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Do Higher Land Costs for New Single-Family Housing Inhibit Economic Activity in U.S. Metropolitan Areas?

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Abstract

The price of a new home is greater if the land to put it on costs more. In many U.S. metropolitan areas, this generates the widely acknowledged equity concern that low- to moderate-income households spend disproportionately on housing. But high residential land prices translating into high single-family home prices may also generate the efficiency concern of discouraging new workers' entry into such areas or encouraging existing workers' exit. The result could be a decrease in economic activity. This research offers panel-data regression evidence in support of the existence of this adverse outcome. Perhaps these findings can raise the saliency of the needed state or federal government intervention to curtail the stringency of local residential land-use regulations. NIMBYs see these land-use regulations as in their jurisdiction's best interest, but as demonstrated here, such restrictions impose additional metro-wide economic concerns.

Keywords

affordable housing, residential land price, metropolitan area, economic outcomes, public policy

A September 2019 poll by the National Association of Home Builders (2019) indicated that nearly 8 out of 10 Americans believe that the United States suffers from a housing affordability crisis. Figure 1 offers support for this opinion based on an index of housing affordability for every U.S. county. In this figure, darker shades represent greater affordability, while lighter shades represent less. In 2019, the five metro areas with the highest household incomes needed to purchase the median-priced home with 20% down and a fixed 30-year mortgage, were San Jose ($259,000), San Francisco ($199,000), San Diego ($132,000), Los Angeles ($123,000), and Boston ($107,000). In contrast, the lowest were Pittsburgh ($38,000), Cleveland ($40,000), Oklahoma City ($41,000), Memphis ($41,000), and Indianapolis ($42,000).[1]

Understanding the economic hardship that high home prices impose on low- to moderate-income households in many metropolitan areas throughout the country, it is not surprising that over three quarters of Americans view the situation as a crisis. Many could also lament the inability to move to an unaffordable metropolitan area or the necessity of leaving such for a bigger or better home (Glaeser, 2020; Sisson, 2018). And, why would they not? The counties and metropolitan areas designated as less affordable in Figure 1 represent some of the most economically productive and amenity-laden locations in the country. There is no doubt that high demand to live in such locations contributes to the higher home prices observed there. But what if these higher home prices are also due in part to local governments that intentionally restrict the supply of land available for single-family homes within their jurisdictions?

The choice of a stringent local regulatory environment on residential land often results from existing homeowners' not-in-my-backyard-based (NIMBY) desire to maximize the value of their assets by preserving the character of their location and generating scarcity to its access (Gyourko & Molloy, 2015). However, the outcome of many jurisdictions pursuing this is a higher average home price in the entire metropolitan area that can lead to adverse external effects (Wassmer & Williams, 2021). Such effects include a constraint on potential new entrants' ability to afford a home in the area or an inducement toward mobility out of the area to renters desiring homeownership and to existing homeowners desiring bigger or better homes. These influences on mobility offer Americans a second motive for labeling their country's lack of housing affordability in many of its metro areas as a crisis warranting intervention—a crisis that restricts a burgeoning metropolitan economy's ability to attract and retain the labor necessary to continue its economic growth.

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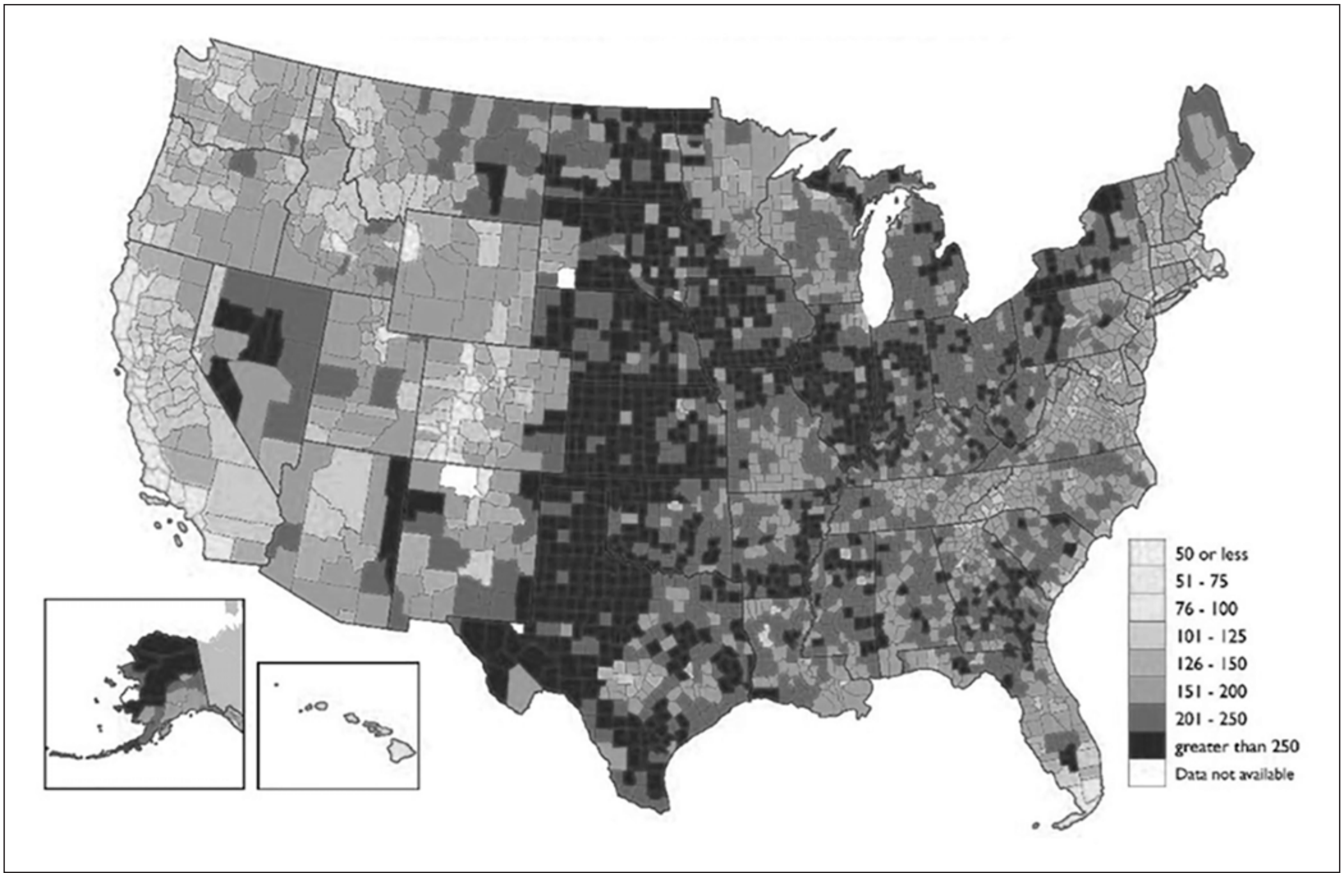

Figure 1. Housing affordability index in the United States, by county, 2014 through 2018.
Note. Housing affordability calculated such that a value of 100 indicates a household has exactly enough income to qualify for a 30-year mortgage on a median valued home assuming a 20% down payment and qualifying median household income of 25% of monthly payment. Calculation also uses 5-year average 30-year mortgage interest rate of 4.04% for 2014-2018. Therefore an index value of 200 indicates a household earning the median household income has 200% of income necessary to qualify for a conventional loan for 80% of the value of a median-priced home.
Source. Institute for Policy & Social Research, The University of Kansas; calculated using data from U.S. Census Bureau, 2014-2018 American Community Survey; Board of Governors of the Federal Reserve System; Freddie Mac. Available at https://ipsr.ku.edu/sdc/images/HousingAffordUS.jpg, permission for use granted by Xan Wedel of Kansas State Data Center.

In a *New York Times* editorial, Hsieh and Moretti (2017b) suggested such a premise. They argued that overly restrictive housing and land use regulation have severely constricted U.S. workers' ability to move to better lives in job markets where their labor is most needed. This lack of housing supply hurts both the immobile worker by obligating them to a lower standard of living and the metropolitan area to which they cannot migrate by moderating potential overall economic activity (gross domestic product [GDP]). Individuals writing for such diverse groups as the Heritage Foundation (Ligon, 2018), the Center for Housing Policy (Wardrip et al., 2011), and the U.S. Department of Housing and Urban Development (Gray, 2018) have all called for reforms that loosen local restrictions on housing supply. Even so, there exist only a few empirical tests of this hypothesis.

This article describes the empirical research undertaken to investigate the possibility that a higher price per acre of land available for new residential development diminishes labor availability to the area's economy. Such unsatisfied labor demand could reduce GDP, GDP per capita, or employment in such an area.

Literature Review

Glaeser and Gyourko (2003) described the economic logic that housing is more expensive in one area than another due to high demand for specific locations with desirable amenities and robust economic opportunities. The desire to live in these areas drives up residential land prices. Due to the supply of land near desirable locations, higher land prices result even without the imposition of local land use and housing regulations. Glaeser and Gyourko acknowledged this explanation of land value capitalization and built a case for the magnifying importance of controls that restrict the amount

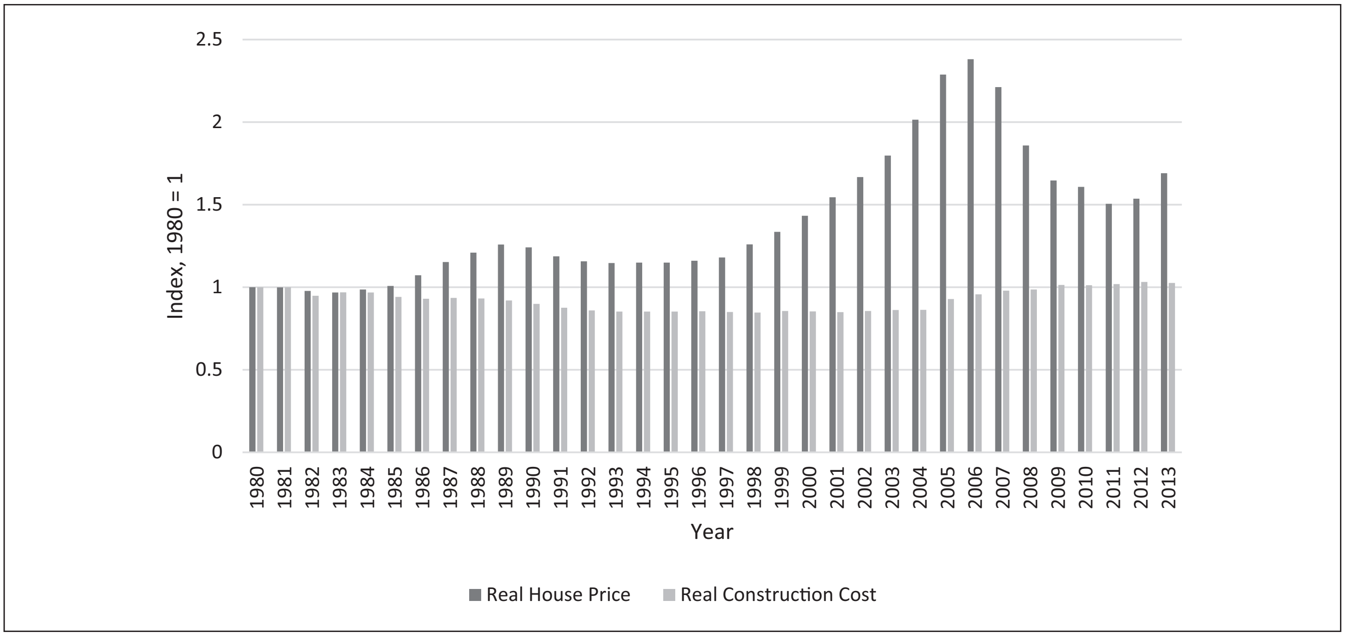

Figure 2. Trends in United States real housing prices and real construction costs.
Note. Data provided by Raven Molloy as used in Figure 19.1 of Gyourko and Molloy (2015).

and elasticity of land available for residential development and, hence, housing supply. They were among the first to suggest that a relaxation of such regulation would assist immensely in the amelioration of U.S. housing affordability concerns.

Gyourko and Molloy (2015) offered a definitive summary of how local building codes and land use regulations reduced local housing supply, increased price inelasticity, raised housing prices, and increased their volatility. As shown in Figure 2, real housing costs throughout the United States have risen at a rate faster than inflation-adjusted construction costs since the early 1980s. Figure 2 also demonstrates the critical point that real construction costs have stayed relatively stable and thus are not the primary cause of housing unaffordability. Since migration into a metropolitan-wide labor market is the principal means by which an increase in local demand is satisfied, Gyourko and Molloy (2015) asserted that " . . . the constraints imposed by regulation could have a meaningful influence on the economic health of local communities" (p. 1327).

Gyourko and Molloy's (2015) extensive review of empirical investigations regarding the stifling influence of local land use regulations on reducing housing supply concluded that a likely bias exists in what we purport to know due to a reliance on cross-section analyses. The findings from such empirical studies do not allow for adequate control of the unobservable characteristics (i.e., topography, history, and economic environment) that vary dramatically across units of observation. These characteristics can significantly influence how regulation affects a metro area's housing supply. They suggested that future researchers employ panel data in regression analyses to control for these metro-area-specific fixed effects. They also stated that it would be " . . . fruitful to think of creative instruments for regulation . . . which would allow for better causal estimation without the use of panel data" (Gyourko & Molloy, 2015, p. 1330). The research offered here does employ panel data. Instead of the direct measure of differences in the regulatory environment, this research depends on their primary outcome—a higher per-acre price for residential land available for new home development—as the key explanatory variable examined.

Glaeser et al. (2006) was an early example of using cross-section regression analysis to sort out the influences that greater housing regulation has on a metropolitan area's response to an increase in labor demand. They used two surveys of the local regulatory environment—the Wharton Land Use Control Survey and one conducted by the American Institute of Planners—to measure differences in housing and land use regulation in U.S. metropolitan areas during the mid-2000s. Glaeser et al. found that metro-area economies responded differently to productivity (labor demand) increases depending on the degree of constraints imposed on the area's housing supply. The greater the constraints, the more the productivity increase yielded a smaller increase in population, a greater increase in housing prices, a greater increase in existing resident incomes, and a smaller increase in metro-area economic output than would have been possible with a more elastic housing supply. Saks (2008) extended this line of inquiry by utilizing four additional surveys to account for differences in housing supply regulations across many metropolitan areas, as well as panel data from 58 urban areas gathered over 22 years. She confirmed the earlier findings of Glaeser et al. and concluded that the employment response for a given increase in labor demand was about 20% lower in a metropolitan area with a high degree of housing supply regulation. Glaeser and Gyourko (2018) summarized the previous empirical analyses and others to draw a link from the rise in U.S. coastal housing prices to the increasing income and wealth gaps observed among Americans.

Chakrabarti and Zhang (2015), Ganong and Shoag (2017), and Hsieh and Moretti (2017a) are also relevant to the empirical analysis offered here. Chakrabarti and Zhang (2015) undertook a panel-data regression study of the influence of the ratio of one California county's median home price to its median household income to the rate of employment growth of 115 large cities in the state. Accounting for city and time fixed effects and recognizing the endogeneity of their affordability ratio, they reported that the presence of relatively expensive housing in a county reduced its principal city's employment growth. Specifically, if a county's affordability ratio rose by one unit (half a standard deviation), its 2-year employment growth rate declined by about 1.5 percentage points (from an average of 3.9%). Ganong and Shoag (2017) investigated why the rate of convergence of per capita income across the states slowed between 1980 and 2010 and offered evidence of this resulting from a similar trend in only high-skilled/high-income workers being able to afford relocation to a high-income/high-housing price state. They calculated that without the disruption of skill-based migration patterns across the United States caused by some states taking on more restrictive housing and land use policies, the increase in hourly-wage inequality across the states would have been about 10% lower.

Finally, Hsieh and Moretti (2017a) quantified the degree of GDP potentially lost to the misallocation of potentially highly productive labor from high-cost housing areas (like Silicon Valley) to low productivity and low-cost housing areas (like Las Vegas). Using a spatial equilibrium model calibrated to data from 220 U.S. metropolitan areas between 1964 and 2009, they predicted that GDP change over this time was 36% lower due to housing and land-use regulation. They also computed that GDP in 2017 could have been around 9% larger, or nearly $7,000 more in annual income for every American worker. The approximate loss of $1.4 trillion in annual GDP would be like the country's economy losing New York State's entire economic output. Given the magnitude of these potentially foregone opportunities, it is decidedly appropriate to further investigate their existence by using two newly available data sets.

Methodology

The hypothesis tested here is that higher home prices in a metropolitan area—generated through local regulatory practices that restrict the amount and price elasticity of land available for residential development—reduces the area's economic vitality as measured by a reduction in its economic activity. Think of the economic vitality of a metropolitan area as measured by positive year-to-year changes in its GDP or GDP per capita. Labor would like to migrate to a high productivity metro area due to its increased labor demand and subsequently higher wages. A metro area's geography and historical development patterns offer restrictions on the availability of land for the new housing development needed for this inflow of labor. The greater these restrictions, the higher the expected price per acre of land available for new single-family homes. But as discussed previously, locally imposed land-use regulations also reduce the quantity and price elasticity of land available for residential development in a burgeoning metro area. Thus, there is an expected positive relationship between the price of land for new residential development in 1 year, and the growth in GDP or GDP per capita that occurs in the next year. But as local land-use restrictions become increasingly prevalent and drive up the price of residential land far beyond what would have occurred without them, the expectation is a slowdown in the year-to-year change in a metro area's economic activity. This decrease is the result of higher home prices generated through stringent residential land-use regulations that discourage migration into the metro area and can even encourage migration out of it. Such a slowdown may also cause a decrease in the year-to-year change in a metro area's employment.

Due to the recent release of two forms of data, the measurement of the effects just described is now possible. The first data set provides estimates of the annual GDP generated in all U.S. counties (Panek et al., 2019). The second data set includes approximations of the selling price for an acre of land available for new single-family homes for all U.S. counties (Davis et al., 2019). In late 2019, both data sets were available for years 2012 through 2015, and for 348 distinct metropolitan (and micropolitan) areas. To account for the cross-county commuting patterns that constitute a metropolitan area designation, the unit of analysis chosen for this study is a metro area and not a single county (unless it is a full metro area). Using the 2010 census definition of counties making up metropolitan and micropolitan areas, individual county values yield multicounty metropolitan area values through aggregation, when necessary, based on relative county population for a multicounty area.

The accuracy of the empirical findings generated here depends on the degree of confidence in the county-specific estimates of the annual GDP and the estimated selling price for an acre of land zoned for residential housing for all U.S. counties. Panek et al. (2019) inspired trust in the use of the new Bureau of Economic Analysis' estimates of county GDP by pointing out that previous measures of county economic activity depended solely on labor data. The new measure better captured the output of capital-intensive industries by relying on business revenue and production value data. Comparing their prototype GDP values with earlier earnings-based approaches, Panek et al. found the mean absolute percent difference between estimates for the labor-intensive industries of services and government at around 4%. At the same time, it was nearly 14% for goods-producing industries. Such a divergence indicated consistency in their estimation of production value in labor-intensive forms and additional output information captured in the new GDP series for more capital-intensive industries.

Davis et al. (2019) inspired faith that the methodology used by these Federal Housing Finance Agency analysts reasonably captured differences in the typical value of an acre of land available for new single-family residential development in a U.S. county. Their method did not rely on the assessed land value under a residential structure generated by local governments for property tax purposes. Nor did it rely on data from the sales of vacant land zoned residential. Instead, it started with a database of more than 16 million home appraisals between 2012 and 2018—required by Fannie Mae, Freddie Mac, and other government sponsored enterprises (GSEs) for mortgage default protection—that represented over 80% of all single-family homes in the country. They then determined land values under each of these privately appraised single-family houses by subtracting the housing structure's depreciated replacement cost. A concern with this method is that some homes sell for less than the structure's replacement cost. An investigation of this occurrence by the authors indicates that this is highly unlikely in homes less than 10 years old. Thus, they limit their calculation to such (about 8 million homes). Davis et al. also used an accepted method of adjusting for the influence of lot size on land prices. Finally, they interpolated land price per acre for less than 10-year-old single-family homes (obtained through CoreLogic data) without a GSE assessment report. To inspire even greater confidence, they used the data to confirm many stylized facts about land prices.[2]

In the analysis described here, Metropolitan Area GDP and Metropolitan Area GDP Per Capita account for total economic productivity.[3] All dollar values are in nominal terms. Since high housing prices may prevent workers from moving into a metro area or encourage the exit of current residents, I also chose to look at the influence of residential land prices on nonfarm payroll employment based on values recorded for December of the appropriate year by the Bureau of Labor Statistics.

Following Gyourko and Molloy's (2015, p. 1329) advice, this analysis does not attempt to directly measure differences between areas in the severity of housing and land use regulations. Instead, it relies upon the newly available "creative instrument" values of Acre Residential Land Price. Through capitalization into the price of residential land available for single-family homes, typical home prices rise across an entire metropolitan area when there is an increase in the rigidity of regulations that restrict housing supply and raise its price inelasticity. Housing prices also rise with the degree of economic activity in a metro area through higher demand. This empirical analysis offers a way to confront this likely endogeneity.

The simple dynamic model below determines whether a higher per-acre price of residential land available for single-family housing in a metropolitan area each year influences various economic outcomes for the metropolitan area in the following year:

$$\begin{aligned}&\text{Metro Area GDP}_{i,t+1}, \text{Metro Area GDP Per Capita}_{i,t+1},\\ &\text{or Non-Farm Payroll Employment}_{,t+1}, =\\ &f\left(\text{Housing Cost}_{i},_{t}, \text{Controls}_{i,t}\right)\end{aligned} \tag{1}$$

where i = 1 to 348 U.S. Metropolitan/Micropolitan Statistical Areas, t = 2012, 2013, and 2014; and,

$$\text{Housing Cost}_{i,t} = f\,(\text{Acre Residential Land Price}_{i,t}) \tag{2}$$

$$\begin{aligned}&\text{Controls}_{i,t} = f\,(\text{Appropriate Lagged}\\ &\text{Dependent Variable}_{i,t}, \text{Fixed Metropolitan-Area Effects}_{i},\\ &\text{Fixed Time Effects}_{t}).\end{aligned} \tag{3}$$

After controlling for the economic outcome in the previous year, and metropolitan-area and time-specific fixed effects, a higher cost for residential land (housing) in the current year influences the economic outcome in the following year.[4] Note that the intent of including metro-area-specific fixed effects is a control for the natural geography and historic development patterns that influence the year-to-year change in the value of the economic variables used as dependent variables. The addition of fixed time effects controls for macroeconomic differences in the U.S. economy that varied over the years observed. However, this deceptively simple model raises prickly econometric issues.

As Bailey (2016, p. 503) warned, due to the inclusion of both time and metro-area fixed effects and a lagged dependent variable, this dynamic model is "sneakily complex" when determining how to proceed in its regression estimation. Even without fixed effects, the lagged dependent variable's inclusion introduces endogeneity through changes in other explanatory variables in period "*t*" affecting it. These changes also influence the dependent variable in the following period "*t* + 1." This second occurrence is especially noteworthy if serial correlation exists in the data set. Bailey recommended beginning such an analysis with an exploratory ordinary least squares (OLS) regression that only includes fixed effects for time. He reasoned that if controlling for the lagged value of the dependent variable in a panel-data regression, he may not need to use fixed effects for the metro areas. Such fixed effects could be unnecessary if the lagged dependent variable captures area-specific variances constant across the years observed. However, my apprehension about using fixed effects that account for only time in this analysis, is that the lagged dependent variable only captures such effects relating to the economic measures.

Proceeding to an estimation of the full model in Equation (1), with both time and metro-area fixed effects and a lagged dependent variable, requires further consideration. First, the addition of fixed area effects in a panel-data regression is the same as including an average of the lagged dependent variable over all periods. This inclusion induces endogeneity because the regression also includes the 1-year lag of the dependent variable. This bias is proportional to the value of 1 divided by the total number of periods in the estimation. Since this analysis is constrained by the newness of the data used, it can only include 3 years of annual data. Therefore, the induced bias is rather significant. As Bailey (2016) noted, Monte Carlo simulations indicate that the induced bias is far worse for the regression coefficient on the lagged dependent variable and only modest for the other explanatory variables. Since the regression coefficient on the lagged dependent variable is not of interest, this is acceptable.

Cameron and Trivedi (2010) summarized how the Arellano–Bond (AB) estimation deals specifically with the induced endogeneity of including a lagged dependent variable in a fixed-effect estimation. It does this by first differencing the data to account for fixed effects. It then uses the dependent variable's earlier lags as instrumental variables for the lagged dependent variable included in the regression. With the short time series available, an AB estimation could only add one lag as an instrument, and even that causes the dropping of one cross-section of data (taking the panel down to the minimum of only two cross-sections).

AB estimation is not possible if variables within the data set are serially correlated (as was later determined to be the case). Bailey (2016) also cautioned against the use of AB estimation because, although it yields unbiased regression coefficients, the estimates are imprecise compared with OLS. Bailey came down on the side of using only OLS to estimate a regression model with both lagged dependent variables and fixed effects. He backed this conclusion by citing Beck and Katz (2011), who found, through Monte Carlo simulations, that OLS performed better than AB at producing a regression coefficient closer to the correct values. Though biased, the OLS estimates were more accurate due to a smaller variance.

A final econometric issue to consider is the likely endogenous determination of Acre Residential Land Price in a metropolitan area with the lagged dependent variables of various economic outcomes included in the regressions. The prescribed approach to deal with this is the use of instrumental variables in fixed-effects panel data regression. However, standard panel data estimation requires values for instruments drawn from every cross-section in the panel. This requirement is a problem because it is only reasonable to bring such exogenous tools, which influence contemporaneous values of residential land price but not metropolitan area GDP, from a previous year. Gyourko et al. (2008) offered single historical numbers for their *Wharton Residential Land Use Regulatory Index* (WRLURI) for each state from 2006. Gyourko and Molloy (2015) reported that this Wharton index correlated well with measures of differences in housing prices.

Furthermore, it is appropriate to use as the needed second instrument (since the residential land price variable is in the quadratic form) the Percentage Water to Total Area in 2010 in the metropolitan area. As described by Cameron and Trivedi (2010), given two exogenous instruments from only 1 year, and the desire to use a fixed-effects panel data model, the only way to do this is through STATA's XTHTAYLOR command. Before offering the results of the proposed regressions, a description of the data employed is necessary.

Data

Note the wide geographic variation in the United States for the economic outcomes used as dependent variables in this analysis. Figure 3 offers this in map form for shaded ranges of GDP by county. The supplementary online appendix table shows how metro areas differed in their 2015 values of residential land price per acre and metropolitan-wide GDP per capita. This table also contains a measure of relative housing cost based on the ratio of an acre of residential land price divided by median annual earnings. Notice the range of this affordability ratio with a low end of Decatur, AL (0.86), to a high end of San Francisco, CA (87.21). The typical estimated price for 1 acre of residential land in some metro areas is only a fraction of the median full-time individual earnings. In other areas, it is more than 80 times greater. The median of residential land price to personal earnings is 3.87 in the metropolitan areas of Sheboygan, WI; St. Louis, MO; Huntington, WV; and Cedar Rapids, IA.

Table 1 offers descriptive statistics for all dependent variables gathered from the 348 metropolitan areas for 2013, 2014, and 2015. Also included are descriptive statistics for all explanatory variables gathered from 2012, 2013, and 2014.

Findings

I first ran a test-case OLS regression with only time fixed effects and using Metropolitan Area GDP as the dependent variable. The Breusch–Pagan/Cook–Weisburg heteroskedasticity test (Baum, 2001) rejected ($p < .01$) the null hypothesis of its absence in this regression. A Wooldridge Test (Drukker, 2003) indicated a similar rejection of the null hypothesis of no autocorrelation in the panel data. The appropriate Hausman

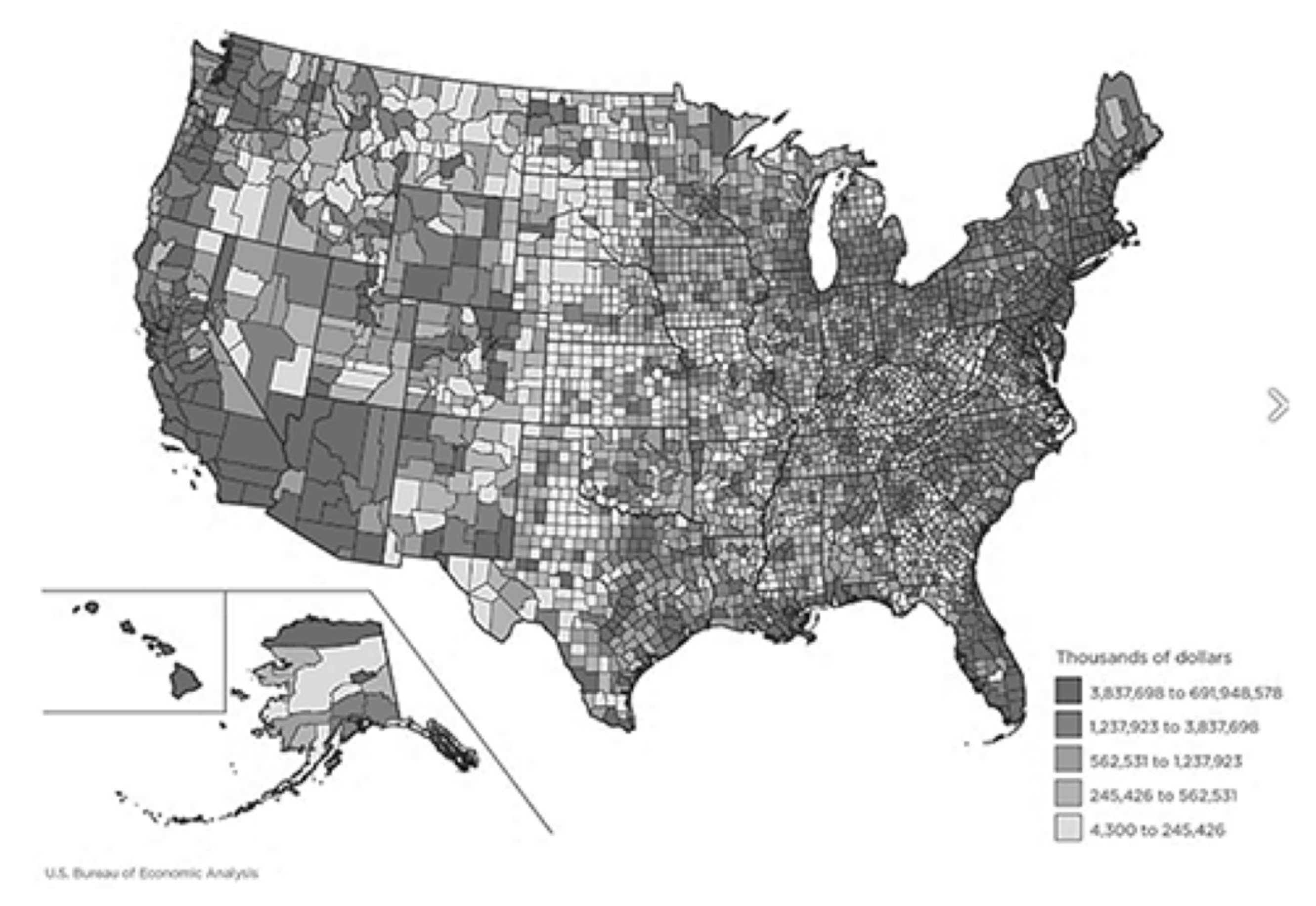

Figure 3. GDP by county in current dollars, 2015.
Note. Available at https://apps.bea.gov/scb/2019/03-march/0319-county-level-gdp.htm. Permission for use granted by Jeanine Aversa, Chief of Public Affairs and Outreach, BEA.

Table 1. Descriptive Statistics (348 U.S. Metropolitan/Micropolitan Areas).

Name	*M*	*SD*	Minimum	Maximum
Dependent (2013, 2014, and 2015)				
Metro area GDP ($1,000s)	39,260,520	96,720,490	441,648	952,609,000
Metro area GDP per capita	48,005	16,036	15,332	219,091
Nonfarm payroll employment (1,000s)	366.347	815.184	27.600	9,537.100
Explanatory (2012, 2013, and 2014)				
Acre residential land price	188,600	303,670	19,200	3,698,475
Metropolitan area GDP ($1,000s)	37,692,590	92,595	433,905	904,615,900
Metro area GDP per capita	46,723	15,964	15,252	219,091
Exogenous instruments (various years)				
Percentage water to total area (2010)	8.13	13.19	0.022	71.77
Wharton Residential Land Use Regulatory Index (2006)	−0.119	0.626	−1.13	2.32

Test (Cameron & Trivedi, 2010) comparing the use of random-effects panel data estimation with fixed-effects panel data indicated the latter as more appropriate. The variance inflation factors values derived from a simple OLS regression showed none higher than three, and thus multicollinearity to be of little concern. Finally, the STATA-provided XTCSD test found cross-sectional dependence. As described in De Hoyos and Sarafidis (2006), the presence of cross-sectional dependence severely reduced the efficiency of regression estimates in a dynamic model and thus needed addressing.

Table 2. Regression Results for All Metro/Micropolitan United States Areas[a] (t = 2012, 2013, and 2014).

Dependent variable Explanatory variable	Metro area GDP_{t+1} (348 metro areas)	Metro area GDP per capita $_{t+1}$ (348 metro areas)	Nonfarm payroll employment $_{t+1}$ (321 metro areas)
Appropriate lagged dependent variable*t*	1.094*** (0.012)	−0.3597* (0.1848)	0.8658*** (0.1142)
Acre residential land $price_t$ (1,000s)	**10,278.64*** (383.37)**	**0.0101*** (0.0018)**	**−0.0267 (0.0226)**
Acre residential land $price^2_t$ (1,000s)	**−1.997*** (0.228)**	**−4.93e-07*** (1.49e-07)**	—
Year 2013 dummy	207,485.20*** (29,575.94)	1.938*** (0.204)	−5.692*** (0.723)
Year 2014 dummy	−44,425.89 (49,160.16)	3.510*** (0.471)	3.399*** (1.692)
Constant	−3,751,974,00*** (458,134.10)	61.158*** (8.092)	59.378* (35.65)
R^2 (within)	0.872	0.284	0.775
R^2 (within) with no lagged dependent variable	0.299	0.236	0.188
Inflection point	$2,575,000	$10,292,000	none
Metro areas beyond inflection point	SF-Oakland-Hayward Urban Honolulu		

Note. GDP = gross domestic product. Bolded regression results are for the key explanatory variable of Acre Residential Land Price.
[a]With metro-area fixed effects and Driscoll and Kraay robust standard errors.
*.90 < *p* < .95. **.95 < *p* < .99. ****p* < .99 (statistical significance in two-tailed test).

Table 3. Regression Results for Single-County Metro/Micropolitan United States Areas[a] (588 observations, *t* = 2012, 2013, and 2014.

Dependent variable Explanatory variable	Metro area GDP_{t+1} (215 metro areas)	Metro area GDP per capita $_{t+1}$ (215 metro areas)	Non-farm payroll employment $_{t+1}$ (195 metro areas)
Appropriate lagged dependent variable*t*	0.6245*** (0.0360)	−0.4962* (0.2533)	0.9027*** (0.0313)
Acre residential land $price_t$ (1,000s)	**10,511.21*** (1473.51)**	**0.0136*** (0.0024)**	**−0.0037** (0.0018)**
Acre residential land $price^2_t$ (1,000s)	**−3.552*** (0.8980)**	**−2.01e-06*** (1.49e-07)**	
Year 2013 dummy	160,673.60*** (14,794.91)	1.961*** (0.287)	0.8089*** (0.0781)
Year 2014 dummy	213,117.90 (44,672.35)	3.271*** (0.615)	0.1961 (0.1473)
Constant	2,921,461.00*** (531,692.50)	62.332*** (10.349)	14.693*** (3.414)
R^2 (within)	0.463	0.236	0.833
R^2 (within) with no lagged dependent variable	0.297	0.135	0.213
Inflection point	$1,480,000	$3,382,000	none
Metro areas beyond inflection point	Urban Honolulu Santa Cruz-Watsonville Oxnard-Th. Oaks-Ventura		

Note. GDP = gross domestic product. Bolded regression results are for the key explanatory variable of Acre Residential Land Price.
[a]With metro-area fixed effects and Driscoll and Kraay Robust standard errors.
*.90 < *p* < .95. **.95 < *p* < .99. ****p* < .99 (statistical significance in two-tailed test.)

The finding of heteroskedasticity drove the choice of robust standard errors in the regression. The additional presence of first-order serial correlation and cross-sectional dependence points to the desirability of using fixed-effects panel-data regression results derived from the STATA-provided XTSCC command. As described by Hoechle (2007), XTSCC is the most appropriate estimator because it accounts for all three of these concerns by calculating the Driscoll and Kraay standard errors for regression coefficients.

The relationships between Acre Residential Land Price and the dependent variables used here are likely nonlinear. Thus, I tried a log transformation of the dependent variables and a quadratic transformation of land price, and then compared both with a linear specification. The quadratic specification offered the best fit (most statistically significant explanatory variables) for all dependent variables. Table 2 contains regression results for all metro/micropolitan United States areas. Table 3 contains the same regression specifications used in Table 2, but utilizes only data drawn from the metropolitan areas consisting of a single county. This second estimation is a robustness check of the population-weighted methodology used to create metro-wide observations from single counties and for the validity of the results by metro areas if not accounting for multicounty governance.

The regression results in Table 4 account for possible endogeneity using the XTHTAYLOR regression command in STATA. This command overcomes the lack of time-varying instruments to estimate a panel data regression where the linear and quadratic inclusion of the cost of the residential land measure is considered endogenously determined with

Table 4. Endogenous Regression Results for All Metro/Micropolitan United States Areas[a] (963 observations, t = 2012, 2013, and 2014).

Dependent variable Explanatory variable	Metro area GDP $_{t+1}$ (348 metro areas)	Metro area GDP per capita $_{t+1}$ (348 metro areas)	Non-farm payroll employment $_{t+1}$ (321 metro areas)
Appropriate lagged Dependent variable*t*	1.035*** (0.038)	0.0914** (0.0406)	1.008*** (0.0077)
Acre residential land price$_t$ (1,000s)	**10,826.21*** (2,649.73)**	**0.0177*** (0.0038)**	**−0.0516*** (0.0100)**
Acre residential land price^2_t (1,000s)	**−1.665*** (0.540)**	**−2.15e-06*** (8.02e-07)**	
Year 2013 dummy	280,299.20** (119,363.90)	1.397*** (0.182)	4.748*** (0.9714)
Year 2014 dummy	−106,034.00 (124,065.30)	2.187*** (0.210)	1.1486 (0.9986)
Constant	−1,488,216.00*** (465,734.70)	39.107*** (2.228)	12.849 (8.149)
Time-invariant instrument			
Percentage Water to Total Area (2010)	−43,558.68* (22,386.93)	−0.0175 (0.0849)	0.3588 (0.5074)
Wharton Residential Land Use Regulatory Index (2006)	−1,004,020.00* (533,935.00)	−4.469** (1.840)	11.370 (10.933)
Inflection point	$3,251,000	$4,107,000	none
Metro areas beyond inflection point	SF-Oakland-Hayward	SF-Oakland-Hayward	

Note. As noted in Cameron and Trivedi (2010, pp. 291-293), the regression coefficients derived from this form of estimation requires testing for consistency using the STATA "XTOVERID" command. Unfortunately, all regressions failed this test. So, although the endogeneity bias no longer occurs, these estimates are not "consistent," or as the number of data points used increases, the estimate does not approach its actual value for the entire population. GDP = gross domestic product. Bolded regression results are for the key explanatory variable of Acre Residential Land Price.
[a]With metro-area fixed effects and Driscoll and Kraay robust standard error.
*.90 $< p <$ .95. **.95 $< p <$ .99. ***$p <$ .99 (statistical significance in two-tailed test).

the lagged dependent variable. The time-invariant instrumental variables used are the WRLURI from 2006 created by Gyourko et al. (2008) for the metropolitan area's primary state and the Percentage Water to Total Area in 2010. I use the WRLURI calculated for an entire state due to its availability for all metro areas in the sample.[5] I also tried the WRLURI specifically derived for 41 of the U.S. metropolitan areas in this sample. Statistical significance of the residential land price variables occurred more often when using the index value calculated for an entire state. The regression results highlighted in all tables are of primary interest to the hypotheses tested regarding the influence of differences in Acre Residential Land Price (housing cost) on economic output, output per capita, and employment.

The R^2 (within) values reported in Tables 2 and 3 indicate the percentage of the respective dependent variable's variation from its mean explained by the variables in the table, absent the explanation offered through the conclusion of metro-area fixed effects. A similar value recorded below it represents the same statistic calculated after the lagged dependent variable dropped from the panel data regression analysis. A comparison of these R^2 values offers the specific contribution of residential land prices to explaining the change within the metro area in the respective dependent variable 1 year later.

The results in Table 2, columns 2 and 3 use data from all 348 counties and the annual Metro Area GDP and Metro Area GDP Per Capita as the dependent variables. These are a test of how higher home prices (as proxied through a higher residential land price for a new single-family home) in a U.S. metropolitan area, in a given year in the mid-2010s, influence the metropolitan-wide economic output measures in the following year. As shown in the quadratic specification, the effect of Acre Residential Land Price is positive on GDP or GDP per capita, but the magnitude of this positive influence falls as land price increases. And, as listed at the bottom of Table 2, the inflection point for this concave quadratic effect on Metro Area GDP is about $2.6 million per acre. As noted in the table, the land prices observed in both the San Francisco–Oakland–Hayward and Urban Honolulu metro areas are beyond this inflection point. Thus, the first two columns of regression results in Table 2 revealed that higher residential land prices in a given, holding economic activity in that year constant, slow the upward trajectory of GDP and GDP per capita in the following year. Also, if the land price reaches the extreme of California's Bay Area, the trajectory can turn downward.

Furthermore, the regression results recorded in columns 2 and 3 of Table 3 indicate that the concave quadratic relationships detected in Table 2 between residential land price and the two measures of economic output hold when using data only from single-county metro areas. Since these single-county metro areas tend to generate lower values of economic activity due to smaller geographic size, the inflection points calculated in Table 3 are at lower per-acre values of residential land. Because of this, the metro areas of Santa Cruz-Watsonville and Oxnard-Thousand Oaks-Ventura now join Urban Honolulu as the single-county metro areas where the price of residential land for single-family housing in a year is expected to exert a negative influence on GDP in the following year.

A higher residential land price in a metropolitan economy is due to both demand pressures on the available land for housing and natural and imposed constraints on land availability for housing use. In the regression analyses here, the control for these demand pressures occurs through the right-side inclusion of the lagged dependent variable. However, doing such could induce endogeneity through the simultaneous determination of both land values and economic activity in a metro area. Table 4 offers the results of an attempt to correct for the bias caused by this possible endogeneity through historical instruments that measure the natural and imposed restrictions on the supply of land available for residential development in a metropolitan area. The natural restriction is the percentage of a metro area covered in undevelopable water in 2010. The imposed restrictions are accounted for by the WRLURI calculated in 2006 for the metro area's primary state (Gyourko et al., 2008). Two relevant findings emerge. First, the concave quadratic relationship between a metro area's residential land values in a year and the two measures of its GDP in the following year remains. However, this influence on GDP and GDP per capita becomes more consistent across the measures of economic output, with respective inflection points of $3.3 million and $4.1 million now being more alike than the $2.6 million and $10.3 million derived from the regressions in Table 2. This finding indicates that when examining all single- or multiple-county metro areas in the United States, San Francisco–Oakland–Hayward emerges as the only metro area where the nearly $4.4 million price for an acre of land available for single-family home development in 2015 likely decreased its GDP and GDP per capita in the following year.

The third economic outcome considered in these regression analyses is employment. For all 348 metro areas, the regression findings in the last column of Table 2 indicate that Acre Residential Land Price exerts a negative but statistically insignificant influence on employment. The last column of Table 2 offers the result for a linear specification since the quadratic specification indicated statistical insignificance. However, when only examining the effect of a metro area's single-family housing land price on its employment for single-county metro areas, the statistical significance of the linear specification emerges. The Acre Residential Land Price regression coefficient indicates that for every $300,000 (about a 1 standard deviation increase) rise in residential land prices in a year, the average single-county metro area lost only about a thousand jobs the following year. Though this reduction is statistically significant, its magnitude needs consideration based on a mean employment number of about 366,000 in this sample. In Table 4, where the regression results account for the potential endogeneity of land price, the effect is again negative and statistically significant, and 50% higher in magnitude. Here, the acre residential land price regression coefficient indicates that for every $300,000 rise in residential land prices in a year, the average single or multicounty metro area loses about 1,500 jobs the following year. These findings only represent a 1-year response. The long-term effects of high-acre, residential, metro-area land prices could be much greater for both employment and the previously calculated GDP measures.

Summary, Policy Implications, and Future Research

The issue of housing affordability at crisis levels in many U.S. urban areas is real and showed little sign of decline before the pandemic-induced recession of 2020. If nothing changes regarding the desirability of living in the same metro areas whose localities impose stringent local land-use regulations, housing affordability will continue to remain an issue for low- to moderate-income households in many of the country's metro areas.

This research offers evidence that high-priced new housing (as proxied by likely high prices for an acre of land available for single-family residential housing) in U.S. metro areas influences metro-wide economic outcomes by diminishing the trajectory of economic output and reducing employment. Figure 4 presents a visual summary of the regression evidence from Table 2. The figure is the result of STATA's margin command and shows the simulated effects of a 1 standard deviation increase in acre residential land cost ($303,000) for a hypothetical average metro area from the mid-2010s. The simulated range of per-acre residential land prices on the horizontal axis of this diagram spans the range of values observed in the data. This range is less than $10,000 per acre (the minimum is about $20,000 per acre in the Decatur, AL Metropolitan Area) to nearly $4 million (the maximum observed is $3.7 million per acre in the San Francisco–Oakland–Hayward, CA Metropolitan Area). Figure 4 depicts the trajectory of GDP for this typical metro area (holding other explanatory constant), as the per-acre price of land for new single-family housing varies within the range of values observed. The clear takeaway is that as the residential land price rises, the increase in GDP in the next year (holding GDP in the current year constant) is expected to be higher, but the magnitude of the expected increase steadily diminishes. When the price of an acre of residential land exceeds about $2.6 million (as in the San Francisco–Oakland–Hayward and Urban Honolulu metro areas), the effects of further residential land price increases turn negative. The 90% confidence interval drawn around this projection indicates that the fully negative influence of high residential land prices can begin at prices near

Figure 4. Simulation results of 1 standard deviation ($303,000) increases in residential land per acre at sample average values for all 384 metro areas and all years.
Note. CI = confidence interval; GDP = gross domestic product.

the $1.5 million mark. As shown in the online appendix table, this encompasses at least five major metro areas in the United States.

Besides the metropolitan-wide effects of high home prices found here, a high cost of shelter in a metro area relative to income imposes welfare burdens on low- and moderate-income households. Though most recognize this as a legitimate public policy concern warranting some form of government intervention, little has occurred. Perhaps this is due in part to many existing homeowners (voters) supporting the idea of affordable housing in general, but not in their backyard when it comes at the cost to them of a drop in their home value. More affordable housing in a community can reduce the price of existing homes in that community due to both an increase in the supply of homes in a community and the perceived negative external effects they may generate (Wassmer & Wahid, 2019). Local governments respond to such NIMBYism through the imposition of local housing and land use regulations. These regulations achieve the parochial goal of keeping new housing out of a community and, if enough of the metro area's localities pursue it, out of the entire metropolitan area. All this results in the nonconstruction of the number of new houses needed metropolitan-wide to bring down the housing prices in an unaffordable metro area.[6]

If this is the case, then it is necessarily left to the higher levels of state and federal government to encroach on the local control of housing amounts and types to get more affordable housing built in all the neighborhoods of a metropolitan area. This impingement of local government is institutionally possible, but in practice, politically tricky. Local control over land use is sacrosanct in the United States. Thus, the more evidence justifying the costs imposed on an entire metropolitan area, state, and even national economy through restrictive housing and land use regulations, perhaps the easier it becomes for state or federal action on this policy front. Glaeser (2020, p. 5) argued that one way to deal with the United States' "closed urban frontier" is to do nothing about its root cause and instead further embrace place-based interventions with a mixed history of success at reducing joblessness in depressed areas. However, Glaeser's preferred policy option is more active intervention at the state or federal level to encourage and even require increased residential construction in high-priced housing areas. I hope that the findings offered here show why doing nothing about the root causes of the lack of housing affordability is not the way to proceed.

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Supplemental Material

Supplemental material for this article is available online.

Notes

1. As noted at https://howmuch.net/sources/salary-needed-to-buy-a-house-in-largest-us-metros
2. See https://www.fhfa.gov/PolicyProgramsResearch/Research/PaperDocuments/FAQs.pdf, for even more detail on the calculation of the acre residential land price variable used here.
3. There exists an extensive literature on the determinants of economic output in a region that I chose to not cover in the literature review due to the dynamic regression estimation method used here that relies on the lagged value of GDP, per-person GDP, or employment as explanatory variables that captures the determinants of the previous year's economic activity to isolate the effect of residential land price.
4. It is reasonable to expect that the effect of per-acre residential land prices in a metro each year may take more than 1 year to show any statistically significant influence on the dependent

variables used here. Thus, the expectation is against finding anything in the current specification. If more time was allowed to measure their influence, perhaps the detected effects are even greater This is later testable as more annual observations become available.

5. Gyourko et al. (2019) contains updated 2018 values for the 2006 Wharton Residential Land Regulation Index used here. Even though the 2018 values are closer to the mid-2010 data used in this analysis, I do not use them because an environment that exists after outcomes in a metro area occurred cannot have caused it. Though, they reported that previously highly regulated markets, as measured in 2006, did not deregulate to any major extent. This supports the notion of using the 2006 index measures as adequate proxies of what existed in a metro area throughout the mid-2010s.
6. Wassmer and Williams (2021) offer evidence that various measures of the stringency of local land use controls in a U.S. metropolitan area relevant to the development of residential projects do exert measurable positive influences on the average price of an acre of land available for single-family housing and therefore reduces the metropolitan area's affordability of housing.

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