Supplement to "Do households use home-ownership to insure themselves? Evidence across U.S. cities": Appendix

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S.1. Robustness checks for home-ownership and LTV effects

Here, we check for robustness in the impact of price levels and volatilities on ownership (Table S.1) and LTV (Table S.2). We report results for both OLS and instrumental variables (IV) (with land scarcity as the instrument) for volatilities measured using different windows (5 years, as in the main text, and 10 years also), for different year cross sections (2000, as in the main text, and 1990 also), and for different data sets for LTV (AHS and MIRS).

For home-ownership, the observed patterns are robust to choice of cross section, volatility window, and year. In each case, we see the strong negative relationships described in the main text. Looking at the OLS specification, the effect of price is very similar across years: a doubling of house prices is associated with a fall in the ownership rate of between 21 and 24 percentage points. The IV results are very similar. With regard to volatility, changing the window of measurement has little effect on the coefficients for each cross section. But the results do vary across years: the OLS effects are larger in 2000 and the IV effects are larger in 1990. Still, the reduced-form effect of the land-scarcity instrument (in the final row) is very similar across years.

In Table S.2, the estimated effects are remarkably similar in magnitude across the AHS and MIRS data sets for the 2000 cross section for all variables. In each case, there is a strongly significant negative effect, consistent with the main text. The results are not very sensitive to the chosen volatility window either. However, the effects on LTV in the 1990 cross section (as measured by MIRS), while negative, are all statistically insignificant. This is a result of smaller coefficients, rather than larger standard errors. In Figure S.1, we explore this further: we plot the estimated coefficients from reduced-form regressions of LTV (from the MIRS data) on land scarcity separately by year (over 1978–2008). The dashed lines are 95 percent confidence intervals. The effect has always been negative, though it was small and insignificant until the mid-1990s (averaging about -0.5). It has grown steadily since though, reaching almost -2 in 2008.

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TABLE S.1. Effects on home-ownership of price, volatility, and land scarcity.

Year Sample	2000			1990		
	OLS	IV	Obs.	OLS	IV	Obs.
Log house price	−0.235***	−0.254***	221	−0.214***	−0.233***	191
	(0.013)	(0.024)		(0.012)	(0.022)	
Volatility (5 yr. window)	−4.952***	−6.755***	221	−2.815***	−8.162***	153
	(0.402)	(0.795)		(0.228)	(2.132)	
Volatility (10 yr. window)	−4.378***	−5.689***	215	−2.630***	−13.390**	98
	(0.323)	(0.642)		(0.519)	(5.552)	
Land scarcity	−0.245***	–	221	−0.263***	–	191
	(0.032)	–		(0.036)	–	

Note: This table reports coefficients from linear cross-city regressions of the local home-ownership rate for both 2000 and 1990 on a range of variables: log house price, two measures of volatility (5 yr. and 10 yr. windows), and land scarcity. For the IV results, we use land scarcity as an instrument for prices and volatility. Note that 1990 has fewer observations because the set of MSAs in the census changed between 1990 and 2000. Local home-ownership rates are conditional on household characteristics, and are constructed as described in Section 2.1, using the IPUMS 5 percent census extracts of 1990 and 2000. We include volatility measures (constructed as described in Section 2.1) for both a 5 year window (i.e., 1995–2000 for 2000; 1985–1990 for 1990) and a 10 year window (1990–2000 for 2000; 1980–1990 for 1990). The 1990 samples are smaller beause the set of MSAs has changed between years. In addition, the samples for some volatility windows are smaller because the FHFA time series for prices are longer for some cities than others. All regressions are weighted by census sample counts. SEs are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

TABLE S.2. Effects on LTV of price, volatility, and land scarcity.

Data Set, Year	AHS, 2000			MIRS, 2000			MIRS, 1990		
	OLS	IV	Obs.	OLS	IV	Obs.	OLS	IV	Obs.
Log house price	−0.064***	−0.076***	42	−0.055***	−0.071***	25	−0.014	−0.021	25
	(0.011)	(0.020)		(0.009)	(0.014)		(0.012)	(0.018)	
Volatility (5 yr. window)	−0.995***	−1.830***	42	−1.153***	−1.695***	25	−0.241	−0.645	25
	(0.329)	(0.612)		(0.242)	(0.406)		(0.156)	(0.629)	
Volatility (10 yr. window)	−0.703***	−1.543***	42	−0.783***	−1.579***	25	−0.347	−0.908	25
	(0.262)	(0.547)		(0.215)	(0.485)		(0.268)	(0.864)	
Land scarcity	−0.072***	–	42	−0.078***	–	25	−0.028	–	25
	(0.023)	–		(0.019)	–		(0.026)	–	

Note: This table reports coefficients from linear cross-city regressions of local mean LTV ratio on a range of variables: log house price, two measures of volatility (5 yr. and 10 yr. windows), and land scarcity. For the IV results, we use land scarcity as an instrument for prices and volatility. The first set of columns corresponds to the AHS in 2000; here, LTV ratios are conditional on household characteristics and are constructed as described in Section 2.1. For the MIRS, we report estimates for both 2000 and 1990. We include volatility measures (constructed as described in Section 2.1) for both a 5 year window (i.e., 1995–2000 for 2000; 1985–1990 for 1990) and a 10 year window (1990–2000 for 2000). The FHFA data do not extend back sufficiently to calculate 10 year volatilities for 1990. All regressions are weighted by census sample counts. SEs are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

S.2. DISAGGREGATION OF PRICE AND VOLATILITY EFFECTS

Table S.3 provides the detail for a discussion in Appendix A. The idea is to show that the strong positive relationship between local land share and price levels/volatilities is entirely a composition effect: the land value component (as opposed to structure cost)

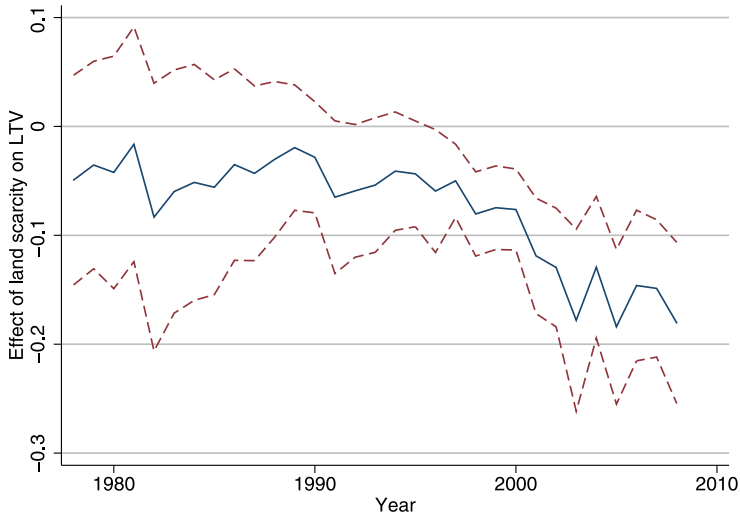

FIGURE S.1. Changing effect of land scarcity on LTV. The blue line gives estimated coefficients from OLS regressions of LTV (from the MIRS data) on land scarcity, separately by year (over 1978–2008). The dashed lines are 95 percent confidence intervals.

is larger and more volatile. The same is true when we instrument land share with land scarcity: the effect appears to be causal.

In Panel A of Table S.3, we regress price levels and volatilities—and their individual components—on land share for the 2000 cross section. This is based on the 42 MSA sample, for which we have the Davis–Palumbo land share data; in this sample, land share varies from 0.15 to 0.85. A 0.1 increase (a 10 percentage point increase) in the land share is associated with a 21 percent increase in local house prices. This effect is entirely due to variation in land value, rather than structure cost. Also, a 0.1 increase in the land share is associated with a 0.0081 increase in price volatility. The effect of land share on the volatilities of land value and structure costs are statistically insignificant. Evidently then, the positive relationship between overall price risk and land share is entirely due to a composition effect (land values are much more volatile than structure costs).

Panels B and C give the reduced form and two-stage least squares (2SLS) effects of land share on the disaggregated price levels and volatilities, where land scarcity is the instrument for land share. The IV effects in Panel C are qualitatively and quantitatively similar to the OLS effects in Panel A.

S.3. LAND-SCARCITY SLOPES FOR PARAMETRIZATION

In Section 4, we described the parametrization of the model. Our method is to compare cities with different scarcity of land, which we take as an exogenous variable. These cities differ in a number of dimensions that are important for the model: specifically, levels and volatilities of local house prices and wages, and local land share. In Table S.4, we report the OLS reduced-form estimates of these variables on land scarcity, our instrument. In the main paper, we use these estimates to characterize cities with high and low land scarcity; see Section 4 for further details.

TABLE S.3. Explaining cross-city variation in local price levels and volatilities.

	(1) Log HP	(2) Log LV	(3) Log SC	(4) Vol HP	(5) Vol LV	(6) Vol SC
			Panel A: OLS (2000)			
Land share	2.110***	4.594***	0.128	0.081***	−0.044	0.004
	(0.151)	(0.168)	(0.155)	(0.012)	(0.035)	(0.004)
Constant	11.239***	9.224***	11.505***	−0.006	0.100***	0.008***
	(0.072)	(0.080)	(0.074)	(0.006)	(0.017)	(0.002)
Observations	42	42	42	42	42	42
R-squared	0.830	0.949	0.017	0.519	0.037	0.022
			Panel B: Reduced Form (2000)			
Land scarcity	0.975***	2.076***	−0.008	0.052***	0.016	0.004
	(0.241)	(0.482)	(0.122)	(0.011)	(0.028)	(0.003)
Constant	11.888***	10.653***	11.565***	0.014***	0.075***	0.009***
	(0.088)	(0.175)	(0.044)	(0.004)	(0.010)	(0.001)
Observations	42	42	42	42	42	42
R-squared	0.290	0.317	0.000	0.350	0.008	0.033
			Panel C: IV (2000)			
Land share	2.075***	4.419***	−0.018	0.110***	0.034	0.008
	(0.246)	(0.276)	(0.255)	(0.021)	(0.060)	(0.007)
Constant	11.254***	9.302***	11.571***	−0.019**	0.065**	0.006**
	(0.112)	(0.126)	(0.117)	(0.010)	(0.028)	(0.003)
Observations	42	42	42	42	42	42
R-squared	0.829	0.948	0.000	0.449	0.000	0.000

Note: HP is house price; LV is land value; SC is structure cost. Price levels (Log **) are means over the four quarters of 2000. Volatility (Vol) is standard deviation over annual growth rates in prices (measured at the first quarter of each year) between 1995 and 2000. The instrument in IV columns is land scarcity. Observations are weighted by city size. SEs are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

TABLE S.4. Land-scarcity slopes for key parameters.

Dependent Variable	(1) Log House Price	(2) Log Wage	(3) House Price Volatility	(4) Wage Volatility	(5) Land Share
Land scarcity	0.966***	0.193***	0.036***	0.012***	0.470***
	(0.100)	(0.062)	(0.004)	(0.003)	(0.099)
Constant	11.760***	10.431***	0.015***	0.008***	0.306***
	(0.034)	(0.021)	(0.001)	(0.001)	(0.036)
Observations	221	221	221	221	42
R-squared	0.299	0.042	0.276	0.087	0.361

Note: Log house price is estimated for 2000 using data from the 5 percent census extract. Log wage is taken from metropolitan level data of 2000 from the BEA. House price volatility is the standard deviation over annual growth rates in prices (measured at the first quarter of each year) between 1995 and 2000, taken from the FHFA. Wage volatility is constructed in the same way using annual BEA data. Land share is taken from Davis and Palumbo (2008). In each case, the regressor is land scarcity (taken from Saiz (2010)). Observations are weighted by census sample size. SEs are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

TABLE S.5. Robustness of land-scarcity slope for house price volatility.

	(1)	(2)	(3)	(4)	(5)
Volatility Window	1995–2000	1990–2000	1985–2000	1985–2009	1990–2009
Land scarcity	0.036***	0.043***	0.049***	0.084***	0.094***
	(0.004)	(0.005)	(0.009)	(0.010)	(0.009)
Constant	0.015***	0.019***	0.030***	0.033***	0.027***
	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)
Observations	221	215	163	163	215
R-squared	0.276	0.269	0.156	0.308	0.322

Note: This table estimates cross-city OLS regressions of local house price volatility on land scarcity, where volatility is calculated using a different time window in each column. House price volatility is the standard deviation over annual growth rates in prices (measured at first the quarter of each year) over the reported time interval, taken from the FHFA. The results in the main text use the 1995–2000 interval in the first column, and this result matches column 3 of Table S.4. The sample size is smaller for intervals including earlier years, because the FHFA metropolitan sample has grown over time. Observations are weighted by census sample size. SEs are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

TABLE S.6. Robustness of land-scarcity slope for wage volatility.

	(1)	(2)	(3)	(4)	(5)
Volatility Window	1995–2000	1990–2000	1985–2000	1985–2009	1990–2009
Land scarcity	0.012***	0.011***	0.009***	0.010***	0.012***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.008***	0.012***	0.012***	0.014***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	221	221	221	221	221
R-squared	0.087	0.122	0.104	0.092	0.092

Note: This table estimates cross-city OLS regressions of local wage volatility on land scarcity, where volatility is calculated using a different time window in each column. Wage volatility is the standard deviation over annual growth rates in prices over the reported time interval, taken from the BEA. The results in the main text use the 1995–2000 interval in the first column, and this result matches column 4 of Table S.4. Observations are weighted by census sample size. SEs are given in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As a robustness exercise, Tables S.5 and S.6 report the land-scarcity slopes for house price volatility and wage volatility, respectively, varying the time window used to calculate volatility in each column. In each table, the first column (volatility window 1995–2000) gives the estimates used in the parametrization in the paper. The mean house price volatility grows significantly as the window is extended: the constant in the regression is more than double for the 1985–2009 window as compared to 1995–2000. The land-scarcity slope also grows with the volatility window, largely due to recent cyclicality: the slope approximately doubles when the boom and bust of the 2000s is included. For reference, if we changed our calibration sample to 1985–2000, the mean city by land scarcity would have as much house price volatility as the 75th percentile city does in the 1995–2000 calibration.We already know from the counterfactual section in the body of the paper that would have only a small effect on the model output, particularly with regard to home-ownership.

The coefficients on wage volatility are more robust to changes in the volatility window. The coefficient on land scarcity hardly changes at all across the columns of Table S.6, but, the constant does grow somewhat as the window is extended: it is almost twice as large for the 1985–2009 window, as compared to 1995–2000.

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