(Why) Are Housing Costs Rising?

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December 15, 2019

For Review

Abstract

Housing costs, relative to household incomes, have grown by 22% between 1980 and 2018. While the standard view among economists is that these costs reflect spatial differences in housing and zoning regulation, others have more recently argued that they reflect increasing labor costs. This paper shows that labor costs cannot explain the rise in housing costs. In fact, housing costs relative to income have grown more in larger counties where labor costs have decreased. Moreover, the areas with the greatest increases in housing costs relative to income are also the areas with the most restrictive housing regulation.

JEL: J31, R14, R21, R31

Keywords: housing affordability, labor costs, regulation, wages.

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1 Introduction

The ratio of median housing costs to household income has grown by 22% between 1980 and 2018 (see Figure 1), generating significant concern among policymakers and the media alike about the deteriorating middle class.[1] Given increasing evidence of polarization in the labor market [Autor and Dorn, 2013], these trends in housing costs are concerning because they imply that the residential housing market could become increasingly segregated by income and lower income individuals will face a greater financial burden due to a rising cost of living.

[INSERT FIGURE 1 HERE]

Despite a broad consensus among economists that excessive land use regulation is the major culprit behind the housing affordability crisis [Glaeser, 2014, Furman, 2015], an emerging narrative is forming among the popular press that increases in construction costs are instead a more significant factor at least in recent years [Romem, 2018a,b]. For example, the National Home Builders Association (NAHB) reports that the share of survey respondents reporting that labor and subcontractor worker shortage problems are raising housing prices has grown by 22 percentage points between 2015 and 2018 [NAHB, 2018, Emrath, 2018]. The optimal public policy response depends crucially on understanding the source of these continued increases in housing prices. For example, if the culrpit is excessive land use regulation, then deregulation at a state and local level is desirable. In contrast, if the culprit is rising labor costs, then federal incentives for home building through, for example, inclusion zoning could attract more workers to the sector.

Using an array of publicly available data from the Census Bureau, this paper shows that

[1] https://www.huduser.gov/portal/pdredge/pdr-edge-featd-article-081417.html
https://www.usatoday.com/story/money/personalfinance/real-estate/2018/08/15/cities-where-middle-class-can-no-longer-afford-home-prices/37105219/

increasing labor costs cannot account for the rise in housing costs. Although real median earnings in the construction sector grew by 5.7%, on average, these increases are concentrated among larger-population counties. In fact, if anything, there is a slightly negative relationship between increases in median housing rents net of household income and median earnings in the construction sector. These results on apparent worker shortages in more rural and smaller counties are consistent with emerging evidence on the decline in middle skill jobs, particularly in urban areas, that were recently highlighted by Autor [2019], as well as a historical urban economics literature that smaller counties tend to have less diverse and agile labor markets [Duranton and Puga, 2014].

Given that labor costs cannot explain the continued growth in housing costs, this paper subsequently explores the role of housing regulation and zoning restrictions. The increase in housing costs is concentrated in more restrictive metropolitan areas, consistent with prior literature about the causal effect of housing regulation on housing prices [Glaeser et al., 2005, Glaeser and Ward, 2009]. Moreover, using a proxy for state housing regulation from Ganong and Shoag [2017], the states with the greatest growth in housing costs are also the states with the greatest growth in land use restrictiveness. These results suggest that federal policy aimed at subsidizing additional housing may be ineffective at best at mitigating the housing affordability crisis, consistent with existing empirical evidence about the adverse effects of inclusionary zoning [Bento et al., 2009].

This paper contributes to a broader literature about the causes and consequences of housing and zoning regulation on economic activity. Starting with early evidence from, for example, Glaeser et al. [2005] and Glaeser and Ward [2009], local regulation has long been viewed as a causal determinant behind housing prices. More recently, however, there is increasing evidence that these regulations also have a causal effect on productivity [Herkenhoff et al., 2018], spatial misallocation [Hsieh and Moretti, 2019], and the risk of housing bubbles [Glaeser et al., 2008a,b].

This paper also connects with a literature in labor economics about searching and matching. The fact that labor costs have increased the most in smaller counties is consistent with evidence that they have a tougher time attracting skilled workers [Duranton and Puga, 2014].

The structure of the paper is as follows. Section 2 discusses the data and measurement strategy. Section 3 examines whether labor costs in construction are rising. Section 4 presents the main results relating housing and labor costs. Section 5 concludes.

2 Data and Measurement

Panel of Housing and Labor Costs.—The primary micro-data comes from the Decennial Census, American Community Survey (ACS), and Current Population Survey (CPS) accessed through SocialExplorer and the Integrated Public Use Microdata (IPUMS) data portal at the University of Minnesota. These data provide nationally representative counts over a range of demographic and economic variables, most notably housing costs and earnings, across location and time. Housing costs are measured using rental rates, rather than property values, since the latter represent the value of an asset, rather than the flow value of housing services. Moreover, using the ratio of housing rents to income normalizes for spatial differences in size that would otherwise correlated with unobserved determinants of productivity and preferences. All nominal variables are deflated using the personal consumption expenditure (PCE) index with (2012 base). Individuals earning less than \$2/hour or \$5,000/year are excluded from the sample.

Panel of Construction Costs.—RSMeans (through Gordion) is the benchmark source for information about construction costs across cities and over time. Their estimates cover material, labor, and equipment for different types of residential structures [Glaeser and Gyourko, 2018].

For a subset of cities, they create a construction cost index (CCI), which combines these different inputs into an index with a reference year at an annual frequency. Appendix Section 6.3 plots the time series of construction costs, demonstrating its recent uptick, and correlates the index with both housing rents to income and labor costs across CBSAs between 2006 and 2017. Although construction costs has a 0.12 correlation with housing rents to income, there is none between it and labor costs across the sample of 163 metropolitan areas between 2006 and 2017.

3 Are Labor Costs Rising?

Some have recently suggested that labor costs are on the rise and a manifestation of a labor shortage in construction, including survey evidence by the National Association of Home Builders (NAHB).[2] In September 2017, NAHB [2017] found that 55.6 percent of the final sales price goes to construction costs, 21.5 percent to finished lot costs, and 10.7 percent to builder profit. The NAHB implemented their 2017 Construction Cost survey by emailing a questionnaire to a representative sample of 4,267 home builders stratified by the size of the builder based on the number of 2016 single-family starts and by Census region, asking builders about the price and construction costs for the typical home built in 2017. Additional claims about rising labor costs comes from BuildZoom [Romem, 2018a] and Zillow [Gudell, 2018].

The most direct way of measuring labor costs involves looking at hourly wages and/or annual earnings among construction workers—that is, those working in the construction sector and in construction-based occupations. I focus on not only raw logged hourly wages, but also their

[2]https://bizeconreporting.journalism.cuny.edu/2017/05/25/construction-labor-costs-drive-home-prices-up-pushing-buyers-out/
https://www.jsonline.com/story/money/business/2018/06/08/rising-costs-labor-lots-lumber-push-up-home-prices-industry-says/684998002/

residual. Motivated by microeconomic evidence of reallocation and churn in the labor market over the business cycle [Solon et al., 1994, Haefke et al., 2013], residual hourly wages helps correct for time-varying selection along observed demographic characteristics, such as age and education.

Using annual micro-data between 2000 and 2018, Figure 2 plots the raw and residualized logged real hourly wage for construction workers. Although there is an increase in raw hourly wages since 2014 of roughly 0.12 logged points, the data not only does not feature a systematic trend since 2000, but also exhibits only a marginal 0.05 logged points increase in residual hourly wages since 2015. One reason for the gap between the raw and residualized hourly wages emerges from the composition effects associated with the recent recovery: as the economy improves, the marginal entrant reduces the average hourly wage because of negative selection. These results are also consistent with a larger body of evidence suggesting that increases in real housing prices cannot be explained by higher physical construction costs, which have been largely flat between 1984 and 2015 [Davis and Heathcote, 2007, Davis and Palumbo, 2008, Glaeser and Gyourko, 2018].

[INSERT FIGURE 2 HERE]

Given the small CPS sample, which contains only between 300 and 700 construction workers per year, one concern is that these minor increases in labor costs are attenuated by a noisy sample. However, turning towards the annual ACS since 2010, which contains 40,000 construction workers per year, I find similar results, which are presented in Figure 6 of Appendix Section 6.1. For example, in this larger sample, both raw and residual hourly wages have increased by roughly 0.05 logged points. Figure 8 in Appendix Section 6.1 also shows that the areas with the greatest growth in construction sector labor costs are the areas with the biggest housing price declines. These results suggest that the areas experiencing an increase in labor costs are potentially those

that were most adversely affected by the housing bubble, thereby scarring their labor market.

4 Housing Costs and the Role of Labor

This section begins by analyzing the raw data from the 5-year 2005-2009 and 2013-2017 ACS. While the unweighted average growth in median real construction sector earnings is 5.7 percent across counties, the population-weighted average is statistically indistinguishable from zero. To see the heterogeneity in growth in median construction earnings, Figure 3 plots the distributions between small (under 100,000 individuals) and large (over 100,000 individuals) counties. Whereas larger counties have an unweighted mean of zero (standard deviation = 8.7 percent), the smaller counties have a mean of 7.1 percent (standard deviation = 23 percent).

[INSERT FIGURE 3 HERE]

One concern with these results is the presence of composition effects. If, for example, larger counties exhibit lower growth in labor costs, but the increase in housing costs is concentrated in smaller counties, then labor costs are still potentially a candidate culprit behind the observed patterns. Figure 4 plots the distribution of growth in rental rates to household income between 2005 and 2017 using the two 5-year ACS samples for smaller and larger counties. While smaller counties have a greater standard deviation (12.7 versus 5.4 percent), the growth is nonetheless concentrated in larger counties with an unweighted average of 7.4 versus 6 percent in smaller counties, which represent 82 percent of the sample of counties in the Census.

[INSERT FIGURE 4 HERE]

Do these differences in demographic composition potentially account for differences in housing

and/or labor costs? While Table 2 in Appendix Section 6.2 examines the cross-sectional correlates of housing costs, I now residualize the growth in median construction sector earnings and growth in median rental rates to household income with 2013-2017 demographic characteristics, including the age and education, marital status, gender, and race distributions. After residualizing using these demographic characteristics, Figure 5 shows a robust negative relationship between growth rates of construction earnings and housing rents to household income. This suggests that, at least in the cross section, counties that experienced the greatest growth in housing costs relative to income are the same counties that experienced the greatest declines in construction labor costs.

[INSERT FIGURE 5 HERE]

Why might labor costs be a larger problem in smaller, rather than larger, counties? Drawing on a voluminous literature from urban economics, labor markets in smaller counties tend to be less diverse and adaptive [Duranton and Puga, 2014]. Since cities are important engines of economic growth [Glaeser, 2008], potentially due to agglomeration externalities [Ellison et al., 2010], they inherently attract more workers and can expand to accommodate demand more rapidly since the returns to suppliers are larger. These facts are apparent in the raw data. While labor force participation (LFP) is an imperfect proxy for a location's ability to attract workers, I find a correlation of 0.206 between logged population and LFP. Moreover, a one percent rise in population is associated with a 1.16 percentage point rise in labor force participation.

These results are also robust to different aggregations of the data, such as state and core business statistical area (CBSA).[3] (County is the default because of consistent measurement over

[3]Moreover, the state aggregation enables me to construct an annual panel from 2006 to 2017, which provides much more year-to-year variation. A regression of the growth in housing rents relative to household income on the growth in construction sector earnings, conditional on the usual demographic controls, produces a gradient of -0.11 (p-value = 0.001), consistent with the main results discussed earlier.

time and sufficient variation for these descriptive statistics.) Moreover, drawing on the CBSA aggregation, I match these data with the Wharton Regulatory Land Index from Gyourko et al. [2007]. If regulation is the driving factor behind the growth in housing costs, there should be a positive association between the regulatory index and growth in housing costs net of income and a non-increasing association between the index and growth in construction sector earnings. These are exactly borne out in the data: a standard deviation rise in the regulatory index is associated with a 1.34 percent increase in the growth of housing rents to household income (p-value = 0.065), but is not associated with growth in construction earnings (p-value = 0.714).

The results thus far illustrate that labor costs are not a culprit of increasing housing costs, and that the areas with greater growth in housing costs relative to household income are those with greater housing market regulation. But, they do not provide definitive evidence on the association between the growth in regulation and the growth in housing costs. Unfortunately, measuring housing market regulation over time is challenging. Table 5 in Appendix Section 6.3 presents a more thorough analysis on alternative potential factors behind growth in housing costs relative to household income, including: labor costs, immigration [Saiz, 2007], and land prices. Although immigration growth has an ecomically significant, but statistically insignificant, association with housing rents to income growth, construction sector earnings and land price growth rates are negatively (not positively) associated with housing rents to income growth.

Apart from the cross-sectional measure from Gyourko et al. [2007], one recently introduced measure from Ganong and Shoag [2017] counts the number of state supreme and appellate court cases containing the phrase “land use” over time. Using their measure, together with the state panel between 2006 and 2012, I find that the population-weighted correlation between growth in the count of land use regulation and the growth in rental rates relative to household income is

0.26. Appendix Section 6.2 presents results controlling for demographics, generating statistically indistinguishable results, as well as additional evidence of heterogeneous treatment effects by estimating the effect of state regulatory growth on growth in housing rents to income separately by county population density—effects concentrated in counties with greater population density.

Further motivated by Autor [2019] on the shrinking share of middle skill jobs, a natural question is whether the incidence of construction costs falls on higher or lower skilled areas. Using the share of college degree and graduate / PhD degree individuals as a proxy for skill, I find that the correlations between their percent change and the growth rate of construction costs are -0.023 and -0.048, respectively. Both correlations suggest that any increase in housing costs that might be driven by construction costs are falling on inherently lower skilled populations that have lower disposable incomes. Moreover, the relative weakness of the correlations implies that even though construction costs are increasing faster in less skilled areas, their removal would do quantitatively little to address ongoing increases in housing costs relative to household income.

5 Conclusion

While there is a general consensus that the surge in housing costs relative to household income is driven by housing and zoning regulation, recent survey evidence and the popular press point towards increasing labor costs. This paper uses various sources of micro-data to show that, on the contrary, the locations that experienced the greatest growth in construction sector earnings are actually the areas that experienced the greatest declines in the relative growth of housing costs to household income. In fact, the bulk of the growth in labor costs is concentrated among smaller counties with less access to labor. Numerous questions, however, remain. How much has housing

and zoning regulation changed over time? And, how have these regulations affected searching and matching in labor markets? These questions remain for future research.

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6 Figures and Tables

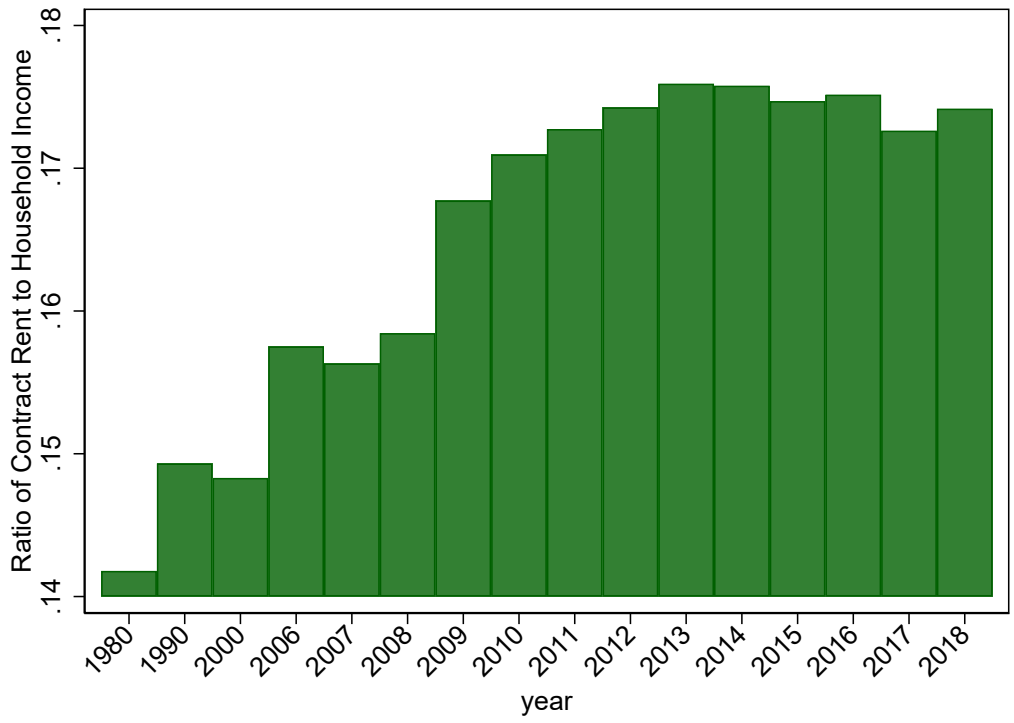

Figure 1: Ratio of Contract Rent to Household Income, 1980-2018

Notes.–Source: Decennial Census and American Community Survey, 1980, 1990, 2000, 2006-2017. The figure plots the ratio of median contract rental fees to median household income deflated by the 2012 personal consumption expenditure index.

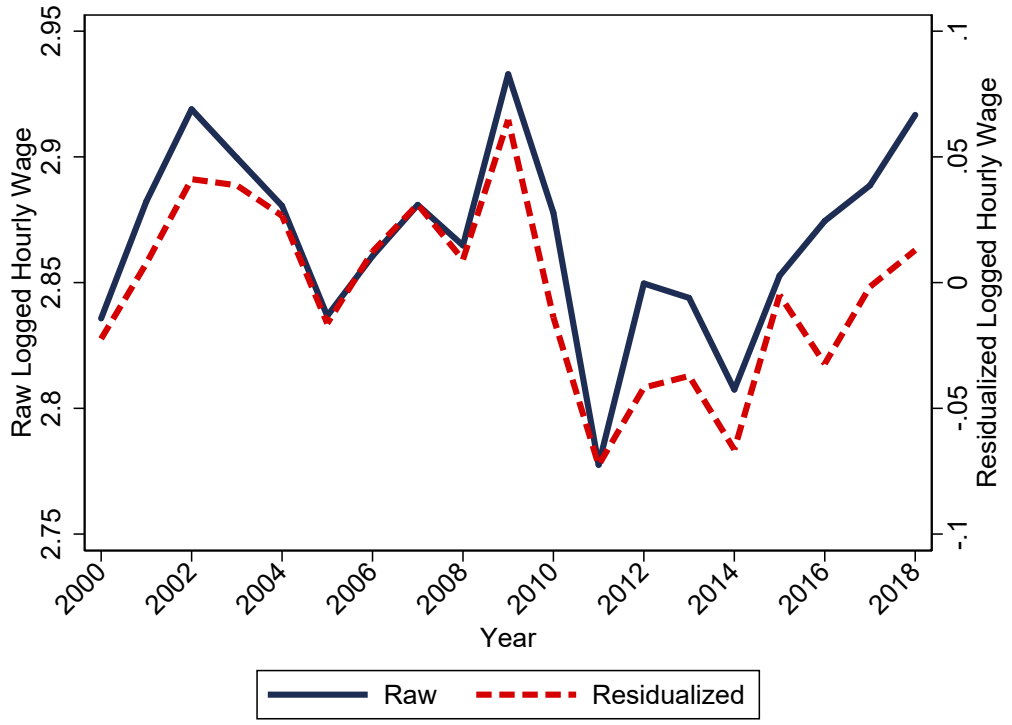

Figure 2: Time Series Evidence of Labor Costs in Construction, 2000-2018

Notes.–Source: Annual Current Population Survey, 2000-2018. The figure plots the logged real hourly wage and the residualized logged real hourly wage over time (deflated using the 2012 personal consumption expenditure index) for construction sector workers. The demographic controls used for residualizing wages include: age, marital status, educational attainment, race (white and black), number of children, and gender. The sample of construction workers is defined as those who work in the construction sector and are in construction occupations.

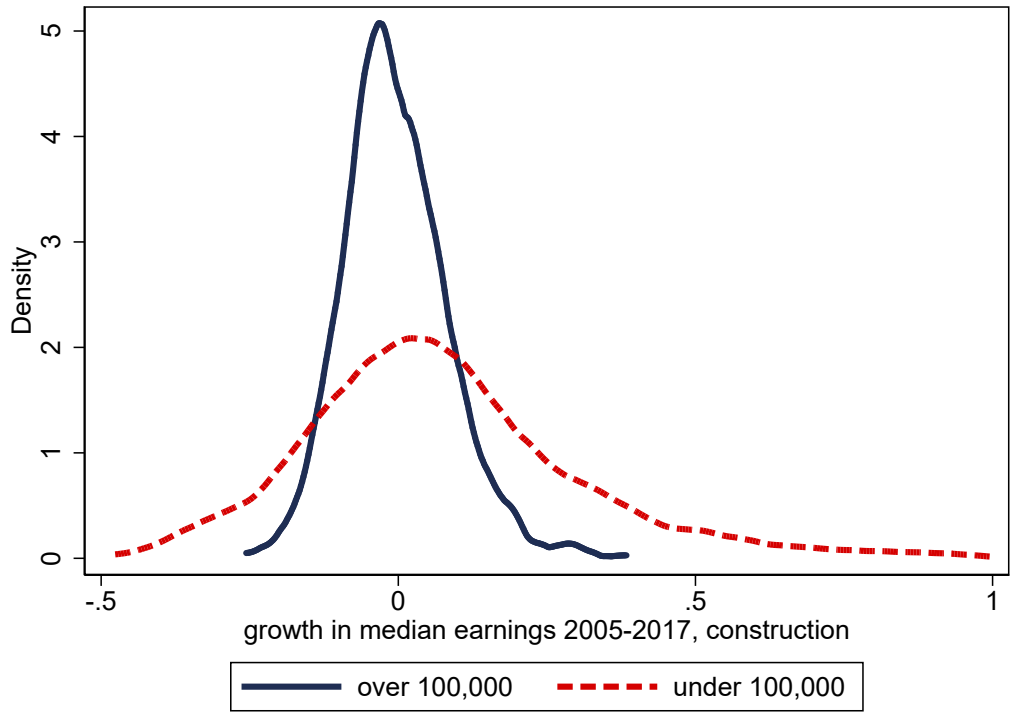

Figure 3: Distribution of the Growth in Median Construction Sector Earnings

Notes.–Source: American Community Survey, 5-year 2005-2009 and 2013-2017. The figure plots the distribution of the growth in median earnings in the construction sector across counties with under and over 100,000 residents.

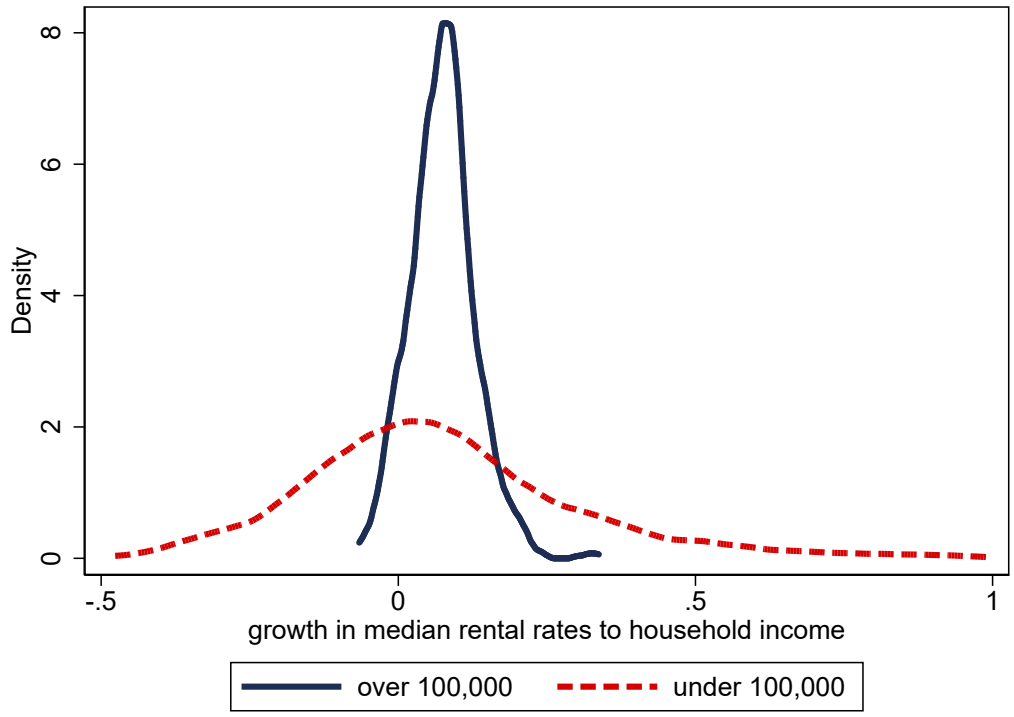

Figure 4: Distribution of the Growth in Median Rental Rates to Household Income

Notes.–Source: American Community Survey, 5-year 2005-2009 and 2013-2017. The figure plots the distribution of the growth in median annual rental rates to annual household income across counties with under and over 100,000 residents.

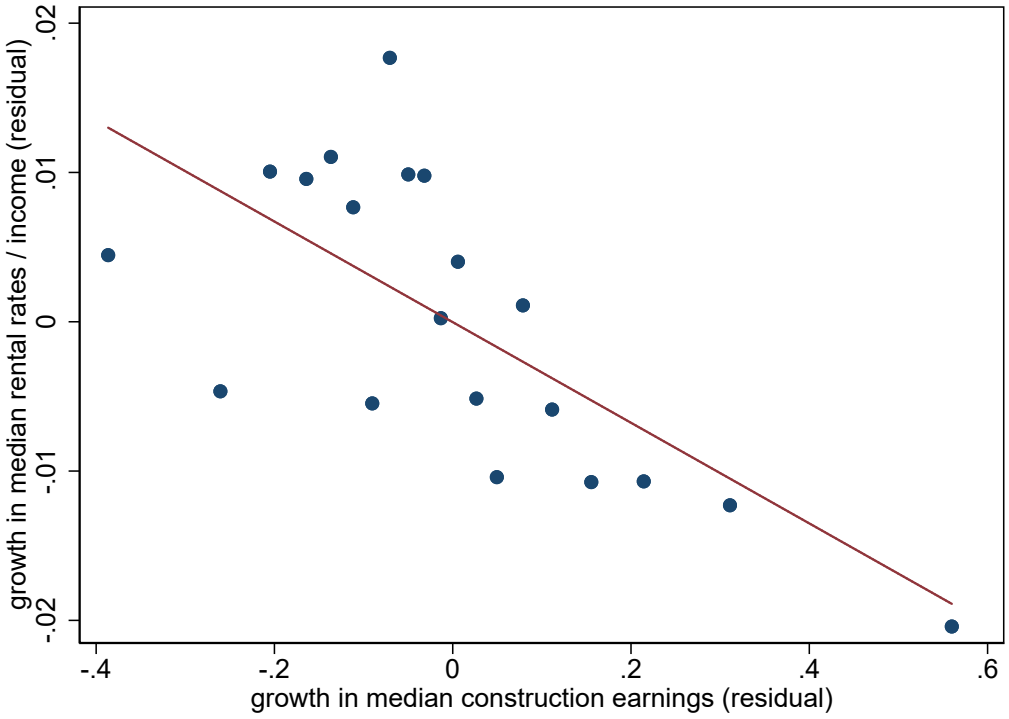

Figure 5: Growth in Construction Earnings and Housing Rents to Income, Residualized

Notes.–Source: American Community Survey, 5-year 2005-2009 and 2013-2017. The figure plots a `binscatter` of the residualized growth in median real construction sector earnings and the growth in median real annual housing rental rates to household income. The controls used for residualizing these variables include: gender, age (0-17, 18-34, 35-54, 55+), race (white, black), education (some college, college, masters or more), and the year the average house was built.

Online Appendix (Not for Print)

6.1 Measuring Labor Costs

The main text presents some time series evidence of raw and residual hourly wages between 2000 and 2018 from the Current Population Survey. One concern, however, is that its small sample size of only between 300 and 700 construction workers. Drawing on the American Community Survey (ACS), Figure 6 illustrates similar patterns of raw and residual logged hourly wages between 2010 and 2017. Although labor costs have increased since 2014 by roughly 0.05 logged points, by 2017 they returned to their 2010 level. These ACS data are based off of samples of roughly 40,000 construction workers per year using the same sample restrictions as the main text.

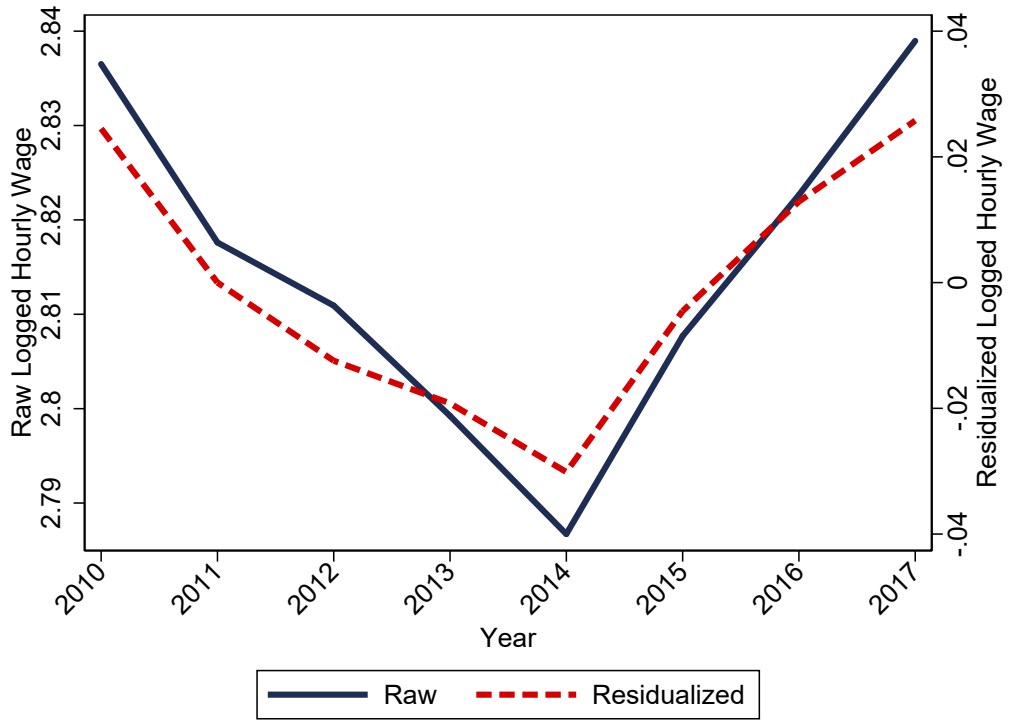

Figure 6: Time Series Evidence of Labor Costs in Construction from the Census Bureau

Notes.–Source: Census Bureau, American Community Survey, 2010-2017. The figure plots the logged real hourly wage and the residualized logged real hourly wage over time (deflated using the 2012 personal consumption expenditure index) for construction sector workers. The demographic controls used for residualizing wages include: age and its square, marital status, educational attainment and its square, race (white and black), and gender. The sample of construction workers is defined as those who work in the construction sector and are in construction occupations. Individuals earning less than $2/hour or $5,000/year are excluded from the sample.

Turning towards the microeconomic variation, Figure 7 plots the distribution of year-to-year real hourly wage growth rates between 2011 and 2017 across counties with at least 200 construction workers separately for California and the full United States Sample. These two mean growth rates are not statistically distinguishable from one another at an annual rate of 1.2 percent, although the dispersion in growth rates is (not surprisingly) much greater for the entire United States. To put the mean growth in hourly wages for construction workers in perspective, the average growth in real hourly wages across sectors is one percent. In this sense, while construction workers have been in greater demand since 2014—arguably because of an 18 percent growth in housing prices between 2014 and 2017 according to the FHFA All-Transactions House Price Index

(https://fred.stlouisfed.org/series/USSTHPI)—wages for these workers have not increased much more rapidly than wages for other workers in the economy.

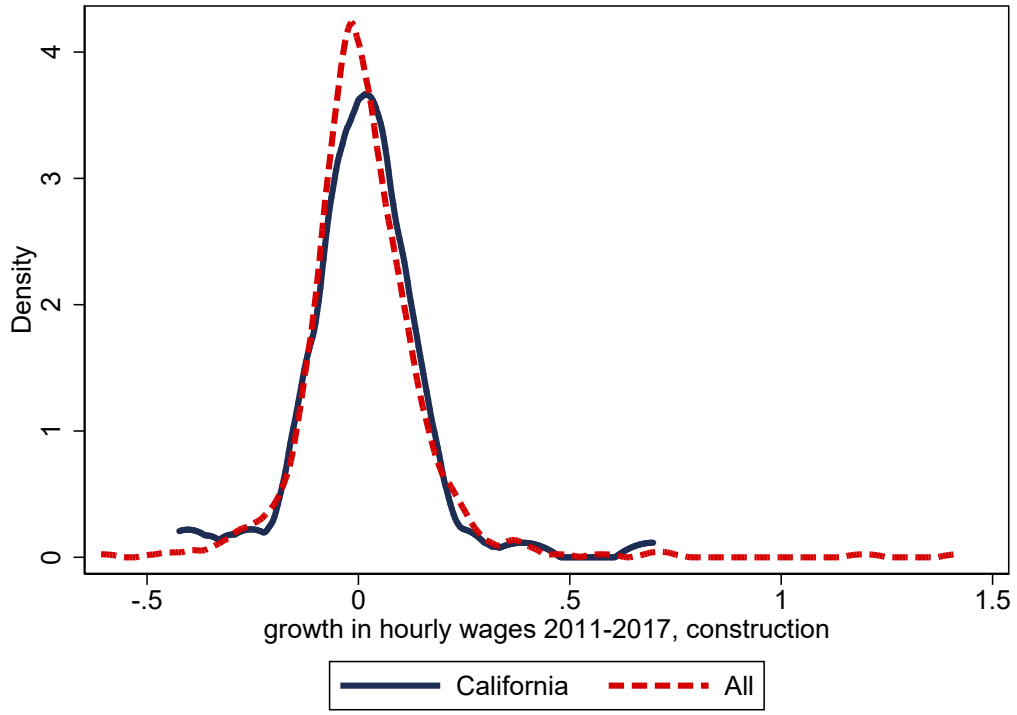

Figure 7: Distribution of Real Wage Growth Across Counties, 2011-2017

Notes.–Source: Census Bureau, American Community Survey, 2010-2017. The figure plots the distribution of hourly wage growth across counties with over 200 workers for California and the entire United States. The sample of construction workers is defined as those who work in the construction sector and are in construction occupations. Individuals earning less than $2/hour or $5,000/year are excluded from the sample.

What explains these recent increases in labor costs across locations? One potential theory is that the areas that were most adversely affected by the housing bubble were also more adversely scarred, thereby dampening the supply of labor as many exited the market following the crisis. Consistent with the theory, Figure 8 finds a strong positive correlation between housing price growth between 2006 and 2009 from the Federal Housing Finance Agency (FHFA) and construction sector earnings growth between 2005 and 2017 from the two 5-year ACS surveys.

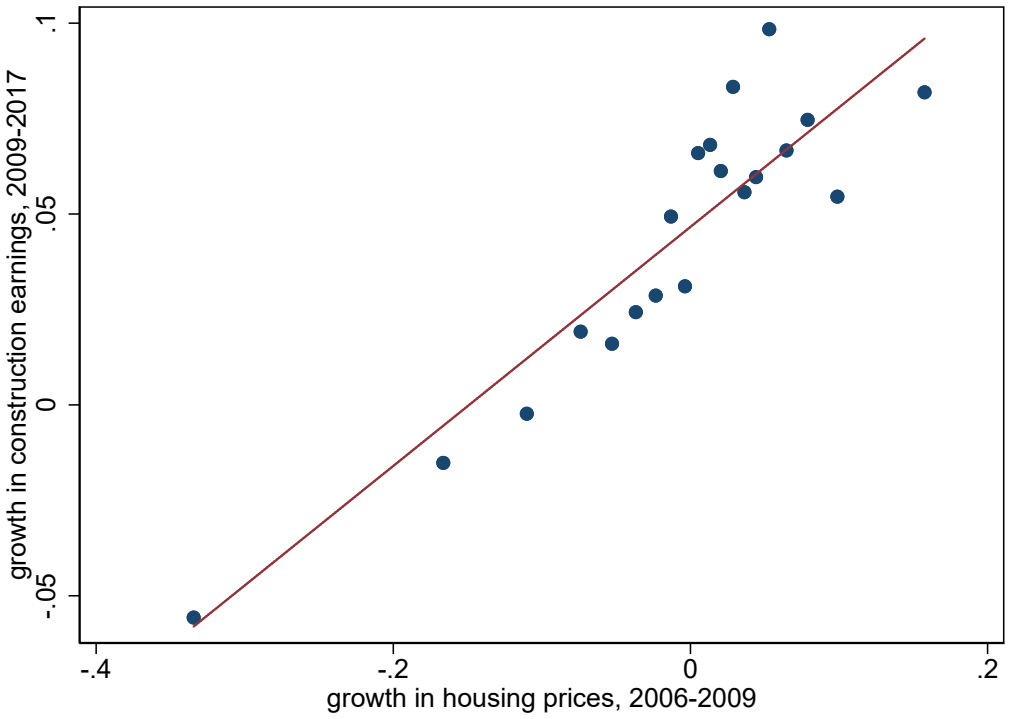

Figure 8: Growth in Construction Sector Earnings (2005-2009) and in Housing Prices (2006-2009)
Notes.–Source: Federal Housing Administration, American Community Survey, 5-year 2005-2009 and 2013-2017. The figure plots a `binscatter` of the decline in housing prices from 2006 to 2009 using the FHA housing price data with the growth in construction sector earnings.

How do real wages for construction workers relate with changes in the cost of living? Table 1 documents these regression results between individual hourly wages and the ratio of state housing rents to income. To measure housing costs, I use annual state-level data from the ACS between 2006 and 2017 on housing rents to household income. I restrict the sample in columns 1 and 2 to individuals who work in the construction sector and in construction occupations, but columns 3 and 4 broaden the sample to include all those in the construction sector regardless of occupation. While there "tends" to be a positive association between the two, there is no statistical association across any of the specifications—p-values, for example, tend to be over 0.60 in magnitude.

Table 1: Labor Costs in Construction and Housing Rent to Income, 2006-2017

Dep. var. =	log(hourly wage)			
	(1)	(2)	(3)	(4)
log(rent/income + 1)	-.51	.28	.05	1.00
	[.99]	[3.46]	[1.12]	[2.77]
R-squared	.16	.22	.20	.24
Sample Size	4763	4763	7671	7671
Controls	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
Sample	Ind + Occ	Ind + Occ	Ind Only	Ind Only

Notes.–Source: Annual American Community Survey and Annual Current Population Survey, 2006-2017. The table reports the coefficients associated with regressions of individual-level logged real hourly wages on logged housing rents to household income measured at the state-level, conditional on individual characteristics, including age, educational attainment, race, gender, number of children, and marital status. Survey sample weights are used and standard errors are clustered at the state-level.

6.2 Housing Costs and Regulation

To better understand the dispersion, Table 2 reports the results associated with regressions of the growth in real construction sector earnings across counties on a set of local demographic characteristics. Under the preferred specification in column 6, counties that experienced growth in real construction sector earnings are those that have a higher share of individuals between ages 18 and 34, a higher share of married workers, and lower shares of individuals with at least some college and individuals with a masters degree or more. There is no statistically significant association between the share of males and/or race and growth in real earnings.

The main text discusses evidence in favor of the view that the increase in housing costs is driven by a rise in land use regulation, rather than labor costs. Ganong and Shoag [2017] introduce a time-varying measure of land use regulation by counting the number of court cases in a state with the text "land use" in them. Using data from the Census Bureau on demographics and housing rents to income starting in 2006, I consider a more comprehensive set of regressions of the growth

Table 2: The Cross-sectional Determinants of Earnings Growth in Construction

Dep. var. =	growth in median construction earnings					
	(1)	(2)	(3)	(4)	(5)	(6)
Male	.406**					.049
	[.203]					[.209]
Ages 18-34		-.145*				.461***
		[.081]				[.119]
White			.095***			.027
			[.026]			[.035]
Married				.246***		.398***
				[.058]		[.097]
Some College					-.054	-.196**
					[.087]	[.091]
College					.025	-.099
					[.136]	[.137]
Masters +					-.643***	-.646***
					[.169]	[.169]
R-squared	.00	.00	.01	.01	.02	.03
Sample Size	3144	3144	3144	3144	3144	3144

Notes.–Sources: American Community Survey, 5-year 2005-2009 and 2013-2017. The table reports the coefficients associated with regressions of the growth in real median earnings for the construction sector across all counties, conditional on local demographic characteristics, including the share who are male, ages 18 to 34, white, married, have some college education, college education, or masters / professional / PhD education. Standard errors are clustered at the county-level.

in these rents to income on the growth in regulations, conditional on controls.

Table 3 documents these results. While the unconditional correlation between the two is not surprisingly strong in column 1 (significant at a 1% level), column 2 subsequently adds a detailed set of demographic characteristics as controls, including the age and education distributions. These are important since age and education are both viewed as major determinants of the demand for housing. One concern, however, is that states vary in their growth rates of regulation for reasons that are correlated with unobserved determinants of growth in housing rents to income. Column 3 introduces state and year fixed effects. While the main estimate is no longer significant at a 10% level, the estimated coefficient is still positive. The fact that the coefficient remains is striking given that the state-level aggregation removes much of the cross-sectional variation and the regulatory count index sample only includes up until 2012 (five years for each state).

Table 3: Housing Costs and Regulatory Growth, 2007-2012

Dep. var. =	housing rent to income (growth)		
	(1)	(2)	(3)
land use regulation (growth)	.017***	.018**	.006
	[.005]	[.007]	[.004]
R-squared	.05	.10	.58
Sample Size	300	300	300
Controls	No	Yes	Yes
State FE	No	No	Yes
Year FE	No	No	Yes

Notes.–Source: Annual American Community Survey Ganong and Shoag [2017], 2007-2012. The table reports the coefficients associated with regressions of state growth in housing rental rates to household income on state growth in land use regulation restriction counts from judicial court cases, conditional on controls, including the average age of a home, marital share, male share, age and education distributions (0-17, 18-34, 35-54, 55+ and some college, college, and college+), and race shares (black and white). Survey sample weights are used and standard errors are clustered at the state-level.

Turning towards the time-varying measure of land use regulation from Ganong and Shoag [2017], I now present results associated with regressions of state housing rents to income growth on state land use regulation growth. While such a regression produces a coefficient of 0.016 on

state regulatory growth (p-value = 0.00) without any controls, adding the usual set of demographic characteristics does not statistically change the estimate: the implied coefficient is 0.017 (p-value = 0.02). While the estimate loses significance when including state and year fixed effects (p-value = 0.153), the point estimate is still positive at 0.0062, which is noteworthy given that there is not much within-state variation in growth rates between 2007 and 2012.

Moreover, to the extent these conditional correlations are capturing something causal, then the effects should be greater for counties with greater population density. That is, because land use regulation restricts the supply of land, which is a major driver behind the price of housing [Davis and Palumbo, 2008], cost of living in these counties should respond more elastically with respect to regulatory shocks. Figure 9 plots the resulting point estimates separately by population density percentile. Consistent with the theory, the effects of regulatory growth on cost of living growth are concentrated among higher population density counties.

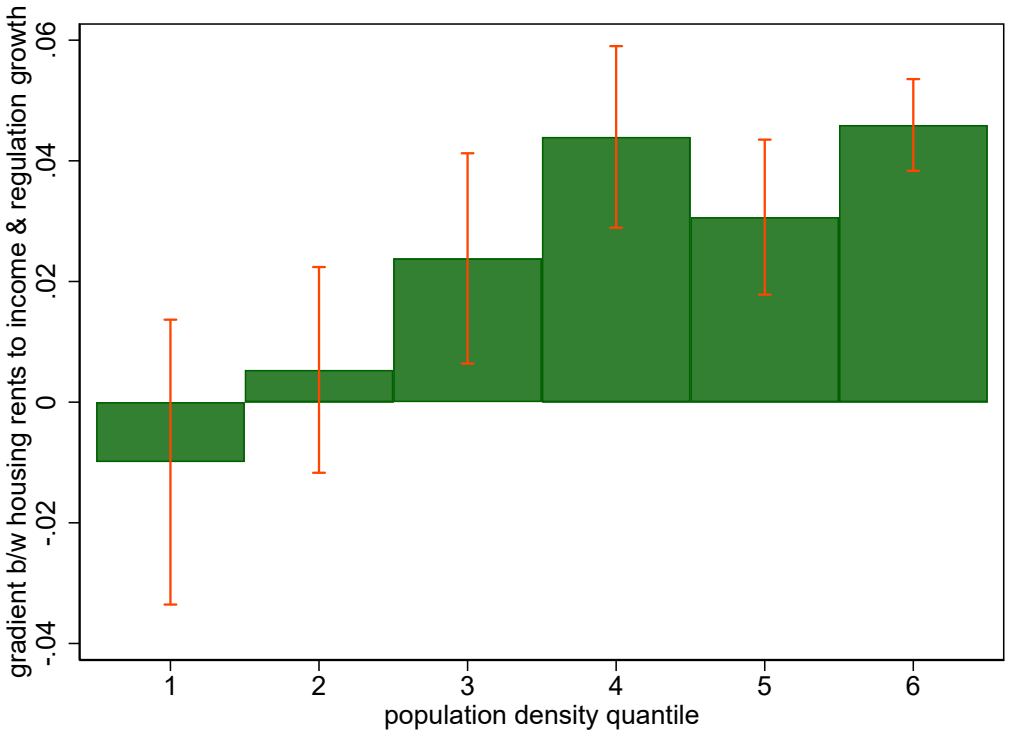

Figure 9: Heterogeneity in State Land Use Regulation on Housing Rents to Income

Notes.–Source: Annual American Community Survey Ganong and Shoag [2017], 2007-2012. The figure reports the coefficients associated with regressions of county growth in housing rental rates to per capita income on state growth in land use regulation restriction counts from judicial court cases, separately by percentile of population density using the 5-year 2005-2009 ACS, conditional on controls, including the average age of a home, marital share, male share, age and education distributions (0-17, 18-34, 35-54, 55+ and some college, college, and college+), and race shares (black and white). Standard errors are clustered at the county-level.

6.3 Construction, Housing, and Labor Costs

The main data source on the construction costs of housing is RS Means. Using their set of 30 core cities observed over time, Figure 10 plots the time series patterns in the construction cost index (CCI). Although it has increased recently, the question is whether it has been increasing most in areas where labor costs have been rising. Answering that question requires their city-level disaggregated data, which is matched with data from CBSAs between 2006 and 2017.

Panel A in Figure 11 confirms the basic intuitive hypothesis that cities with greater growth in construction costs have greater growth in housing costs. However, the statistical relationship is

weak. Moreover, Panel B in Figure 11 shows that the cities that experienced the greatest growth in construction costs are not actually the ones that experienced the greatest growth in labor costs in construction. That suggests that construction costs are likely dwarfed by other factors (e.g., constrained supply), rather than just labor.

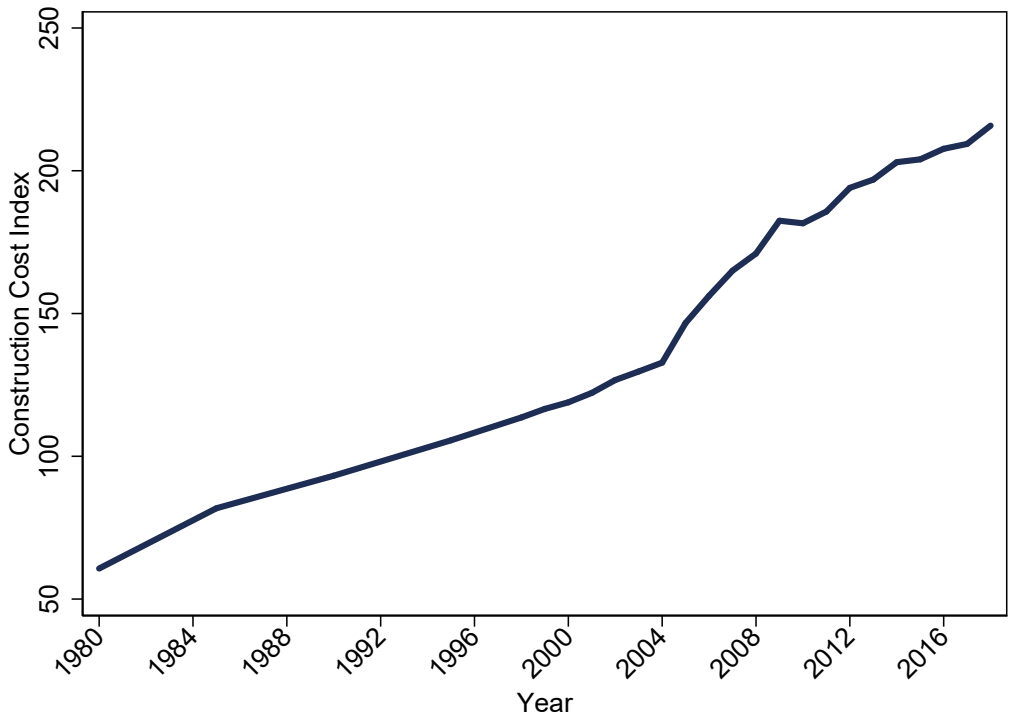

Figure 10: Time Series Patterns of the Construction Cost Index

Notes.–Source: RS Means, 1980-2017. The figure plots the national time series on the construction cost index (CCI) across the panel of 30 core cities.

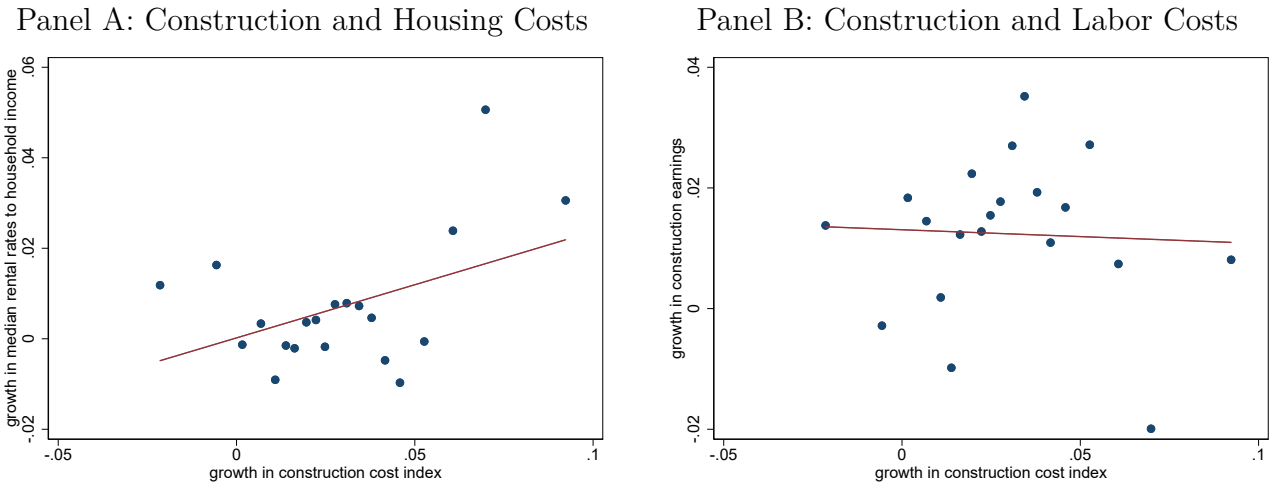

Figure 11: Construction, Housing, and Labor Costs Across CBSAs, 2006-2017

Notes.–Source: Annual American Community Survey and RS Means, 2006-2017. The figure plots a `binscatter` of growth in the construction cost index (CCI) and both growth in median real housing rents to household income and real earnings growth in construction across core business statistical areas (CBSAs).

Do these results hold more generally when controlling for demographic characteristics and/or time-invariant heterogeneity? Table 4 documents these results. Like Figure 11, there is a robust association between growth in construction costs and housing rents to income (columns 1-2), conditional on controls, although the relationship is not statistically significant after adding CBSA and year fixed effects (column 3). However, neither the unconditional nor conditional correlations between growth in labor costs and the CCI are significant (columns 4-6). These results suggest that, to the extent labor costs are rising in the construction sector, they cannot explain systematic movements in aggregate nor spatial construction costs.

Finally, consider a "horse race" among the determinants behind the rise in housing costs relative to household income. While the earlier results suggest that labor costs are not the culprit, two alternative factors include changes in immigration, which has been linked with increases in housing rents by raising the demand for housing [Saiz, 2007], and changes in land prices. To measure these competing potential determinants, I focus on a common sample of over 730 counties per year from

Table 4: Relationship between Housing and Labor Costs with Construction Costs

Dep. var. =	housing costs to income growth			construction earnings growth		
	(1)	(2)	(3)	(4)	(5)	(6)
construction cost index (growth)	.23***	.15**	.10	-.02	.11	.32
	[.05]	[.06]	[.08]	[.11]	[.14]	[.22]
R-squared	.01	.03	.20	.00	.01	.05
Sample Size	1804	1802	1802	1804	1802	1802
Controls	No	Yes	Yes	No	Yes	Yes
CBSA FE	No	No	Yes	No	No	Yes
Year FE	No	No	Yes	No	No	Yes

Notes.–Source: Annual American Community Survey and RS Means, 2007-2017. The table reports the coefficients associated with regressions of CBSA growth in the median housing rents to household income and construction earnings on the growth in the construction cost index (CCI), conditional on controls, including the average age of a home, marital share, male share, age and education distributions (0-17, 18-34, 35-54, 55+ and some college, college, and college+), and race shares (black and white). Standard errors are clustered at the CBSA-level.

county data between 2012 and 2017. Moreover, to measure immigration and land price changes, I use the change in the share of foreign-born individuals in a county and the change in the land price index introduced from Davis et al. [2019], respectively.

Table 5 documents these results, presenting each of the potential factors sequentially. Replicating the results from the main text, growth in construction-sector earnings are weakly associated with declines in the growth of housing rents to household income (column 1). Moreover, the relationship holds even when focusing on the growth of housing rents (i.e., without the normalization). Consistent with Saiz [2007], increases in immigration are economically, but not statistically, are: a 1pp change in the share of foreign-born individuals in a county is associated with a 0.13pp rise in housing costs relative to income (column 2). (If counties are weighted by population, the gradient rises to 0.27 (p-value = 0.031), suggesting that immigration has raised housing costs more in larger counties.) Turning to land prices, there is a statistical association between its growth and the growth of housing rents relative to income (column 3). These results are indistinguishable from controlling for each of the factors concurrently (column 4).

Table 5: Relationship between Housing and Labor Costs with Construction Costs

Dep. var. =	housing rents to income (growth)			
	(1)	(2)	(3)	(4)
construction earnings (growth)	-.037***			-.038***
	[.008]			[.008]
foreign-born share (growth)		.173		.193
		[.139]		[.140]
land price (growth)			-.030**	-.032**
			[.015]	[.016]
R-squared	.02	.01	.01	.02
Sample Size	3367	3353	3422	3298
Controls	Yes	Yes	Yes	Yes

Notes.–Source: Annual American Community Survey and Davis et al. [2019], 2012-2017. The table reports the coefficients associated with regressions of county growth in the median housing rents to household income on the growth in labor costs (construction earnings), foreign-born share individuals, and land prices, conditional on controls, including the average age of a home, marital share, male share, age and education distributions (0-17, 18-34, 35-54, 55+ and some college, college, and college+), and race shares (black and white). Standard errors are clustered at the county-level.