dummy variable indicates whether the most densely populated county within the metropolitan area is within 80 kilometers of the Atlantic, Pacific, or Gulf coasts (Rappaport and Sachs 2003).

Simple Decomposition

Panel A of table 1 reports a simple decomposition of the annual values of construction and changes in house prices into a portion that is common across all MSAs in each year (year fixed effects), a portion that is specific to an individual metropolitan area in all time periods (MSA fixed effects), and a residual that reflects idiosyncratic changes in quantities and prices. These results are derived by estimating the partial sum of squares attributable to each set of fixed effects and dividing that estimate by the total sum of squares of each dependent variable. The year-specific component explains very little of the total variation in construction (5 percent) and only a modest fraction of changes in house prices (15 percent). Metropolitan area fixed effects explain nearly two-thirds of the variation in construction, suggesting that the location-specific component of construction is highly persistent. By contrast, nearly 80 percent of the variation in changes in house prices cannot be tied to either year-specific or time invariant factors; it is highly idiosyncratic.

At face value, these results suggest that local economic conditions must be the driving force behind metropolitan area housing market dynamics. However, this simple decomposition does not account for the possibility that national economic conditions may have a differential impact across locations depending on the elasticity of housing demand or supply in each location. Because those elasticities cannot be directly observed, I interact the year dummy variables with metropolitan area characteristics that are likely to be correlated with them. Panel B of table 1 shows the contribution of these interaction terms to the variation in construction and changes in house prices.[8]

The combined interactions of all of these characteristics with the year effects explain a considerable fraction of local housing market outcomes: they account for 16 percent of the variation in construction and 44 percent of the variation in changes in house prices.[9] Industrial composition (defined by employment shares of fifteen major industry categories, excluding construction) and the nine census divisions largely account for those results. Thus, locations that are closer to one another or that produce similar types of goods and services tend to have experienced similar housing market fluctuations during the sample period.

Somewhat surprisingly, the other MSA characteristics do not appear to explain much of the annual fluctuations, even though theoretically they are correlated with the elasticity of housing supply or demand. For instance, locations with a large fraction of water and an initially high density of housing units are likely to have a less elastic supply of land on which to build new homes. Metropolitan areas near an ocean coast also may have a relatively more constrained supply of land.[10] In addition, the housing supply may be less elastic in locations with a richer, more highly educated population, because such households may be better able to get local government regulations passed that restrict new construction.[11] On the other hand, higher average incomes or educational attainment in addition to proximity to the coast may also signal a greater amenity value of living in such locations, which would raise the elasticity of housing demand.[12]

8. As shown in appendix table A-1, the results reported in table 1 are robust to using a measure of construction that includes multifamily housing units and a sample that includes all available metropolitan areas (361).

9. The fraction of the variance attributable to all of the variables in the regression is greater than the sum of the partial contributions of each separate component due to the covariance between the MSA characteristics and the MSA fixed effects.

10. The "near ocean coast" dummy variable indicates whether the most densely populated county within the metropolitan area is within 80 kilometers of the Atlantic, Pacific, or Gulf coasts (Rappaport and Sachs 2003).

11. Glaeser, Gyourko, and Saks (2006).

12. Gyourko, Mayer, and Sinai (2006).

The decomposition reported in table 1 establishes several stylized facts that shed light on the determinants of housing market dynamics. First, the importance of metropolitan area fixed effects in construction shows that metropolitan areas grew at systematically different rates over the 1980–2006 period. By contrast, changes in house prices tend not to persist over a long time. These results are consistent with a model in which location-specific trends in housing demand generate diverging trends in city sizes, while household migration offsets relative house price differentials across locations.[13] Second, the nationwide component of both construction and price changes is only a modest fraction of the overall variance. Even after excluding time invariant differences across locations, year effects by themselves explain only about 16 percent of the time series variation in prices and quantities (results unreported). However, a significant portion of these time series fluctuations *can* be explained by grouping metropolitan areas according to their initial characteristics, especially geographic location and industrial composition. Thus, it appears that housing market dynamics have been at least modestly correlated across metropolitan areas over the past 25 years.

National and Local Economic Conditions

Although the year effects in the analysis above provide a simple way to describe the time series fluctuations in house prices and quantities that are common to all locations, they do not reveal what types of shocks drive housing markets. I therefore analyze the correlation of construction and changes in house prices with changes in national and local economic conditions, which reflect national and local shocks to housing markets. The baseline regressions estimate construction and changes in house prices from 1981 to 2006 as function of national economic conditions, local economic conditions, and metropolitan area fixed effects. Thus, these regressions decompose metropolitan area housing markets into time invariant differences across locations, responses to national shocks, and responses to time-varying local shocks. After establishing the average correlation of shocks with prices and construction, I explore how the effect of the shocks varies across metropolitan areas.

The national variables in the regression reflect shocks to housing demand or supply that are common to all locations. Variables representing aggregate housing demand are the real 30-year fixed conventional mortgage rate, the log change in real income per capita, the log change in aggregate employment, and

13. Robak (1982); Glaeser and Gyourko (2007).

the detrended employment-population ratio, which is included to capture business cycle fluctuations in housing demand.[14] Because some of these variables are highly correlated with one another, interpreting the partial effect of any single variable is difficult. However, the goal of the exercise is not to identify the structural effect of each individual factor but to assess their significance as a group. Therefore, I include all of these variables to account for shifts in aggregate housing demand in the most flexible way possible. Shifts in the cost of housing supply are represented by the log change in the real price of construction materials.[15] The regressions include the contemporaneous values and one lag of each of these aggregate variables.[16]

The local shocks in the regression are the log change in income per capita, the detrended employment-population ratio,[17] and a weighted average of changes in national industry employment relative to the change in aggregate employment, where the weights are each metropolitan area's employment share of fifteen major industries in 1980.[18] The last variable reflects local changes in labor demand—and therefore housing demand—that are driven by aggregate shocks to an industry. Each local variable is expressed relative to its national average, so these three variables reflect the idiosyncratic local components of income, employment, and the business cycle. Although the two other national variables in the regression—mortgage rates and prices of construction materials—may

14. All nominal independent variables except the mortgage rate are deflated using the consumer price index. The real mortgage rate is the nominal rate on 30-year fixed conforming loans from Freddie Mac's Primary Mortgage Market Survey (www.freddiemac.com/pmms/abtpmms.htm) minus expected inflation over the next ten years from the Philadelphia Fed Survey of Professional Forecasters (www.philadelphiafed.org/econ/spf/index.cfm). The employment-population ratio is detrended by calculating the log of the actual ratio relative to a linear trend estimated from 1969 to 2006. The employment and population data are published by the Bureau of Labor Statistics (www.bls.gov/). Results are similar using the unemployment rate, but I use the employment-population ratio to be consistent with the metropolitan-level data, for which unemployment rates are not available back to 1980.

15. I use the producer price index (PPI) for construction materials to measure construction costs instead of the cost estimates published in R. S. Means (2005) because the Means estimates include labor costs, which vary considerably across locations. However, results are similar when I use the Means index instead of the PPI. Results also are similar when construction wages at the aggregate and MSA levels are included in addition to the PPI.

16. Coefficient estimates of the second lags of these and the local variables discussed below are mostly small and insignificantly different from zero. Although these shocks might continue to influence housing market outcomes through the influence of lagged endogenous variables, I focus on their initial impact because the lagged dynamics are not likely to differ whether the shock is national or local.

17. All of these variables are published by the Bureau of Economic Analysis (www.bea.gov/regional/index.htm#state). The employment-population ratio is detrended separately for each metropolitan area using a linear trend from 1969 to 2005.

18. Bartik (1991).

also vary somewhat across locations, the local variation is minor and a lack of data prevents their inclusion in the analysis.[19] The error term in the regression therefore includes the contribution of this omitted local variation in changes in house prices and construction. More generally, the regression residuals reflect all other time-varying shocks to housing markets—including national and local factors—that are not included in the model.

Since the national and local economic conditions in this model are meant to reflect shocks to housing demand and supply, ideally they should not be influenced by conditions in the housing market. I have included contemporaneous values of the national economic conditions as well as their lagged values because fluctuations in construction or house prices in each individual location can have only a small impact on these aggregate variables. On the other hand, reverse causality is a greater concern for the local variables. Therefore, I include only lagged values of local income and the local employment-population ratio.[20] However, I include both the contemporaneous and lagged values of the local employment variable because it is based on national industry employment and therefore should be largely exogenous to local changes in the supply of housing.[21]

Column 1 of table 2 shows the coefficient estimates from an OLS regression with construction as the dependent variable, and column 3 shows estimates with the change in house prices as the dependent variable. Rather than approximating the real change in house prices by deflating by the consumer price index (CPI), I use nominal house prices and control for contemporaneous changes in the CPI because the CPI also is used to deflate some of the other nominal variables in the regression; measurement error in the CPI therefore would bias the coefficient estimates if it were also used to calculate the dependent variable.[22] With two notable exceptions, most of the coefficient estimates have the expected sign. First, construction costs tend to be positively correlated with construction, which could indicate that the price of materials is bid up in periods of strong housing demand.[23] Second, changes in aggregate employment are neg-

19. Although mortgages rates do vary across locations, the differences mostly reflect variation in the prices of high-cost loans made to lower-credit households. Rates vary much less in middle- and high-income areas (Ergungor 2006). Thus, the rate on a 30-year fixed conforming loan—which is the variable used in this analysis—is likely to be relatively similar across locations.

20. Results are similar when I restrict the analysis to lagged values of all national and local shocks.

21. I omit construction employment from this weighted average because it is likely to be correlated with housing supply as well as demand.

22. Moreover, it is not obvious that changes in the aggregate price level should affect house prices in all locations in the same way, so restricting the coefficient on general inflation to 1 might not be valid.

23. Insignificant or perverse estimates of the effect of construction costs on housing markets are common (DiPasquale 1999; Hwang and Quigley 2006). Although the perverse sign in this case

Table 2. Determinants of Construction and Changes in House Prices[a]

	Construction$_{it}$		*ΔLn(Price$_{it}$)*	
Variable	*OLS*	*IV*	*OLS*	*IV*
National				
Fixed mortgage rate$_t$	-0.121**	-0.180	-1.271**	-0.043
	(0.030)	(0.194)	(0.484)	(0.974)
Fixed mortgage rate$_{t-1}$	0.073**	-0.547*	0.035	1.394
	(0.027)	(0.307)	(0.299)	(2.352)
ΔLn(Price of construction materials$_t$)	0.035*	0.033	0.371*	1.474**
	(0.018)	(0.045)	(0.194)	(0.534)
ΔLn(Price of construction materials$_{t-1}$)	0.002	0.081*	0.051	1.368**
	(0.018)	(0.041)	(0.202)	(0.424)
ΔLn(Income/capita$_t$)	0.024	0.238	0.869**	1.375
	(0.026)	(0.164)	(0.261)	(1.148)
ΔLn(Income/capita$_{t-1}$)	0.042	0.153	0.777**	0.766
	(0.030)	(0.119)	(0.230)	(0.823)
ΔLn(Employment$_t$)	-0.200**	-0.499	-2.413**	-4.091
	(0.061)	(0.323)	(0.510)	(2.479)
ΔLn(Employment$_{t-1}$)	-0.038	-0.091	-0.208	-1.612
	(0.037)	(0.080)	(0.344)	(1.017)
Detrended employment/population$_t$	0.385**	0.137	2.199**	1.613
	(0.070)	(0.107)	(0.696)	(1.446)
Detrended employment/population$_{t-1}$	-0.330**	-0.011	-2.206**	-0.190
	(0.071)	(0.104)	(0.681)	(0.923)
ΔLn(CPI$_t$)	n.a.	n.a.	1.262**	-0.848
			(0.311)	(1.008)
Vacancy rate$_{t-1}$		-1.062**		-14.67**
		(0.507)		(6.621)
Local				
ΔLn(Income/capita$_{it-1}$)	0.045**	0.023	0.626**	0.149
	(0.014)	(0.021)	(0.188)	(0.132)

atively correlated with both construction and changes in house prices. That result is due to the covariance of employment with changes in income and the national employment-population ratio.[24]

Columns 1 and 6 of table 3 decompose the variation of construction and changes in house prices into portions explained by each set of independent variables from the regressions reported in columns 1 and 3 of table 2. All of the national variables combined explain about as much of the overall variation in construction as the local time-varying factors. Moreover, the national factors account for even more of the variation in house price changes than the local

suggests that changes in prices of construction materials are not entirely exogenous, results are similar when this variable is excluded.

24. When both of these other variables are excluded, an increase in aggregate employment has a significantly positive correlation with construction and a negative but small and insignificant correlation with changes in house prices.

Table 2 (continued). Determinants of Construction and Changes in House Prices[a]

	Construction$_{it}$		*Δ Ln(Price$_{it}$)*	
Variable	*OLS*	*IV*	*OLS*	*IV*
Industry-weighted ΔLn(Employment$_{it}$)	0.091	-0.129	2.362**	0.452
	(0.116)	(0.139)	(0.834)	(0.587)
Industry-weighted ΔLn(Employment$_{it-1}$)	0.126	0.275	-1.147	-1.279
	(0.086)	(0.313)	(0.864)	(1.439)
Detrended employment/population$_{it-1}$	0.090**	-0.067	0.222**	0.499
	(0.013)	(0.079)	(0.066)	(0.473)
Construction$_{it-1}$		1.281		6.582
		(0.972)		(4.276)
Construction$_{it-2}$		-0.095		-4.520**
		(0.303)		(2.156)
ΔLn(Price$_{it-1}$)		0.076		-0.067
		(0.114)		(0.675)
ΔLn(Price$_{it-2}$)		0.061		0.873*
		(0.047)		(0.439)
Vacancy rate$_{t-1}$		0.004		-0.096
		(0.054)		(0.553)
MSA fixed effects	Yes	No	Yes	No
Sample period	1981–2006	1987–2006	1981–2006	1987–2006

a. All nominal variables except the mortgage rate are deflated by the consumer price index. The mortgage rate is deflated using 10-year inflation expectations from the Philadelphia Fed survey. Local income and employment/population variables are expressed as deviations from their national counterparts. The trends in the local employment/population ratios are linear estimates from 1969 to 2005, and the national trend is from 1969 to 2006. The IV regressions are estimated from the change in all dependent and independent variables in the OLS specification. The instruments for the lagged changes in construction and acceleration in house prices are the third and fourth lags of construction and the change in house prices. The F statistics for the test that the instruments can be excluded from the first-stage regression are 13.1, 5.9, 5.0, and 18.1 for the first and second lagged changes in construction and the first and second lagged acceleration in house prices, respectively. Standard errors are reported in parentheses and are clustered by year. *Significant at the 10 percent level; **significant at the 5 percent level.

variables. That result is especially surprising because the model simulations reported by Glaeser and Gyourko (2007) and Van Nieuwerburgh and Weill (2006) both use changes in local income or wages to calibrate the local productivity shocks that drive their models, suggesting that local income shocks should account for a large share of the variation in housing market outcomes. A possible explanation for that result is that their models provide a good description of how shocks to housing demand are perpetuated through housing market dynamics but that they do not distinguish between different potential sources of the shocks.

The unexplained variation in each of these dependent variables reflects a myriad of excluded time-varying factors—national and local—that influence housing markets. Although slow-moving local factors are largely captured by the metropolitan fixed effects, many other local shocks are not. If the unex-

Table 3. Fraction of Annual Variation Explained by National and Local Economic Conditions[a]

	$Construction_{it}$					*$\Delta Ln(Price_{it})$*				
Contribution of variable	*OLS (1)*	*IV (2)*	*OLS (3)*	*OLS (4)*	*OLS (5)*	*OLS (6)*	*IV (7)*	*OLS (8)*	*OLS (9)*	*OLS (10)*
Adjusted R^2	0.74	n.a.	0.84	0.86	0.82	0.19	n.a.	0.44	0.47	0.40
Contribution										
MSA fixed effects	0.59	n.a.	0.58	0.36	0.58	0.04	n.a.	0.04	0.04	0.04
Local time-varying conditions alone	0.04	0.08	0.02	0.00	0.03	0.06	0.03	0.02	0.01	0.03
Local conditions * MSA characteristics				0.02	n.a.				0.04	n.a.
National conditions alone	0.04	0.14	0.01	0.01	0.04	0.12	0.25	0.08	0.07	0.11
National conditions * MSA characteristics			0.11	0.07	n.a.			0.29	0.26	n.a.
National conditions * each common factor of MSA characteristics										
Factor 1					0.02					0.05
Factor 2					0.01					0.03
Factor 3					0.00					0.03
Factor 4					0.00					0.03
Factor 5					0.01					0.02
Factor 6					0.01					0.01
Factor 7					0.01					0.01
Factor 8					0.00					0.01
Factor 9					0.00					0.01
Factor 10					0.00					0.00
Factor 11					0.00					0.00
Sample period	1981–2006	1987–2006	1981–2006	1981–2006	1981–2006	1981–2006	1987–2006	1981–2006	1981–2006	1981–2006

a. Each cell below the first row reports the partial sum of squares of the named combination of variables relative to the total sum of squares. The rows do not sum to the R^2 of the regression due to the covariance among the independent variables. Columns 1, 2, 6, and 7 correspond to the regressions reported in columns 1, 2, 3, and 4 of table 2, respectively. The metropolitan area characteristics include all of the variables listed in table 1. The eleven factors are linearly independent common factors of the MSA characteristics.

plained variation is due primarily to omitted local factors, the analysis above would underestimate the contribution of local shocks. To investigate this conjecture, columns 2 and 4 of table 2 include lagged values of construction, changes in house prices, and the vacancy rate of existing homes.[25] These variables reflect many local economic conditions that are not otherwise observable, and therefore they may be better proxies for local conditions than the relatively more exogenous variables discussed above. The sample period for these regressions is restricted to 1987–2006 because of the limited availability of vacancy rate data, but the change in the sample period does not materially affect the coefficient estimates. Because the coefficients of lagged endogenous variables are biased in panels with fixed effects, I estimate the regressions in changes and instrument for the lagged changes in construction and house prices with their lagged levels.[26]

Columns 2 and 6 of table 3 report the contributions of the national and local time-varying factors to the variation in construction and changes in house prices using this instrumental variable specification. Even after including all of the additional information on local housing market conditions, the local variables still explain less of the total variation in construction and house prices than the aggregate variables. Of course, the large amount of unexplained variation in both dependent variables still could be related to other unobserved local shocks. Nevertheless, even if all of the unexplained variation were due to local shocks, the national variables would still explain a nontrivial portion of both outcomes.

Geographic Differences in the Effect of National Economic Conditions

In addition to the average effect of national economic conditions on housing market dynamics, the initial decomposition suggests that aggregate shocks also may affect the dispersion of housing market outcomes through their differential impact across metropolitan areas. Therefore, I interact all of the national conditions in the base specification from columns 1 and 3 of table 2

25. The vacancy rate is a proxy for the inventory of unsold new homes, which reflects the state of the housing cycle. Metropolitan area vacancy rates are available only for the seventy-five largest areas. For the remaining metropolitan areas, I impute values based on a weighted average of state-level vacancy rates. Although Hwang and Quigley (2006) emphasizes the importance of vacancy rates in local housing market dynamics, I do not include them in the base specification because they are available only for a shorter time period and including them does not significantly alter the results.

26. Because these specifications model the *acceleration* in prices and quantities, the coefficient estimates are substantially noisier than the comparable specification in changes. Results are similar when these specifications are estimated using OLS instead of instrumental variables.

with the initial metropolitan area characteristics described previously. Columns 3 and 8 of table 3 report the contributions of the aggregate variables, interactions terms, and local variables to the overall variance in construction and changes in house prices. The interaction terms explain 11 percent of the variation in construction and 29 percent of the variation in changes in house prices, a substantially greater amount than the contribution from local economic conditions or even national conditions by themselves. To assess whether the effects of local economic conditions also vary across locations, columns 4 and 9 include interactions of local time-varying conditions with metropolitan area characteristics. However, the local interaction terms explain very little of either outcome.

Although the interaction of national economic conditions and MSA characteristics explains a substantial portion of local housing market dynamics, a large degree of colinearity between metropolitan area characteristics makes many of the individual coefficient estimates imprecise and difficult to interpret. Moreover, a set of random variables that is large enough can appear to explain any outcome, even if the true effect of each one is zero. To address these concerns, I use factor analysis to reduce the MSA characteristics into linearly independent components, with the goal of identifying a small number of factors that reflect differences in the elasticity of housing supply or demand across locations. This technique creates a set of orthogonal factors that allow each MSA characteristic to be described by a linear combination of the factors, thereby reducing the entire set of characteristics into a smaller set of common components. I find eleven factors with an eigenvalue greater than 1. Columns 5 and 10 of table 3 report the contribution of each of these factors to the variance in construction and changes in house prices. The first factor clearly makes the largest contribution to the variation in both construction and changes in house prices, while the second through fifth factors also make modest contributions.

Table 4 reports the factor loading on each of the five factors that appear most relevant to housing market fluctuations. The first factor has large positive weights on the initial density, fraction of water area, and the near ocean coast indicators, suggesting that metropolitan areas with a large value of this factor are likely to have an inelastic housing supply. In fact, as shown by the two bottom rows of the table, this factor is negatively correlated with average construction in a metropolitan area and positively correlated with the average change in house prices. Not surprisingly, metropolitan areas with the highest values of this factor include Honolulu, San Francisco, and New York.

Table 4. Factor Loadings on Metropolitan Area Characteristics[a]

MSA characteristic	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
Water area/total area	0.846	-0.045	0.109	-0.201	0.090
Housing units/kilometer^2 in 1980	0.637	0.093	0.101	-0.174	-0.280
Near ocean coast	0.747	-0.074	0.245	0.450	0.114
Ln(Income per capita) in 1980	0.313	0.499	-0.092	-0.037	-0.286
Fraction of population with a college degree in 1980	-0.090	0.113	0.124	0.100	0.059
Fraction of employment in					
Manufacturing	-0.070	0.015	0.091	-0.138	-0.769
Oil and gas	-0.080	0.237	-0.210	0.083	-0.009
Mining	-0.428	0.137	0.064	0.125	0.021
Finance, insurance, and real estate	0.101	-0.076	0.172	0.100	0.178
Professional services	0.131	-0.148	-0.096	0.019	0.112
Leisure and hospitality services	0.124	0.046	-0.144	0.084	0.052
Education and health services	0.124	0.234	0.443	-0.121	0.467
Information services	-0.038	0.095	-0.153	-0.015	0.249
Other services	-0.066	-0.077	-0.239	-0.058	0.707
Transportation	0.323	0.009	-0.151	0.047	0.011
Wholesale trade	-0.170	0.016	-0.154	-0.070	-0.074
Retail trade	0.020	0.023	-0.048	0.009	0.874
Utilities	0.028	0.167	0.248	0.110	0.058
Census division					
New England	0.205	0.022	1.035	0.205	-0.323
Middle Atlantic	0.024	-0.011	-0.333	0.301	-0.220
East North Central	0.031	0.152	-0.153	-1.045	-0.040
West North Central	-0.362	0.118	0.074	0.135	-0.045
South Atlantic	0.172	-0.897	-0.157	0.240	0.064
East South Central	-0.135	0.158	0.096	0.156	-0.084
West South Central	0.017	-0.048	0.091	0.021	-0.052
Mountain	-0.446	0.028	0.036	-0.031	0.131
Pacific	0.277	0.573	-0.228	0.238	0.302
Correlation with					
Average MSA construction, 1981–2006	-0.0023** (0.0011)	-0.0043** (0.0010)	-0.0023** (0.0011)	0.0038** (0.0010)	0.0026** (0.0011)
Average MSA change in house price, 1981–2006	0.0069** (0.0011)	0.0039** (0.0013)	0.0012 (0.0013)	0.0061** (0.0012)	0.0023* (0.0013)

a. Factor analysis of the MSA characteristics named in the rows yielded eleven linearly independent factors with an eigen value greater than 1. The "near ocean coast" dummy variable indicates whether the most densely populated county within the metropolitan area is within 80 kilometers of the Atlantic, Pacific, or Gulf coasts (Rappaport and Sachs 2003). This table lists the five factors that display the strongest correlation with construction and changes in house prices (in the order of the fraction of total variation that they explain). The two bottom rows report coefficient estimates from separate regressions of average construction or house price changes in each MSA on the factor named in the column. Standard errors are reported in parentheses. *Significant at the 10 percent level; **significant at the 5 percent level.

The second factor highlights areas that have relatively high incomes and that are located in the Pacific division but that are not especially dense or near water. Examples of locations with high values of factor 2 include Bakersfield, Napa, and San Jose, California. Although those locations do not appear to have an especially constrained supply of land, they may have government regulations that constrain residential construction because they experienced relatively low construction and high house price appreciation over the sample period.

The third factor has high weights on education and health service employment and on the New England division, highlighting metropolitan areas such as Boston, Providence, and Hartford. These locations tend to have had lower average construction over the sample period, suggesting that they may have a constrained housing supply, although this factor is not significantly related to larger price increases.

The fourth factor has a negative weight on density and water area, suggesting that locations with a high value of this factor have an elastic supply of land. However, this factor is positively correlated with both average construction and the average change in house prices, implying that these locations may have experienced comparatively large increases in demand over the sample period that offset limits on the supply of land. Salinas and Santa Barbara, California, are among the metropolitan areas with the highest values of this factor.

Finally, the fifth factor highlights less dense locations with a low share of manufacturing and a high weight on education and health, "other" services, and retail trade employment.[27] These characteristics likely signal high-demand locations, a conjecture that is supported by their positive correlation with both construction and house price increases over the period. Pueblo, Colorado, and Washington, D.C., are examples of locations with high values of this factor.

Table 5 reports the coefficient estimates of the interactions of these five factors with each of the national economic conditions. Most of the interaction terms are significant, showing that geographic differences in housing supply and demand alter the effect of a national shock. For example, an aggregate shock to income results in less construction and larger price increases in locations with a high value of the first factor, which further supports the conjecture that these locations have an inelastic housing supply. However, not all of the interactions are so easily interpretable, perhaps due to the covariance of the national conditions with one another. Nevertheless, on balance these common factors appear to provide a succinct way to categorize metropolitan areas into groups with similar housing market dynamics. As shown in table 6, the interaction of these factors with national economic conditions explains an additional 4 percent of the variation in construction and 18 percent of the variation in house price changes. Moreover, the relationship between the factors and average construction and house price changes in each location is absorbed by the MSA fixed effects. Columns 2 and 4 of table 6 report the result of including the val-

27. The "other service" employment category includes all services except professional, leisure, education, health, and information services, such as business and personal services.

Table 5. Interactions of National Economic Conditions with Common Metropolitan Area Factors[a]

	Construction$_{it}$						*$\Delta Ln(Price_{it})$*					
Variable	*Baseline*	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	*Baseline*	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*
National												
Fixed mortgage rate$_t$	-0.120**	0.041**	0.041**	-0.021	-0.031**	0.039**	-1.271**	0.654**	0.102	0.007	0.247	0.431
	(0.032)	(0.017)	(0.016)	(0.021)	(0.015)	(0.013)	(0.470)	(0.275)	(0.225)	(0.233)	(0.177)	(0.298)
Fixed mortgage rate$_{t-1}$	0.073**	0.052**	0.051**	0.014	-0.033	0.041**	-0.047	-0.458**	0.012	0.224	-0.556**	-0.214
	(0.030)	(0.022)	(0.016)	(0.015)	(0.023)	(0.012)	(0.312)	(0.219)	(0.107)	(0.185)	(0.150)	(0.197)
ΔLn(Price of construction materials$_t$)	0.033	0.029**	0.038**	0.002	-0.052**	0.029**	0.362*	0.301**	0.214*	-0.190*	0.137	0.259**
	(0.021)	(0.013)	(0.010)	(0.005)	(0.010)	(0.008)	(0.201)	(0.110)	(0.116)	(0.097)	(0.082)	(0.099)
ΔLn(Price of construction materials$_{t-1}$)	0.007	-0.005	0.028**	0.018	-0.035**	0.020**	-0.052	-0.029	0.073	-0.352**	-0.132	0.488**
	(0.019)	(0.014)	(0.011)	(0.011)	(0.009)	(0.009)	(0.201)	(0.094)	(0.121)	(0.083)	(0.087)	(0.085)
ΔLn(Income/capita$_t$)	0.021	-0.042**	-0.013	-0.011	0.049**	-0.009	0.888**	0.256*	-0.010	0.028	0.448**	0.045
	(0.028)	(0.018)	(0.013)	(0.013)	(0.016)	(0.010)	(0.266)	(0.146)	(0.127)	(0.153)	(0.084)	(0.123)
ΔLn(Income/capita$_{t-1}$)	0.044	-0.033**	0.003	-0.031**	0.024	0.004	0.787**	0.419**	0.016	0.145	0.455**	0.175
	(0.030)	(0.015)	(0.015)	(0.011)	(0.015)	(0.014)	(0.243)	(0.122)	(0.084)	(0.099)	(0.089)	(0.126)
ΔLn(Employment$_t$)	-0.199**	-0.078**	-0.058*	0.037*	0.082**	-0.013	-2.395**	-2.473**	-1.087**	-0.407	-1.302**	-0.069
	(0.066)	(0.036)	(0.028)	(0.021)	(0.032)	(0.023)	(0.510)	(0.279)	(0.236)	(0.261)	(0.190)	(0.253)
ΔLn(Employment$_{t-1}$)	-0.054	-0.005	-0.055**	0.007	0.044*	-0.042*	-0.185	-0.223	-0.384**	0.310*	-0.029	-0.569**
	(0.047)	(0.024)	(0.025)	(0.019)	(0.022)	(0.021)	(0.367)	(0.712)	(0.171)	(0.156)	(0.164)	(0.163)
Employment/population$_t$	0.398**	0.236**	0.059**	-0.046	-0.197**	0.091**	2.147**	2.757**	1.938**	0.562	0.977**	-0.213
	(0.070)	(0.063)	(0.042)	(0.031)	(0.048)	(0.039)	(0.707)	(0.521)	(0.382)	(0.547)	(0.325)	(0.471)
Employment/population$_{t-1}$	-0.344**	-0.148**	-0.083*	0.101**	0.060	-0.031	-2.157**	-2.309**	-1.102**	-1.157**	-1.173**	0.742*
	(0.073)	(0.069)	(0.047)	(0.033)	(0.053)	(0.041)	(0.693)	(0.526)	(0.469)	(0.481)	(0.345)	(0.435)
ΔLn(CPI$_t$)							1.252**	-0.137	-0.196	-0.217	0.423**	-0.104
							(0.299)	(0.150)	(0.162)	(0.133)	(0.107)	(0.186)
Local												
ΔLn(Income/capita$^i_{t-1}$)	0.039**						0.464**					
	(0.015)						(0.149)					
Industry-weighted ΔLn(Employment$_{it}$)	0.149						2.633**					
	(0.187)						(1.109)					
Industry-weighted ΔLn(Employment$^i_{t-1}$)	0.042						-0.850					
	(0.155)						(0.909)					
Employment/ population$_{it-1}$	0.098**						0.217**					
	(0.013)						(0.035)					

a. Each panel shows the coefficient estimates from a single regression. The "baseline" columns show the level effect of each national variable and the remaining columns show the estimated interaction of the national variable with the factor named in the column heading. The factors are identified from factor analysis of the metropolitan area characteristics named in table 1. All nominal variables are deflated by the consumer price index. Local income and employment/population variables are expressed as deviations from their national counterparts. The employment/population ratios are detrended using a linear trend from 1969 to 2005. Standard errors are reported in parentheses and are clustered by year. *Significant at the 10 percent level; **significant at the 5 percent level.

Table 6. Fraction of Annual Variation Explained by National Economic Conditions, Local Economic Conditions, and Factors of MSA Characteristics[a]

	Construction$_{it}$		*ΔLn(Price$_{it}$)*	
Contribution of variable	*(1)*	*(2)*	*(3)*	*(4)*
Adjusted R^2	0.80	0.42	0.37	0.37
Contribution				
MSA fixed effects	0.58	n.a.	0.04	n.a.
MSA factors	n.a.	0.22	n.a.	0.02
National conditions alone	0.04	0.08	0.12	0.12
National conditions * MSA factors	0.04	0.05	0.18	0.18
Local time-varying conditions alone	0.03	0.09	0.04	0.04

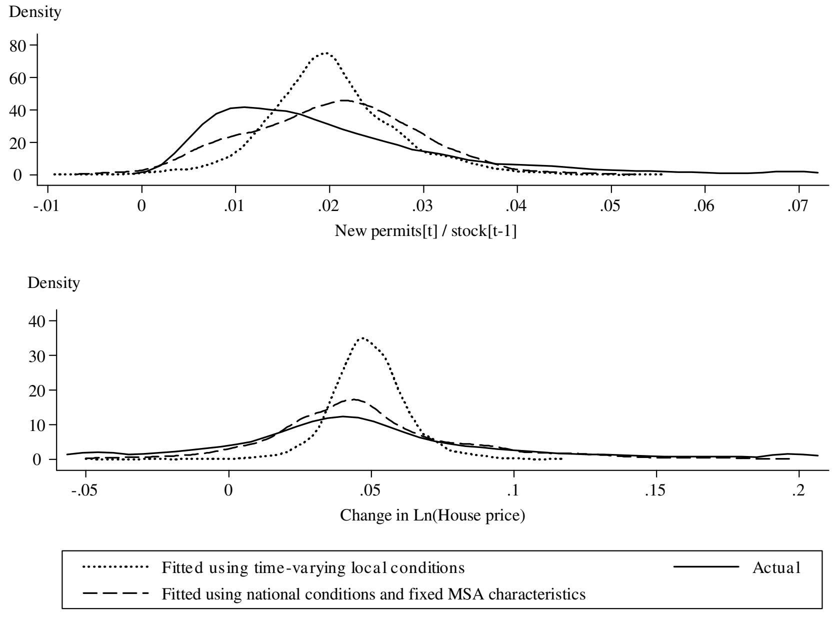
a. Each cell below the first row reports the partial sum of squares of the named combination of variables relative to the total sum of squares. The rows do not sum to the R2 of the regression due to the covariances among the independent variables. Columns 1 and 3 correspond to the regressions reported in table 5. The metropolitan area factors are the five most important factors identified from factor analysis of the metropolitan area characteristics named in table 1.

ues of the five factors independently, which can be identified only by excluding the MSA fixed effects. Taken together, the MSA factors, national economic conditions, and their interactions explain about one-third of the variation in both construction and changes in house prices.

As a final illustration of the importance of the aggregate variables, I predict the value of construction and the change in house prices for each metropolitan area in every year using only information on national economic conditions, local economic conditions, and the five factors identified in the analysis above. Because the MSA fixed effects embody trends in city sizes or house prices that would not be known at the beginning of the sample period, I use the specification that excludes these fixed effects (reported in columns 2 and 4 of table 6). Thus the predicted values of this regression can be interpreted as the evolution of construction and house prices that would have been anticipated in 1980 if the changes in national and local economic conditions over the next 25 years had been known.

The dashed line in the upper panel of figure 3 shows the distribution of the predicted values of construction based on national economic conditions, the factors, and their interactions. The dotted line depicts predicted values using only time-varying local economic conditions. For comparison, the solid line shows the actual distribution of construction over the sample period. The lower panel displays analogous results for changes in house prices. The local shocks predict a much narrower distribution of changes in house prices than that which occurred, while the predictions based on national economic conditions and initial MSA characteristics match the actual outcomes much more closely. The same qualitative result holds for construction, although the realized distribution of construction is considerably wider than predicted by either type of

Figure 3. Distribution of Actual and Predicted Values of Construction and Changes in House Prices[a]



Source: Author's calculations.

a. Sample is a balanced panel of 115 metropolitan areas. Changes in house prices are from the OFHEO repeat-sales price indexes and permits are from the Census Bureau. See the text for a description of the sample and data definitions and for the calculation of the predicted values.

shock. Thus, a notable portion of the differences in construction across locations remains unexplained. Despite the imperfect fit of these predicted values, they demonstrate clearly that the combination of national economic conditions and initial metropolitan area characteristics has contributed to the dispersion in housing market outcomes across metropolitan areas over the past 25 years.

Conclusion

Large geographic differences in residential construction and house prices have led many researchers to focus on the local aspect of housing markets. This paper provides a new perspective on that heterogeneity by showing that national economic conditions—such as mortgage rates and growth in aggregate income—play out differently across different types of metropolitan areas. Specifically, the characteristics of a metropolitan area in 1980 shaped the effects of aggregate variables on construction and changes in house prices over the subsequent 25 years. Those characteristics likely reflect differences in the elasticity of supply and demand, although more work is needed to investigate whether they have a causal effect on housing market outcomes or whether they simply reflect other unobservable factors that affect housing markets. After the differential responses across locations are accounted for, national economic conditions explain a nontrivial portion of the annual variation in both construction and changes in house prices from 1981 to 2006.

Another important feature of local housing markets is that the average rate of construction has varied considerably across metropolitan areas, while differences in changes in house prices tend not to persist. Heterogeneity in the average amount of construction across locations exceeds the differentials predicted by the initial metropolitan area characteristics in this analysis, suggesting that further work is necessary to understand the factors driving the divergence in city size. Possible explanations related to trends in housing demand include secular increases in the amenity value of nice weather[28] and growth in urban amenities that have made large cities increasingly more attractive.[29] To the extent that housing supply regulations are not fully captured by the MSA characteristics included in this analysis, the relative ease of obtaining a permit to build new housing also may have contributed to the unexplained persistent differences in construction.[30]

Finally, the types of national and local economic conditions that I consider in this analysis are far from the only factors that affected housing markets during the sample period, and more work is needed to identify the major determinants of housing supply and demand and how they have changed over time. For example, a relaxation of mortgage lending standards in 2004 and 2005, signaled by a surge in issuance of subprime and near-prime mortgages, may have boosted housing demand nationwide in those years, while new restrictions on subprime credit availability may have reduced housing demand more recently.[31] House price expectations, which likely vary considerably both across locations and over time, also may have had a considerable influence on house prices and new construction in the past several decades.[32]

28. Rappaport (2007).
29. Glaeser and Gottlieb (2006).
30. Glaeser and Tobio (2007).
31. Pavlov and Wachter (2007). Himmelberg, Mayer and Sinai (2005) note that looser restrictions on access to credit did not appear to raise house prices relative to rents, but their analysis ends in 2004.
32. Case and Shiller (2003); Mishkin (2007).

APPENDIX

Table A-1. Fraction of Annual Variation Explained by MSA and Year Fixed Effects, 1981–2006[a]

	Construction				Δln(Price)	
	All MSAs (361)		*Balanced panel (115)*			
Fixed effect	*All permits*	*Single-family*	*All permits*	*Single-family*	*All MSAs (361)*	*Balanced panel (115)*
MSA	0.56	0.65	0.54	0.67	0.07	0.05
Year	0.03	0.03	0.09	0.05	0.13	0.15
Residual	0.41	0.32	0.37	0.28	0.80	0.79
MSA	0.31	0.34	0.19	0.21	0.03	0.02
Year alone	0.02	0.02	0.05	0.03	0.10	0.09
Year * MSA characteristics	0.14	0.10	0.21	0.16	0.37	0.44
Residual	0.27	0.22	0.16	0.11	0.43	0.35

a. Each cell reports the partial sum of squares of each independent variable relative to the total sum of squares. The contributions in the lower panel do not sum to 1 due to the covariances between the MSA characteristics and the MSA fixed effects. The MSA characteristics are listed in table 1. The group of all available metropolitan areas is a balanced panel for construction but unbalanced for changes in house prices.

Comments

Grace Wong: Raven Saks's paper examines the puzzle of the widening distribution of the housing stock and housing values in different geographic locations. Using data from 1980–2005, the author argues that the disparities observed are not necessarily solely attributable to idiosyncratic local shocks, as previous research has discussed. Instead, it is important to consider the effect of national economic shocks when analyzing the annual changes in housing stock and values in different MSAs.

Three main questions come to mind when one considers the importance of the national housing market, some of which the author addresses carefully. The first question is whether local idiosyncratic shocks explain the dramatic changes in the distribution, as previous research has emphasized. The answer from this paper seems to be a resounding no, because persistently different local shocks are needed to account for a persistent flattening of the housing stock and price distribution. The second question that arises is whether different housing markets have different responses to the same national shocks. That is the question that the paper sets out to investigate. It presents new evidence for the significant variations that appear in local responses to economic shocks and sheds some light on exactly how different those responses are across various geographic locations. The third question of interest, which the paper does not directly address, regards events prior to 1980: more precisely, are we simply witnessing a distribution change specific to the period from 1980 to 2005, or is it part of a bigger cycle? Figure 1 in the paper seems to suggest that downturns actually decrease the spatial distribution. It will then be more useful to examine the spread of the distribution across a longer time horizon, or at least over the period of a housing market downturn.

The main results from the paper are summarized as following: A standard decomposition of the construction trends by controlling for only MSA and year fixed effects reveals that most of the variations (67 percent) are explained by MSA fixed effects while year fixed effects explain only 5 percent. As for variations in price changes, only 5 percent can be accounted for by MSA fixed effects and 15 percent by year fixed effects. A novel approach in this paper adds an interaction between year fixed effects and the "initial" (1980) MSA characteristics to the analysis. These interaction terms reduce the explanatory power of the MSA fixed effects to 21 percent and that of the year fixed effects to 3 percent. A similar, though much smaller, reduction can also be seen in the price change regressions. The author draws three conclusions from those results:

—Dramatically different growth rates are seen for construction, but not for prices, by MSA.

—The nationwide component in the economic shocks explains little of the observed variance over time.

—Initial characteristics help explain a significant portion of housing market dynamics.

Another way to interpret the results is to note that national time trends (year fixed effects) do not have as much explanatory power relative to MSA-specific time trends (year fixed effects interacted with MSA initial conditions). The more useful initial conditions include industrial composition, geographic location (census division), topography (percentage of water area), density, income, education, and proximity to an ocean coast. If we interpret the MSA fixed effects as MSA-specific growth rates, the results also suggest that the growth rates are a function of the initial conditions with respect to the above state-specific characteristics. By singling out a group of characteristics for a meaningful and useful level of aggregation, the author has made a significant contribution to the literature, which consists of either national or city-level analysis but little work on the possibility of intermediate levels of aggregation.

To use the results for predictive purposes, however, we need to explore whether the level of aggregation remains stable across time. This goes back to the third question mentioned earlier. While the choice of the initial conditions (in 1980) is somewhat arbitrary and probably imprecise, the characteristics concerned are mostly slow-moving variables. Nonetheless, a useful exercise will be to experiment with different years as the "initial" condition. Specifically, the simple decomposition exercise can be done by 8-year periods, with the start of the period defining the initial condition.

Another issue that arises when one tries to interpret the results comes from the choice of the left-side variable. Throughout the paper, the author focuses on construction levels. However, because vacancy data are unavailable, new construction approximates changes only in the housing stock, not exactly "quantity." It can be beneficial to the paper to expand on the significance of the construction level and under what circumstances the housing market adjusts through the vacancy rate or new construction. My best guess is that the nature of the shock and the condition and/or characteristics of the existing housing stock play a role.

The choice of construction data also is potentially problematic. The PPI is used to indicate construction costs because it excludes the labor cost component, which can vary significantly by location. However, material costs also vary by region. Therefore, it will be helpful to explore other indicators of construction costs and their similarities and differences.

Since the focus of the paper is on the prominence of the national housing market, it is worthwhile to think about what the evidence presented in the paper tells us about national shocks and local shocks. It is important to point out that this paper shows national conditions to explain at least as much as local conditions. Together, they account for 10 to 20 percent of the variations. The economic conditions examined include income, employment, and the industrial composition of employment and also the mortgage interest rate and construction costs.

To understand the results, it is useful to take a step back and consider the nature of the shocks to the economic conditions. Intuitively, one might think that changes in mortgage interest rates and construction costs naturally include a national component due to Federal Reserve policies and global material market conditions. National employment, on the other hand, can be interpreted as the aggregation of local employment. Local employment directly affects local housing demand, while regional or national shocks affect total housing demand through substitution or migration. Presumably, regional shocks will have a bigger effect on local housing conditions than national shocks. Allowing for a regional component might helpful in understanding the comparison of local and national shocks. Ultimately, it will be useful to draw a distinction between conditions such as mortgage interest rates and the level of employment instead of mechanically breaking down changes in economic conditions into national trends and local "shocks."

An alternative approach is to further break down national trends and deviations from them as well as local trends and deviations (which can be interpreted as idiosyncratic local shocks). In this paper, local conditions are defined relative to national averages. This framework of analysis might be less logical when national economic conditions are in fact an aggregation of local conditions.

In addition to the issues mentioned above, there are others that prevent a straightforward interpretation of the results in the paper. One problem is that of omitted unobserved variables, which the author addresses by including lagged terms, which is likely to help capture slow-moving unobserved variables. However, more volatile conditions, such as local amenities, public services, transportation costs, and crime are missed. It would be useful to gauge how important those variables are from the literature of hedonic pricing models. Specifically, taxes are omitted from the model. Local school taxes and income taxes can be substantial and volatile, and more important, they are not accounted for by MSA fixed effects. A discussion of the expected nature of the resulting bias is crucial.

The author is well aware of potential endogeneity in the analysis resulting from the lack of a natural instrument for the various economic shocks, which affects both the interpretation and the validity of the results. This problem is likely to be more severe with respect to results related to local economic conditions. Using lagged variables as an instrument variable is unlikely to be a complete solution; it begs the question of whether using an alternative framework—for example, a simultaneous equation framework—would be more appropriate.

Aside from the differentiation between national and local shocks, this paper offers a new approach to aggregate geographical areas through a factor analysis. Variations in the way national conditions relate to construction and housing price changes are used to produce groupings of MSAs by economic conditions. Factors such as density and geographical characteristics are all shown to be of first-order importance in explaining housing market dynamics while factors such as income level are second-order conditions. Generally speaking, these results are consistent with an elasticity-driven explanation of local housing dynamics (see the model of "Superstar Cities" in Gyourko, Mayer, and Sinai 2006). To interpret the results as a causal effect, however, one needs to think harder about potential endogeneity issues. For example, it may be that during years when average employment is high, correlated but unobserved changes in accumulation of wealth occur for some demographic groups through their stock market investments, thus driving up local housing demand in areas with a higher concentration of stock market investors. Predicting housing market dynamics directly from employment data will in this case lead to incorrect conclusions.

There are three main takeaways from this paper:

—National indicators are somewhat helpful in accounting for construction and housing price variations.

—A useful way to approach differences in the evolution of housing market conditions is to group geographical areas by local characteristics.

—Elasticity-related characteristics are the most helpful in grouping MSAs.

These results shed light on how one should consider the differences between an aggregate analysis and a microanalysis of the housing market. Further work can be done to fill in the gaps unaddressed in this paper. While it is interesting to see a flattening of the construction and price distributions, we need to understand the underlying reasons and whether a consistent flattening of distributions is implied. Interestingly, Figure 1 in the paper demonstrates a tightening of the distributions between 2005 and 2006, which suggests that responses to negative shocks are inelastic. A useful addition to the literature would be a similar analysis over a period of a housing market downturn.

This is a very thoughtful paper that addresses an important question and provides novel evidence of spatial variations in reaction to shocks. To interpret and utilize the results, one needs to think more carefully about the definition of national and local conditions and about potential biases and endogeneity problems. The central result—that local housing markets react very differently to the same (national) shocks—seems to lend support to the claim that "real estate is local." It is then possible that the results in this paper diminish the importance of a national housing market.

Min Hwang: The saying "All real estate is local" is one of the favorite phrases of real estate agents, most likely because they want to emphasize the importance of hiring a real estate agent who possesses a great deal of information about the local housing market. The local nature of the real estate market appears to have been accepted by economists as well. Except for one study, Grenadier (1995), many studies have relied on local variables (usually income and employment) in making statistical inferences about regional housing market outcomes. Although it remains unclear what kind of local information is most useful for understanding the housing market, the local nature of the housing market itself is not difficult to check. The following table—which replicates Hwang and Quigley (2006), using a two-stage least squares approach with three-way error components in analyzing seventy-four MSAs from 1987–99—shows a decomposition of variance of housing prices and residential construction.

Percent

Component	*Housing price*	*New construction*
Idiosyncratic	30	27
MSA-specific	62	32
Time-specific	8	41

The table shows that the MSA-specific components dominate the variation in housing prices but that the effects of the three factors seem to have more or less similar magnitude for new construction.

Even though direct comparison of the results of the Saks paper in this volume and those of Hwang and Quigley (2006) is not possible due to differences in econometric methods and data coverage, some of the Saks findings are quite unexpected. In contrast to Hwang and Quigley, Saks finds that national factors, combined with MSA characteristics, seem to explain a substantial portion of the variation in housing prices. She also shows that, in contrast to housing prices, residential construction is driven mainly by local factors. It is not difficult to understand why local factors can be important in residential construction. Many developers are rather small and depend on local markets for labor, material, and capital. More importantly, there is a large variation in zoning and building restrictions across different metro areas. Therefore, it is at least plausible for housing supply to be driven by local rather than national factors. But it is not a straightforward matter to understand why national factors are more important in explaining the variation in housing prices, since many local factors that affect residential construction should also have an impact on housing prices. For the 115 MSAs studied during the sample period, it is possible that in the short run a combination of demand shocks dominated by national factors and high price elasticity for demand caused most of the adjustment to housing supply shocks to take place in terms of changes in quantity, not in price. In addition, it also is possible that shocks through national factors affecting housing prices tend to be highly persistent, but shocks through local factors tend to be rather short-lived.

But I think that there is a more important issue that needs to be better addressed: how do we identify and estimate local shocks orthogonal to national shocks? When one tries to decompose given shocks into different components, usually either a fixed effects approach (used in the paper) or a random effects approach (used in Hwang and Quigley) is employed. One of the key assumptions in the random effects approach is that all the error components are independent of each other. Even though it is a restrictive assumption, it also generates clear estimates of the contributions of individual components. Since the Saks paper relies mainly on the fixed effects approach, it is not easy to see how much of the variation in housing prices is due to local rather than national factors. Moreover, it is the interaction of year fixed effects with MSA characteristics that has a major impact on housing prices, which makes it even more difficult to understand the true contributions of individual components. At the same time, due to their time-varying and MSA-varying nature, it is not clear how the year effects interacted with initial MSA characteristics should be understood. Should they be understood as year effects with MSA-varying coefficients or MSA effects with time-varying coefficients? The author seems to understand them to be year effects due to national factors with MSA-varying coefficients. However, is such an interpretation warranted?

I think that the alternative interpretation is equally plausible. How can MSA effects have time-varying impacts on housing prices? There are many local variables, such as local macro variables (income, employment, industrial composition) and regulation-related variables such as zoning restrictions that may explain housing markets. Of the two groups, local macro variables do not seem to consistently explain a great deal of the variation in housing prices or in construction, at least not in the framework of constant parameters. On the other hand, regulation-related indicators do appear to explain a majority of the variation in housing prices, as confirmed by other studies. In fact, the regulation index was consistently the strongest predictor of housing prices in Hwang and Quigley (2006). However, it does raise another question. A high degree of regulation will raise land values and subsequently the house prices in a given area. But without restrictions on mobility, people can always move from an area with high living costs to an area with lower costs, which will tend to equalize house prices in different areas, everything else being equal. That indicates that the variables used to measure regulation might be indicators of another variable that is highly correlated with regulation.

Then what do regulation indicators capture? It may be either urban amenities in a broad sense, such as a tolerant social atmosphere, ethnic diversity, or cultural activities, or variables related to urban agglomerations that are not captured by local income and employment. If those variables have time-varying effects on housing prices, they will be captured in the year effects interacted with initial MSA characteristics. Therefore, it looks as if it is equally possible to interpret the results of the paper in another way: housing prices are driven by local factors, but their impacts are time-varying.

More important, in either interpretation, classical factor decomposition methods (both in fixed effects and in random effects) with fixed coefficients cannot sufficiently capture complex dynamic interactions among local housing markets, local economies, and the national economy. More flexible but appropriately specified empirical models with good micro foundations should be considered, which seems to be the most important point raised by Saks's paper in this volume.

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